CITYTUTOR

Eighth Grade Math Lesson Materials

Terms of Use

Effective Date: January 1, 2023

Updated: August 16, 2023

CityBridge Education, its subsidiaries, and its affiliates ("we," "our," or "us") own and operate this and related websites, supporting servers, online services, and content accessible therefrom ("Property"), including the Lesson Materials discussed below, whose use is governed by this Agreement. This Agreement is a contract between any user of the Property or visitor or accessor of the websites ("you," "your") that governs your access and use of the Property. Please read and understand this Agreement in its entirety. If you do not agree, you may not access or use any portion of the Property.

Conduct with Property

You agree to comply with this Agreement and all applicable laws, rules, and regulations in connection with your use of the Property. You shall not use the Property in any manner indicated to you by us as improper or to be ceased. You shall not use the Property for any commercial or other purposes unless expressly permitted by this Agreement. You shall not use the Property in a manner that falsely implies our endorsement, partnership, or otherwise misleads as to your relationship with us. You shall not attempt to bypass, remove, deactivate, impair, decrypt, or otherwise circumvent any legal or technological measure implemented by us to protect or limit access to the Property, or otherwise gain unauthorized access to any part of the Property. You shall not use or access the Property in any manner that could damage, disable, overburden, and/or impair the Property and/or interfere with any other party's use and enjoyment of the Property. You shall not deep-link to, frame, scrape, copy, monitor and/or perform any other form of systematic retrieval of the Property. You shall not harass, threaten, or engage in any objectionable behavior to our employees, contractors, or agents. You shall not engage in criminal or tortious activity, including, without limitation, fraud, spamming, sending of viruses or other harmful files, infringement, theft, or property damage in connection with Property. All rights in whole and part in Property are vested with us and further subject to copyright, trademark, trade dress, domain name, patent, trade secret, international treaties, and/or other intellectual or proprietary rights belonging solely to us. You agree that the Property and all derivative works of the same are the sole property of us, with all title, rights, and benefits strictly reserved to us except as set out in writing in this Agreement.

You agree to comply with the above conduct requirements and agree not assist or permit any person in engaging in any conduct that does not comply with the above conduct. You agree that failure to comply with any term of this Agreement, including the above Conduct, constitutes material breach of this Agreement and causes damages beyond any reasonable monetary compensation and is thus subject to all equitable and injunctive remedies in addition to monetary damages for all actual, resultant, compensatory, punitive, consequential, and attorneys' fees damages resulting in any form or degree from such breach. You agree to indemnify us and hold us harmless from and against any losses, liabilities, claims, actions, costs, damages, penalties, fines and expenses, including without limitation attorneys' and experts' fees and expenses, that may be incurred by us arising out of or in connection with your breach of this Agreement, your gross negligence or violation of any law, rule, or regulation, or any dispute or issue between you and any third party.

Limited License in Lesson Materials

We make available documents through and as part of the Property in the nature of educational materials, including written, graphical, audiovisual, and/or interactive lessons for teaching ("Lesson Materials"). Your accessing and use of the Lesson Materials is subject to the Conduct Requirements, Disclaimers, and all other parts of this Agreement, and the following special terms:

If you are an entity having status set out in 26 U.S.C. § 501(c)(3) and having an educational purpose, we grant to you a limited, non-exclusive, non-transferable in any nature or part, and revocable license to access, copy, perform, display, and use the Lesson Materials strictly to educate pupils as part of your educational purpose, provided that the Lesson Materials are provided under your control and without fee to pupils, and only to your educators and pupils. You may not alter, reproduce in number beyond a number of pupils and educators, create derivative works from, remove any notice from, or gain or provide any right or title beyond this license in the Lesson Materials. You agree that this License is revocable and may be withdrawn at any time without notice by us.

Any other use of the Lesson Materials is strictly prohibited. All rights not expressly granted herein are reserved by us, we at all times are the sole owners of Lesson Materials and any derivative works created from the same.

Disclaimers and Limitations of Liability

The Property is provided "AS IS" without warranty of any kind, express or implied. We disclaim any warranty, statutory or otherwise, including any warranty of fitness for a

particular purpose, merchantability, non-infringement, or freedom from defect including computer viruses, malware, access controls, error, libel or defamation, falsehood, obscenity, profanity, danger, or harm to any person or property caused by Property. We make no representations as to results, accuracy, correctness, reliability, completeness, safety, or quality of the Property. Any and all costs, loss, damages, and other expenses in accessing and using the Property fall on you.

NOTWITHSTANDING THE ABOVE DISCLAIMER, TO THE FULLEST EXTENT PERMISSIBLE BY APPLICABLE LAW, IN NO EVENT SHALL WE BE LIABLE TO YOU FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE, EXEMPLARY, OR CONSEQUENTIAL DAMAGES, OR ANY LOSS OR DAMAGES WHATSOEVER (INCLUDING PERSONAL INJURY, PAIN AND SUFFERING, EMOTIONAL DISTRESS, LOSS OF DATA, REVENUE, PROFITS, REPUTATION, USE, OR OTHER ECONOMIC ADVANTAGE), EVEN IF WE WERE AWARE OF THE POSSIBILITY OF THE SAME, ARISING OUT OF USE, CONSUMPTION, OR ACCESS OF, OR WARRANTY, CONTRACT, NEGLIGENCE, TORT, OR ANY OTHER ACTION OF ANY TYPE THAT IN ANY MANNER ARISES OUT OF OR IN CONNECTION WITH, THE PROPERTY.

THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY. YOU AGREE THAT THESE DISCLAIMERS AND LIMITATIONS OF LIABILITY IN THIS AGREEMENT ARE FAIR AND REASONABLE AND MATERIAL, BARGAINED-FOR BASES OF THIS AGREEMENT, AND THAT THEY HAVE BEEN TAKEN INTO ACCOUNT IN THE DECISION TO ENTER INTO THIS AGREEMENT. YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DAMAGE ARISING OUT OF YOUR USE OF PROPERTY IS TO DISCONTINUE USING THE PROPERTY, WHICH YOU MAY DO AT ANY TIME.

Infringement of Your Rights

If you believe that your copyrighted work has been copied or is otherwise infringed by the Property, provide our Copyright Agent as set forth below with notification containing the following information in accordance with the Digital Millennium Copyright Act, 17 U.S.C. §512 (“DMCA”):

A physical or electronic signature of a person authorized to act on behalf of the copyright owner of the work that allegedly has been infringed;

Identification of the copyrighted work claimed to have been infringed, or, if multiple copyrighted works allegedly have been infringed, then a representative list of such copyrighted works;

Identification of the material that is claimed to be infringing and that is to be removed or access to which is to be disabled, and information reasonably sufficient to permit us to locate the allegedly infringing material, e.g., the specific web page address on the Platform;

Information reasonably sufficient to permit us to contact the party alleging infringement, including an email address;

A statement that the party alleging infringement has a good-faith belief that use of the copyrighted work in the manner complained of is not authorized by the copyright owner or its agent, or is not otherwise permitted under the law; and

A statement that the information in the notification is accurate, and under penalty of perjury, that the party alleging infringement is authorized to act on behalf of the copyright owner of the work that allegedly has been infringed.

To: CityBridge Education, Attention: Copyright Agent, 600 New Hampshire Ave NW, Washington DC 20037.

Operation of Agreement

This Agreement represents the entire agreement of the parties and supersedes all other or prior agreements, understandings or discussions concerning its subject matter. We reserve the right to update and replace this Agreement at any time; any prior Agreement(s) before the Updated date above govern conduct falling within their effective timeframe. Any modifications to any Agreement must be in writing and agreed to by all parties.

This Agreement will be construed according to the laws of the District of Columbia, without reference to the principles of conflicts of law therein. The parties agree that any disputes relating to this Agreement will be resolved in the United States District Court for the District of Columbia or the District of Columbia Superior Court.

The invalidity of any provision of this Agreement will not affect the validity of the remaining provisions.

CITYTUTOR DC

G8 Unit 3:

Linear Relationships

G8 U3 Lesson 1
Represent proportions with graphs, equations, tables and stories.

G8 U3 Lesson 1 - Today we will represent proportions with graphs, equations, tables and stories.

Warm Welcome (Slide 1): Tutor choice

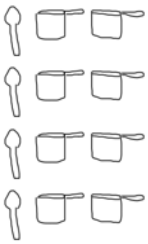
Frame the Learning/Connect to Prior Learning (Slide 2): The next 15 lessons are going to be about linear relationships. You've actually already done one kind of linear relationship in 6th and 7th grade called proportions. And really, you've been working with linear relationships your whole life without even realizing it. So I know you're going to do great!

Let's Review (Slide 3): Today we will represent proportions with graphs, equations, tables and stories. This is review. For instance, what even is a proportion? Let's read this story together as an example. Follow along with your eyes and read silently in your head while I read out loud. *For the remainder of this lesson and the following lessons in this unit, the prior sentence is the cue that you can always use when you are reading. Before to point to each word as you read to help kids follow along.* "To make Kool-Aid, you need 1 tablespoon of powder for every 2 cups of water. Let's imagine making different amounts of Kool-Aid." First, I am going to draw 1 spoon and 2 cups. That's the recipe so you don't have to do much there. We're just making sense of what the problem is saying.

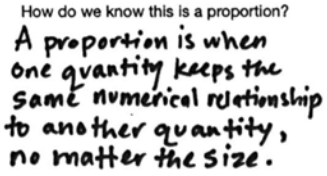
Now let's imagine we want to make more Kool-Aid. What might I draw next? Possible Student Answers, Key Points:

- You can keep drawing spoons and cups.
- You can draw 1 more spoon and 2 more cups.
- You can repeat the picture you just drew.

This is a recipe that tells us how much powder for how much water. Let me draw another spoon. If I add more powder without adding anymore water. My drink will be super super sweet like it will not even taste good. So I need to add more water too. And I'm going to add 2 cups because that was the recipe: 1 tablespoon of powder for 2 cups of water.



But let's say I'm having a party and I want a really huge amount of Kool-Aid. I could keep going with as many spoons as I like. But I'd also need to keep going with 2 cups for every tablespoon. So I can draw that exact same picture again and again!



This is an example of a proportion! In the picture, we can see that still have that same basic ratio or relationship that we had from the very beginning. I can see the 1 tablespoon and the 2 cups together. It's kind of like a building block and I just keep using that same basic block to keep building and building. I will write that as "A proportion is when one quantity keeps the same numerical relationship to another quantity no matter the size."

In this case, because one quantity, the powder, kept the same numerical relationship to the other quantity, the water, the Kool-aid is always going to taste the same no matter how much we make. But let's write down some specific numbers on the next slide so we can see this exactly.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

t	c
0	0

Let's Talk (Slide 4): Today the main thing we need to review is the answer to this question: "How do we know when a relationship is a proportion?" We have the same story and we have our same picture. Now I am going to represent what we drew on a table. First, I need to label each column. I will write t for tablespoons and c for cups. Now, you might want to jump straight to filling in the recipe. But we actually didn't start with 1 tablespoon of powder and 2 cups of water. We started with nothing. I am going to write 0 for tablespoons and 0 for cups. That is secretly the start. Or sometimes we call it the initial amount - even though it wasn't spelled out in the story.

t	c
0	0
1	2

Now we can write in 1 for tablespoons and 2 for cups.

t	c
0	0
1	2
2	4

Now let's think about what happened as we drew the next picture. *Cover up the bottom two rows in the picture and point as you count up the first two rows.* I see 2 tablespoons and 4 cups.

t	c
0	0
1	2
2	4
3	6

Now let's think about what happened as we drew the next picture. *Cover up the bottom row in the picture and point as you count up the first three rows.* I see 3 tablespoons and 6 cups.

And the next picture! I see 4 tablespoons and 8 cups. Look carefully at our table. What do you notice? Possible Student Answers, Key Points:

- The left column keeps adding 1.
- The right column keeps adding 2.
- If you look across, it is always "times 2."

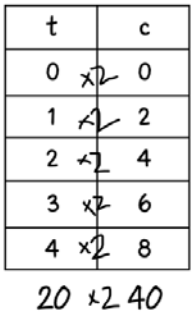
t	c
0	0
1	2
2	4
3	6
4	8

There are several patterns to notice. Going down, we see that the left column keeps adding 1. 0 plus 1 is 1. 1 plus 1 is 2. 2 plus 1 is 3. 3 plus 1 is 4. And the right column keeps adding 2. 0 plus 2 is 2. 2 plus 2 is 4. 4 plus 2 is 6. 6 plus 2 is 8. All that makes sense because, of course, every time we drew, we drew 1 more tablespoon and 2 more cups.

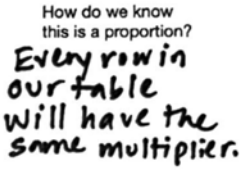
t	c
0	0
1	2
2	4
3	6
4	8
20	40

But we might not always see the adding patterns going down if we jumped to a super huge amount of Kool-Aid like 20 tablespoons and 40 cups of water. *Write those numbers under the table, lined up with the correct columns.*

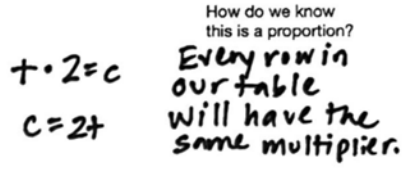
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.



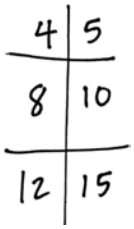
So it is really the pattern going across that is super super important. I can see in this example that it is always times 2. 0 times 2 is 2. 1 times 2 is 2. 2 times 2 is 4. 3 times 2 is 6. 4 times 2 is 8 and even here, 20 times 2 is 40. This number is so important; it has its own name. It is called the "constant of proportionality." Constant means always the same. So for a proportion, the multiplier will be constant or the same.



We wanted to figure out how to tell if something was a proportion. I will write it down, "Every row in our table will have the same multiplier." It is called the "constant of proportionality. Or another word you will in the next few lessons is "constant rate of change." It's the same idea. These amounts change together in the same way, in a way that is constant.

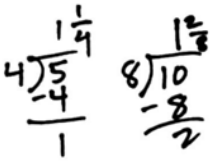


And since it's always going to have the same multiplier, we can write it as an equation: t times 2 = c or c = 2t. These mean the same thing just written in a different order.

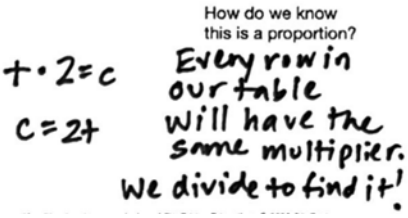


This one is pretty easy because the "times 2" really jumps out at us. What would we do if we had trickier number like these, for example, and we didn't know what the multiplier was. *Jot the example table on the board.* Do any of you remember from last year?
Possible Student Answers, Key Points:

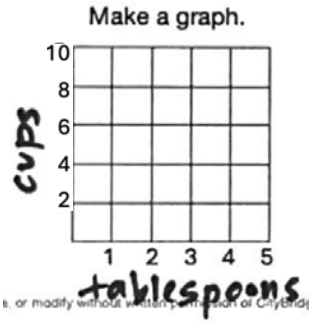
- We can use guess and check.
- We can divide.



We know it is a multiplier so we can use the opposite operation to work backwards from multiplication: division! I can do 5 divided by 4, which is 1 and 1 fourth. 10 divided by 8 is 1 and 2 eighths, which if I simplify is 1 and 1 fourth. And I could keep going. *You can erase the example table if you want to.*

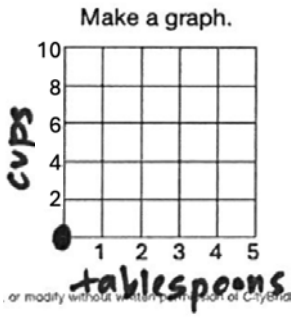


Let's return to our original table. We don't have to do it because it's so easy but we can see division works here too. *Point from the right hand number to the left hand number as you go through each row. 2 divided by 1 is 2. 4 divided by 2 is 2. 6 divided by 3 is 2. 8 divided by 4 is 2.* Division works to find the multiplier! I'm going to write that down, "We divide to find it."

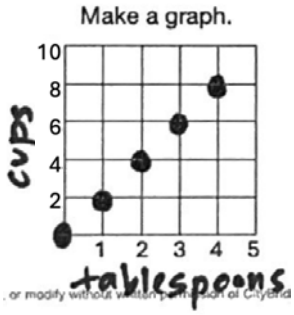


Let's Think (Slide 5): So we reviewed tables. Now let's review graphs. We still have the same story and the same picture and now the same table. Let's graph it to answer this top question, "How do we know when a relationship is a proportion?" I am going to start by labeling my axes here just like we labeled the top of our columns. The x-axis is tablespoons and the y-axis is cups.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

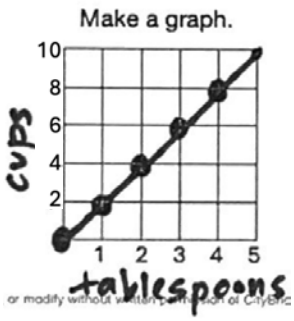


Remember how we had nothing as our initial value? This first row of my table is 0 and 0. I am going to graph that like a coordinate, (0,0), and put a point here.

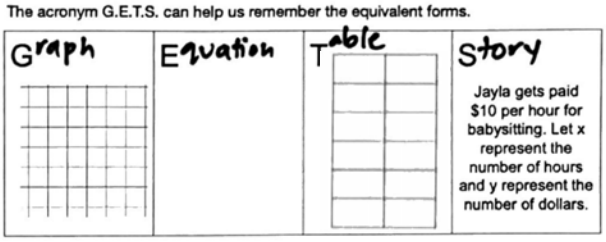


Now it's time for my next point which is the next row on my graph, (1, 2). I find the 1 on the x-axis, which is tablespoons. *Point to the 1 on the x-axis, the horizontal axis.* I find the 2 on the y-axis, which is cups. *Point to the 2 on the y-axis, the vertical axis.* Then I see where they meet up and draw a point. *Drag your fingers from each number to show how they meet and draw the point.* Let's keep going! The next row is (2,4). The next row is (3,6). The next row is (4,8). What do you notice? Possible Student Answers, Key Points:

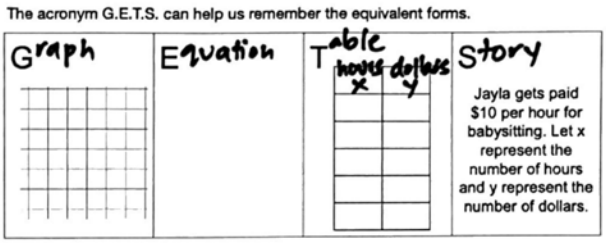
- The points keeping going up diagonally.
- The points go up like a staircase.
- The points go up 2 and over 1.
- The points make a diagonal line.



We might see two things. First of all, I can connect the dots and make a straight line. That is always going to be true about proportions. Also, the whole reason they make a straight line is because they go up like a nice steady staircase up 2 and over 1, up 2 and over 1, up 2 and over 1, up 2 and over 1, up 2 and over 1. We're going to talk more about that tomorrow. Because all those equal stairs are important. They are constant just like our CONSTANT of proportionality! But for now, I just want to point out one more thing, and that is that our graph goes through this special point, (0,0), which has a special name, "the origin." This is always going to be true about proportions. so I am going to write all that down. "The graph is always a straight line through the origin, (0,0)."



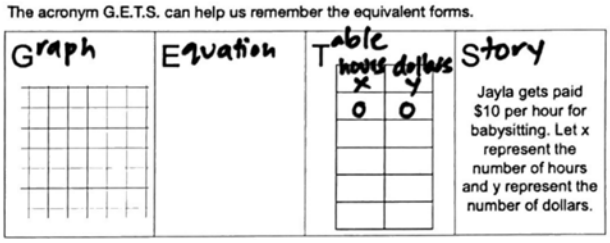
Let's Think (Slide 6): Let's put all this together. "We can use a graph, equation, table and story to represent a proportion. They are all equivalent forms that are just different ways to show the same relationship. Kind of like how "bro" is another word for "brother." We can remember this with the acronym, GETS. G stands for Graph. E stands for Equation. T stands for Table and S stands for Story.



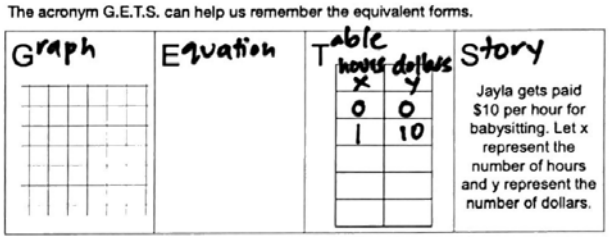
Let's fill this in. We'll start by reading the story. I will read it out loud while you follow along silently. *Read the story in the far right column.* I am going to use this story to fill in the table. We have x and y. I will

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

write hours about the x and dollars above the y to help me remember which is which.

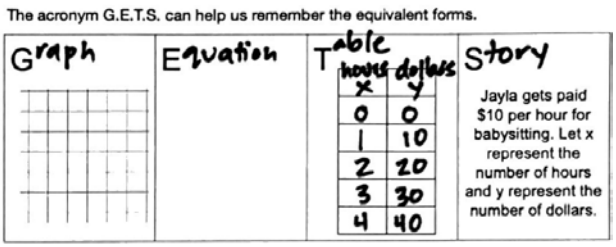


Now, the story doesn't say anything about Jayla having money when she starts so we're going to think of her initial starting point as 0 hours and 0 dollars. I'm going to write that in my table.

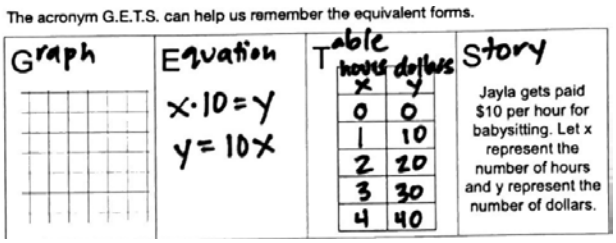


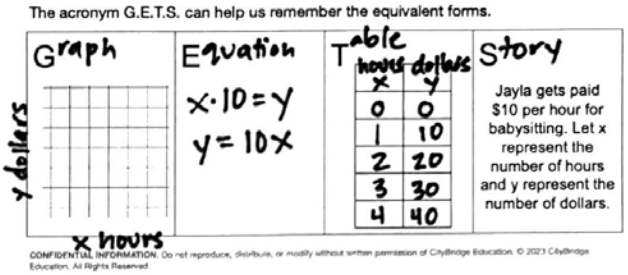
She gets paid $10 per hour. So when she works 1 hour, she gets paid $10. I am going to use that to fill in my next row.

Let's think about if she keeps working. If she works another hour, that will be another $10. We want that same, constant relationship, which is the whole idea of what a proportion is. Another hour makes 2 hours. Another $10 makes $20. So now we have 2 hours gets $20 so I am going to use that to fill in another row. You see where I'm going here, right? Another hour and another $10 means 3 hours gets $30. I'll write that in. And another hour and another $10 means 4 hours gets $40.



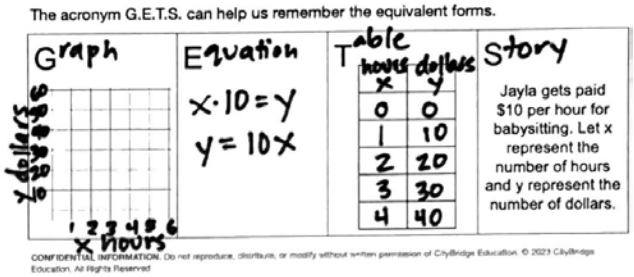
Now here is where we use the ideas from earlier. We said, "Every row in our table will have the same multiplier called a constant of proportionality." We can divide to find it, like 10 divided by 1 is 10 and 20 divided by 2 is 10 and 30 divided by 3 is 10 and 40 divided by 4 is 10. But we don't have to do that in this case because the "times 10" is kind of obvious. That helps me write the equation. It is the left side times 10 makes the right side. We can write x times 10 equals y. But usually it is written the opposite way but it still all equals up to y. I write, y = 10x. The 10x means the same as 10 times x or x times 10. We just write it that way for short.

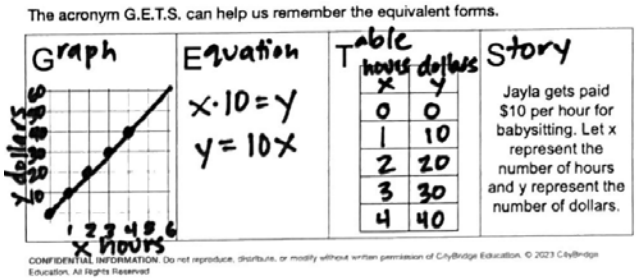




And finally, we get to our graph. We said, "The graph of a proportion is always a straight line that goes through the origin, (0,0)." Let's see if that's true. I going to label the horizontal line, x and hours. I am going to label the vertical lines, y and dollars.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.





For numbers, I will put 1, 2, 3, 4, 5, 6 on the x-axis. The numbers have to go right under the little tick marks to keep me organized. On the y-axis, I will put 10, 20, 30, 40, 50, 60. The numbers have to go right next to the little tick marks to keep me organized. If I am not exactly lined up, I will start to confuse myself.

And finally, we can put points. *Point to each row on the table as you talk it through and graph it.* I see 0 and 0 so I will make a point at (0,0). I see 1 and 10 so I will make a point at (1,10). I see 2 and 20 so I will make a point at (2,20). I will see 3 and 30 so I will make a point at (3,30). I see 4 and 40 so I will make a point at (4,40). Does it make a straight line? YES! Does it go through the origin? YES! So all these equivalent forms all show that our story is a proportion in their own special way! I love the way all of math works together like that. It is very cool!

Let's Try It (Slide 7): Let's practice filling out GETS together now. I will walk you through each step.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

WARM WELCOME

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Today we will represent proportions with graphs, equations, tables and stories.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Review: What is a proportion?

To make Kool-Aid, you need 1 tablespoon of powder for every 2 cups of water. Let's imagine making different amounts of Kool-Aid.

Draw a picture:

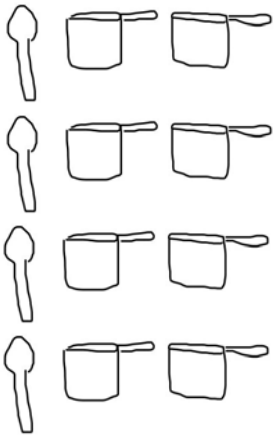
How do we know this is a proportion?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk: How do we know when a relationship is a proportion?

To make Kool-Aid, you need 1 tablespoon of powder for every 2 cups of water. Let's imagine making different amounts of Kool-Aid.

Draw a picture:



Make a table.

How do we know this is a proportion?

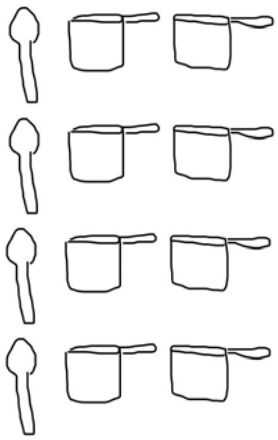
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

How do we know when a relationship is a proportion?

To make Kool-Aid, you need 1 tablespoon of powder for every 2 cups of water. Let's imagine making different amounts of Kool-Aid.

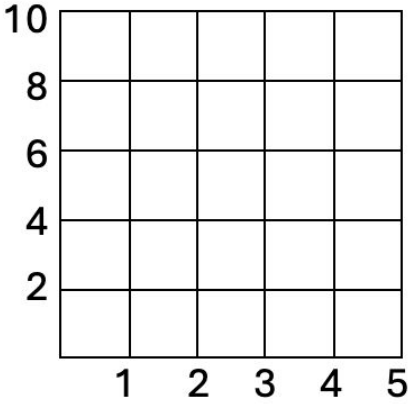
Draw a picture:



Make a table.

t	c
0	0
1	2
2	4
3	6
4	8

Make a graph.



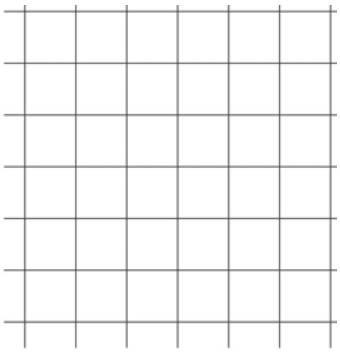
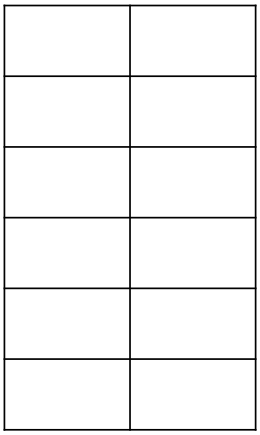
How do we know this is a proportion?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

We can use a graph, equation, table and story to represent a proportion.

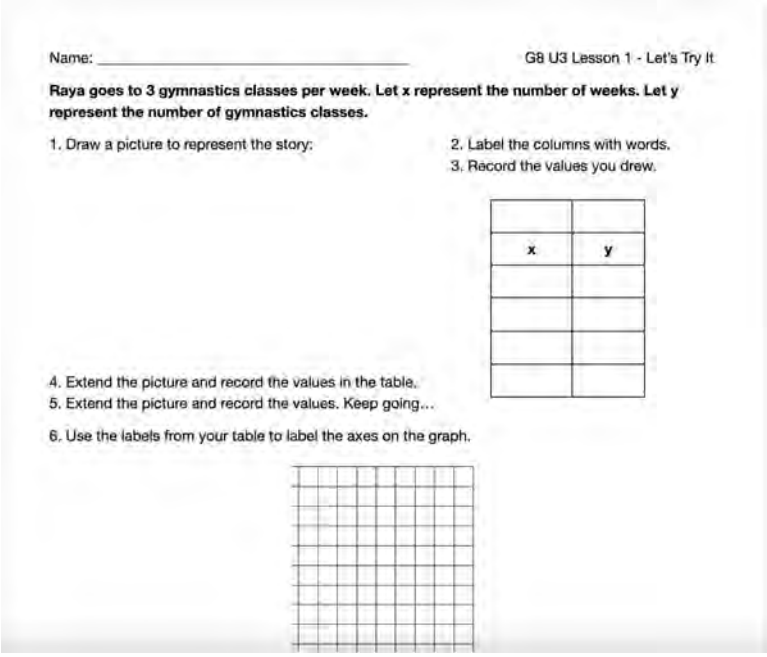
The acronym G.E.T.S. can help us remember the equivalent forms.

G	E	T	S
			Jayla gets paid $10 per hour for babysitting. Let x represent the number of hours and y represent the number of dollars.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Try It:

Let's practice making pictures, tables and graphs for proportions together!



Name: _____ G8 U3 Lesson 1 - Let's Try It

Raya goes to 3 gymnastics classes per week. Let x represent the number of weeks. Let y represent the number of gymnastics classes.

1. Draw a picture to represent the story:

2. Label the columns with words.
3. Record the values you drew.

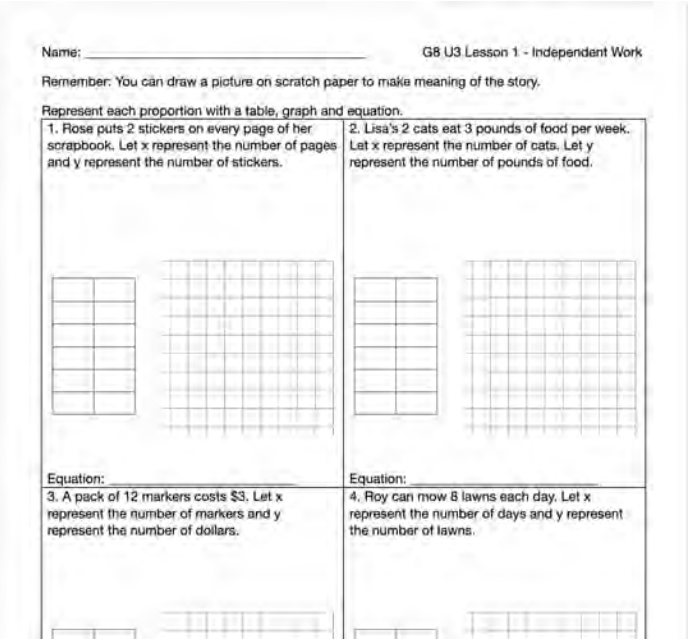
x	y

4. Extend the picture and record the values in the table.
5. Extend the picture and record the values. Keep going...
6. Use the labels from your table to label the axes on the graph.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

On your Own:

Now it's time for you to do it on your own.



Name: _____ G8 U3 Lesson 1 - Independent Work

Remember: You can draw a picture on scratch paper to make meaning of the story.

Represent each proportion with a table, graph and equation.

1. Rose puts 2 stickers on every page of her scrapbook. Let x represent the number of pages and y represent the number of stickers.

Equation: _____

2. Lisa's 2 cats eat 3 pounds of food per week. Let x represent the number of cats. Let y represent the number of pounds of food.

Equation: _____

3. A pack of 12 markers costs $3. Let x represent the number of markers and y represent the number of dollars.

4. Roy can mow 8 lawns each day. Let x represent the number of days and y represent the number of lawns.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Raya goes to 3 gymnastics classes per week. Let x represent the number of weeks. Let y represent the number of gymnastics classes.

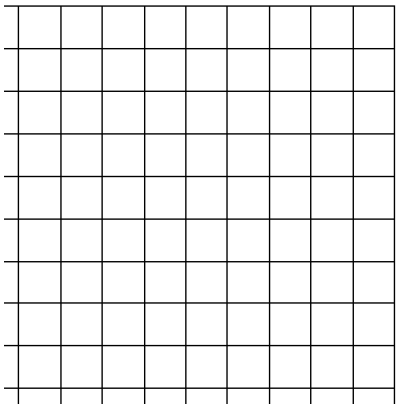
1. Draw a picture to represent the story:

2. Label the columns with words.
3. Record the values you drew.

x	**y**

4. Extend the picture and record the values in the table.
5. Extend the picture and record the values. Keep going…

6. Use the labels from your table to label the axes on the graph.



7. Fill in the numbers on each axis. You might have to skip count in order to reach the highest number on your table.
8. Use each row of the table as a set of coordinates.
9. Look for a pattern going across the table OR divide y by x for each row to find the multiplier.

10. Write an equation in y = kx form. _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

Michael does 7 laps around the field every 2 minutes. Let x represent the number of minutes. Let y represent the number of laps.

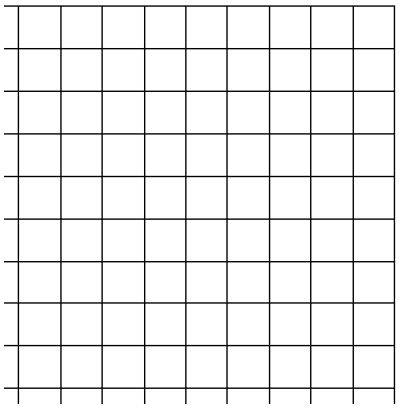
11. Draw a picture to represent the story:

12. Label the columns with words.
13. Record the values you drew.

x	**y**

14. Extend the picture and record the values in the table.
15. Extend the picture and record the values. Keep going…

16. Use the labels from your table to label the axes on the graph.



17. Fill in the numbers on each axes. You might have to skip count in order to reach the highest number on your table.
18. Use each row of the table as a set of coordinates.
19. Look for a pattern going across the table OR divide y by x for each row to find the multiplier.

20. Write an equation in y = kx form. _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: _____ G8 U3 Lesson 1 - Independent Work

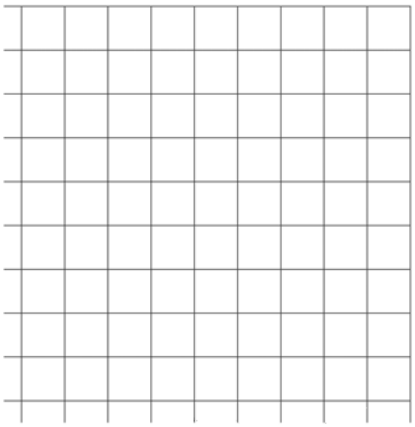
Remember: You can draw a picture on scratch paper to make meaning of the story.

Represent each proportion with a table, graph and equation.

1. Rose puts 2 stickers on every page of her scrapbook. Let x represent the number of pages and y represent the number of stickers.

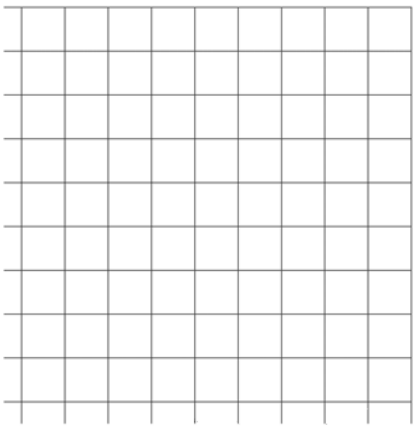
Equation: _____

2. Lisa's 2 cats eat 3 pounds of food per week. Let x represent the number of cats. Let y represent the number of pounds of food.



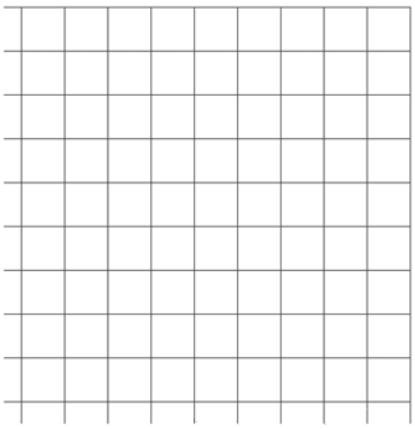
Equation: _____

3. A pack of 12 markers costs $3. Let x represent the number of markers and y represent the number of dollars.



Equation: _____

4. Roy can mow 8 lawns each day. Let x represent the number of days and y represent the number of lawns.



Equation: _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

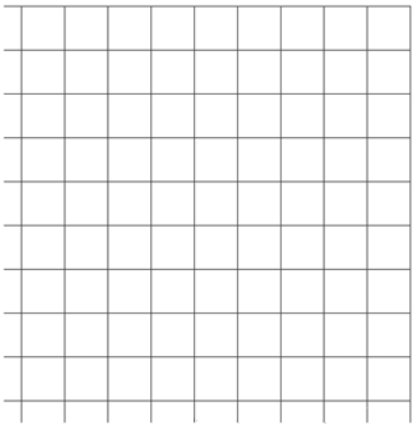
© 2023 CityBridge Education. All Rights Reserved.

Represent each proportion with a table and a graph.

5. Jane is going to average about 45 miles per hour the whole way from New York to California. Let x represent the number of hours and y represent the number of miles.

Equation: _____

6. Francie hired 2 helpers to work with 10 children. Let x represent the number of children. Let y represent the number of helpers.

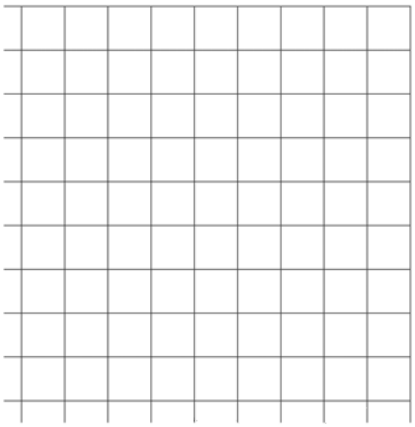


Equation: _____

7. Each teacher at Parkland Middle School spends 3 hours grading for the 4 classes she teaches. Let x represent the number of classes. Let y represent the number of hours.

Equation: _____

8. It takes 6 inches of ribbon per bow that Lisa makes. Let x represent the number of bows and y represent the number of inches of ribbon.



Equation: _____

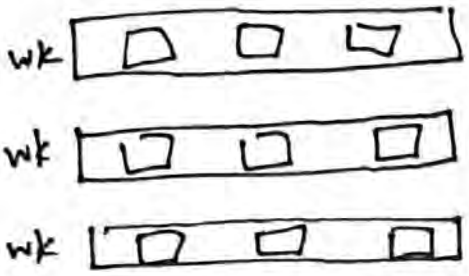
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

Raya goes to 3 gymnastics classes per week. Let x represent the number of weeks. Let y represent the number of gymnastics classes.

1. Draw a picture to represent the story:

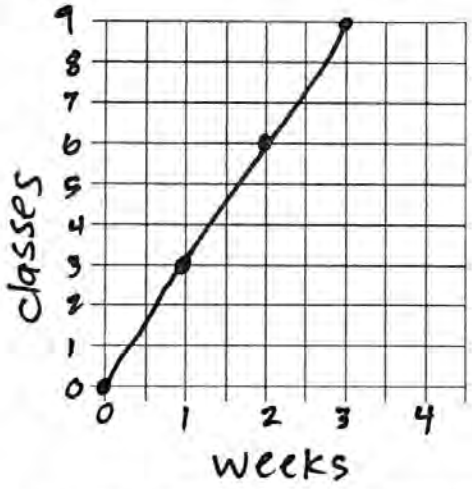


2. Label the columns with words.
3. Record the values you drew.

weeks	classes
x	y
0	0
1	3
2	6
3	9

4. Extend the picture and record the values in the table.
5. Extend the picture and record the values. Keep going...

6. Use the labels from your table to label the axes on the graph.



7. Fill in the numbers on each axes. You might have to skip count in order to reach the highest number on your table.
8. Use each row of the table as a set of coordinates.
9. Look for a pattern going across the table OR divide y by x for each row to find the multiplier.

$1 \times 3 = 3$
$2 \times 3 = 6$
$3 \times 3 = 9$

$x \cdot 3 = y$

$1\overline{)3}$ $\quad 2\overline{)6}$ $\quad 3\overline{)9}$

10. Write an equation in y = kx form. $y = 3x$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
©2025 CityBridge Education. All Rights Reserved.

Michael does 7 laps around the field every 2 minutes. Let x represent the number of minutes. Let y represent the number of laps.

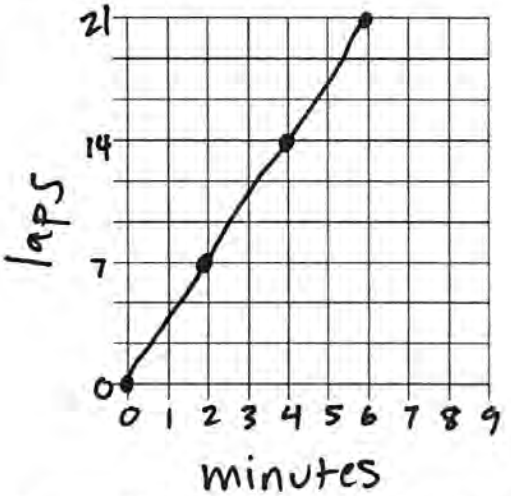
11. Draw a picture to represent the story:

12. Label the columns with words.
13. Record the values you drew.

minutes	laps
x	y
0	0
2	7
4	14
6	21

14. Extend the picture and record the values in the table.
15. Extend the picture and record the values. Keep going...

16. Use the labels from your table to label the axes on the graph.



17. Fill in the numbers on each axes. You might have to skip count in order to reach the highest number on your table.
18. Use each row of the table as a set of coordinates.
19. Look for a pattern going across the table OR divide y by x for each row to find the multiplier.

$2\overline{)7}\ 3\frac{1}{2}$ -6 1 $\quad 4\overline{)14}\ 03\frac{2}{4}$ -12 2 $\quad 6\overline{)21}\ 03\frac{3}{6}$ 18 03

20. Write an equation in y = kx form. $y = 3\frac{1}{2}x$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

G8 U3 Lesson 1 - Independent Work

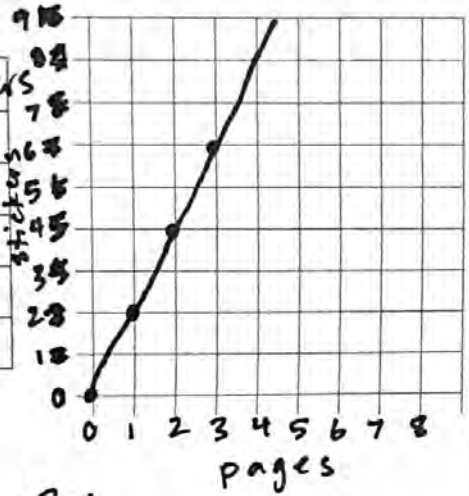
Remember: You can draw a picture on scratch paper to make meaning of the story.

Represent each proportion with a table, graph and equation.

1. Rose puts 2 stickers on every page of her scrapbook. Let x represent the number of pages and y represent the number of stickers.

$1\overline{)2}$ -2 0 $\quad$ $2\overline{)4}$ -4 0

pages	stickers
x	y
0	0
1	2
2	4
3	6

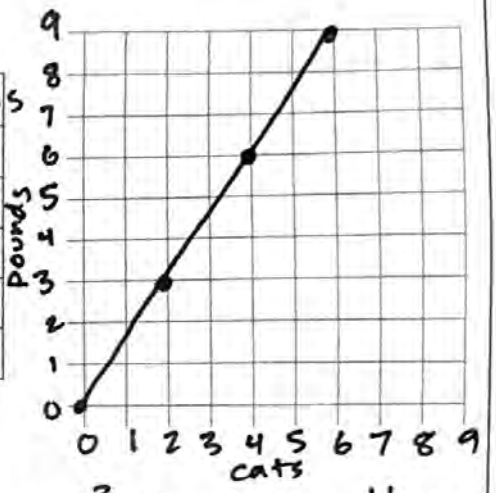


Equation: $y = 2x$

2. Lisa's 2 cats eat 3 pounds of food per week. Let x represent the number of cats. Let y represent the number of pounds of food.

$2\overline{)3}$ $1\frac{1}{2}$ -2 1 $\quad$ $4\overline{)6}$ $1\frac{2}{4}$ -4 2

cats	pounds
x	y
0	0
2	3
4	6
6	9

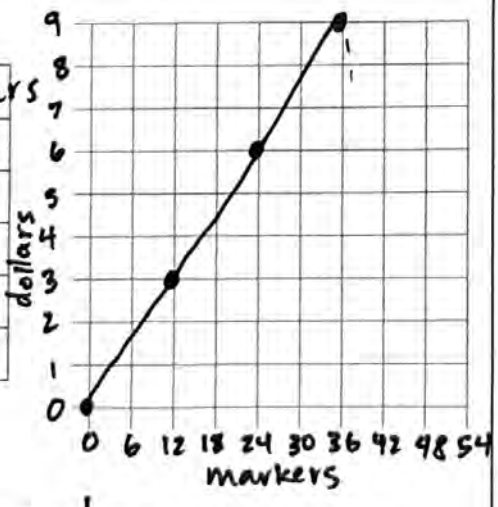


Equation: $y = \frac{3}{2}x$ or $y = 1\frac{1}{2}x$

3. A pack of 12 markers costs $3. Let x represent the number of markers and y represent the number of dollars.

$12\overline{)3}$ $0\frac{3}{12}$ $\quad$ $24\overline{)6}$ $0\frac{6}{24}$

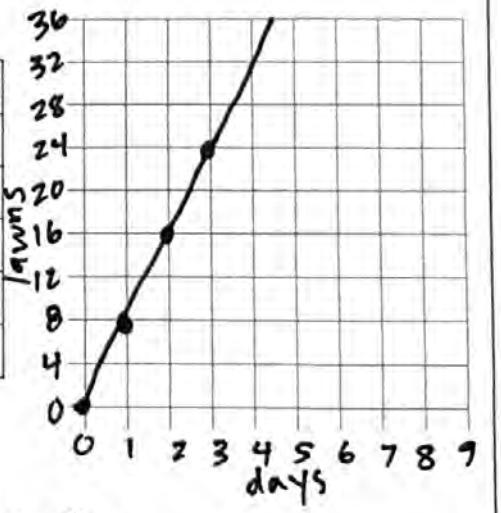
markers	dollars
x	y
0	0
12	3
24	6
36	9



Equation: $y = \frac{1}{4}x$

4. Roy can mow 8 lawns each day. Let x represent the number of days and y represent the number of lawns.

days	lawns
x	y
0	0
1	8
2	16
3	24



Equation: $y = 8x$

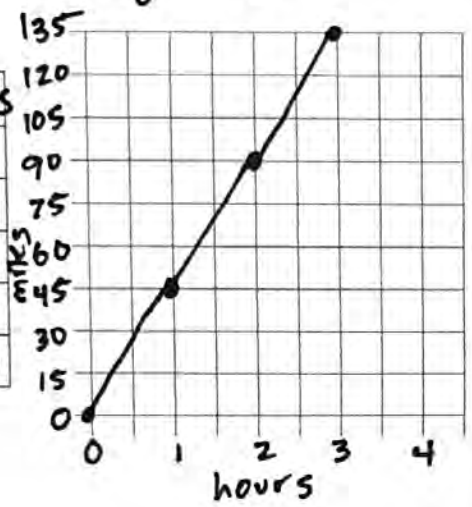
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Represent each proportion with a table and a graph.

5. Jane is going to average about 45 miles per hour the whole way from New York to California. Let x represent the number of hours and y represent the number of miles.

$1\overline{)45}$ $2\overline{)90}$

hours	miles
x	y
0	0
1	45
2	90
3	135

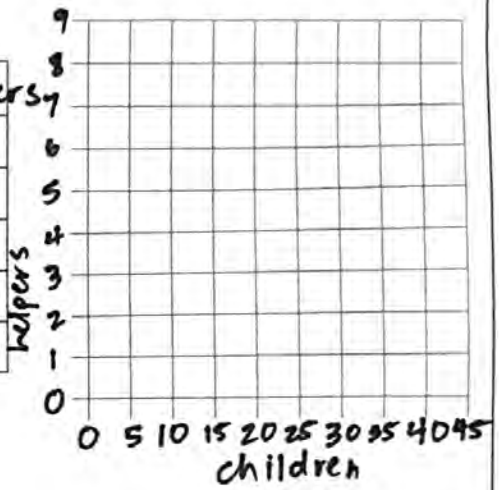


Equation: $y = 45x$

6. Francie hired 2 helpers to work with 10 children. Let x represent the number of children. Let y represent the number of helpers.

$10\overline{)2}$ $20\overline{)4}$

children	helpers
x	y
0	0
10	2
20	4
30	6

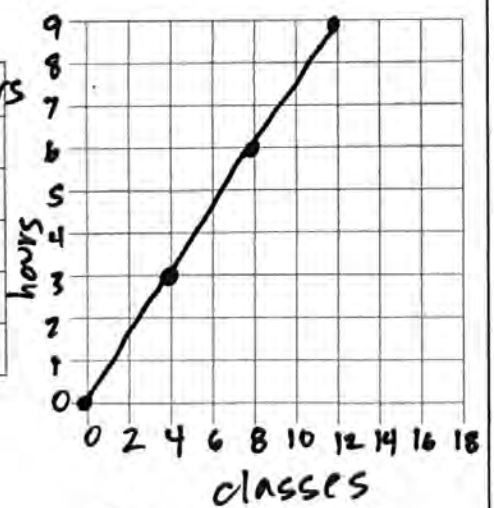


Equation: $y = \frac{1}{5}x$

7. Each teacher at Parkland Middle School spends 3 hours grading for the 4 classes she teaches. Let x represent the number of classes. Let y represent the number of hours.

$4\overline{)3}$ $8\overline{)6}$

classes	hours
x	y
0	0
4	3
8	6
12	9

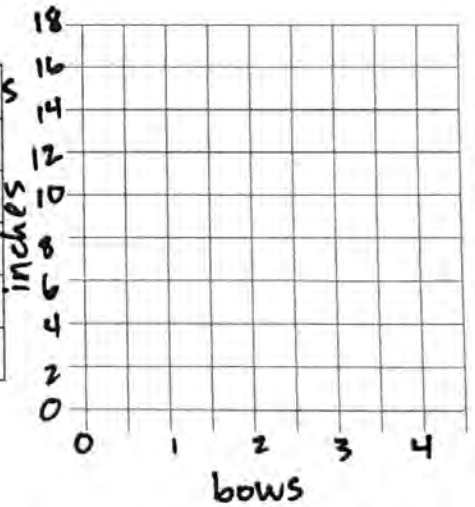


Equation: $y = \frac{3}{4}x$

8. It takes 6 inches of ribbon per bow that Lisa makes. Let x represent the number of bows and y represent the number of inches of ribbon.

$1\overline{)6}$ $2\overline{)12}$

bows	inches
x	y
0	0
1	6
2	12
3	18



Equation: $y = 6x$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

G8 U3 Lesson 2
Connect the meaning of the unit rate, the constant of proportionality and the slope.

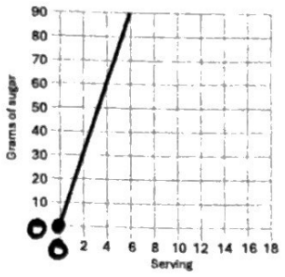
G8 U3 Lesson 2 - Today we will make meaning of the y-intercept and slope on a graph of a proportion.

Warm Welcome (Slide 1): Tutor choice

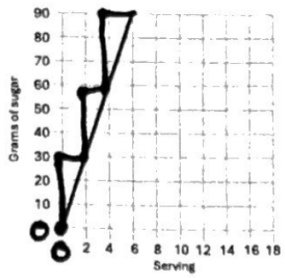
Frame the Learning/Connect to Prior Learning (Slide 2): Today we will make meaning of the y-intercept and slope on a graph of a proportion. Yesterday we reviewed how to represent a proportion with a graph, equation, table and story. Today we are going to focus a little more on graphs to make meaning of the y-intercept and the slope.

Let's Review (Slide 3): The graph of a proportion always has two special features. These two features help us know that a graph is a proportion so we can answer this question, "How do we know if the graph below shows a proportion?" First, let's read the description. I will read it out loud while you read it silently in your head. *Read the problem.* Now we want to know if this shows a proportion. Do you remember this from previous grades? What two parts of this graph are important for us to pay attention to? Possible Student Answers, Key Points:

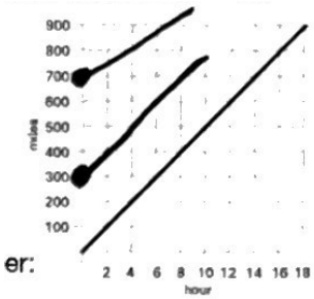
- The graph intercepts the origin.
- The graph goes through the point (0,0).
- The graph is a straight line.
- The graph has a constant slope.



The purpose of this question is to see what children already know. It is important to accept many different versions of correct explanations. However, if children say something that is not totally correct (for example, the line always goes up) be sure to say, "Not exactly." There are two key things to notice about this graph. First, it goes through the point (0,0), which is called the origin. *Draw a point at (0,0).*



Second, the graph is a straight line. The line can go up or down or straight across. But the point is that it is a straight line. This matter because it means it has a constant slope which we also call a constant rate of change. You can see this if I draw a staircase from point to point. This graph is up 30, over 2 then up 30, over 2 then up 30, over 2 again. It is always going to be the same slope no matter which part of the line I look. This is what we mean by constant. It keeps going and going, making a straight line. The important thing to remember is that if a graph is a straight line through (0,0) then it is a proportion.

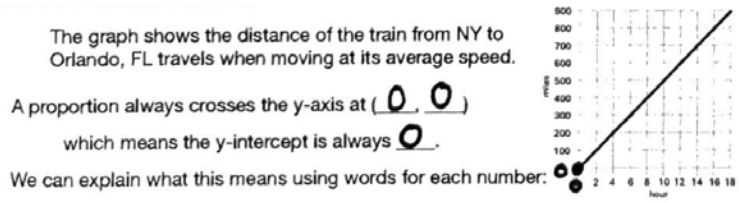


Let's Talk (Slide 4): This important feature where the graph goes through (0,0) has a name. This says, "The y-intercept of a graph is where it cross the y-axis and where x = 0." The y-intercept could be any number. A graph could cross the y-axis here or here. *Draw some sample lines on the graph that have a y-intercept that doesn't equal zero and discuss their meaning.* X is equal to zero for each of these lines where it crosses the y-axis. For example, this is (0,300) so the y-intercept is 300. As another example, this is (0,700) so the y-intercept is 700. *Erase these examples when you are done.*

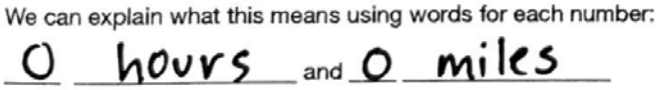
Now let's look at this specific example. Read the story along with me in your head while I read the story out loud. It says, "The graph shows the distance of the train from NY to Orlando, FL travels when

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

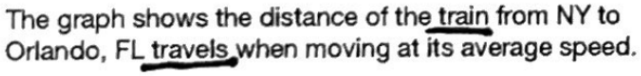
moving at its average speed." On the graph I see hours on the x-axis and miles on the y-axis. Now, we just said that we can know this is a proportion because it crosses (0,0) and has a constant slope. *Draw a point at (0,0).* Now we can connect this to our new vocabulary word and fill in these blanks, "A proportion always crosses the y-axis at…" (0,0). "Which means the y-intercept is always…" Zero.



We can explain what this means using words for each number. The first zero is x so that represents 0 hours since hours is what the x-axis stands for. The second zero is y so that represents 0 miles since miles is what the y-axis stands for.

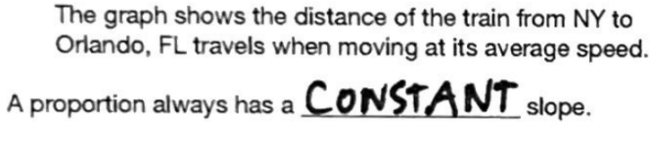


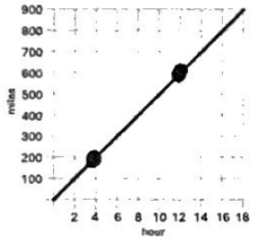
That helps us answer this question, "So, what does the y-intercept represent?" We just have to take these numbers with their words and put them in a sentence. To do this well, we want to try to use as many other words from the story as I can. For example, this story is about a train that travels. *Underline the words "train" and "travels."*



You can create a good frame for your sentence if you use the words "when" and "then." I'll do this example, "WHEN the train has traveled for 0 hours, it will have traveled 0 miles." So, let's review the big ideas. FIrst, the y-intercept is where the line crosses the y-axis. That's where x = 0. But for a proportion, y is going to equal 0 too. So we get the coordinates (0,0) and then we need to use some words with those numbers to make a when/then sentence. Now let's look at that second feature of our graph, the slope.

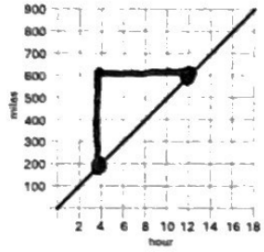
Let's Think (Slide 5): "The slope of a graph is how it increases or decreases. It is measured by the change in y divided by the change in x." You might have learned a bit about this in earlier grades but we need to make sure we all agree on what work we show and what it means today. We have the same story about the train and the same graph. We already talked about how "a proportion always has a CONSTANT slope." That means the slope will be the same no matter what part of the line you use to find it.





This says, "we use two points to show the change in y and the change in x." The change in y and the change in x is really just the two parts of the staircase we used earlier when we were saying "up 30 over 2." Now let's see how we get that same answer with two points because the numbers will get less obvious later on. You can pick any two points. But for now I will pick (4,200) and (12,600). *Mark the two points.*

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.



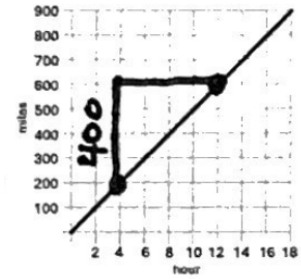
This makes a giant step on the staircase that I could count up. *Draw the "step" from one point to the other.*

Find the change in y:
$y_2 - y_1$

But another way to find the change or difference is subtraction. So I am going to start with y and subtract "y two" minus "y one." It is written like this. That's just like saying the second value of y minus the first value of y.

Find the change in y:
$y_2 - y_1$
$600 - 200$
400

Y_2 is 600 and y_1 is 200 so this will be 600 minus 200 which is 400. That is the change in y.



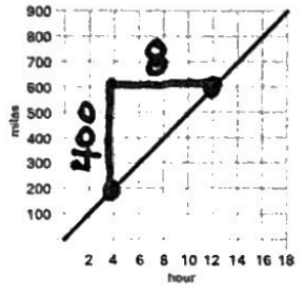
That is how much the line increased on the y axis, or in this case, it is how much that step went up. *Label the vertical line of the step you drew.*

Find the change in x:
$x_2 - x_1$

Now we need to find the change in x. Again, that is the difference so we subtract. I am going to do "x two" minus "x one" which is like saying the second value of x minus the first value of x.

Find the change in x:
$x_2 - x_1$
$12 - 4$
8

X_2 is 12 and x_1 is 4 so this will be 12 minus 4 which is 8. That is the change in x.



That is how much the line moved over on the x-axis, or in this case, it is how much that step went over. *Label the horizontal line of the step you drew.*

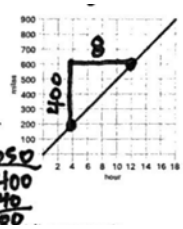
The graph shows the distance of the train from NY to Orlando, FL travels when moving at its average speed.

A proportion always has a CONSTANT slope.

We use two points to show the change in y and change in x.

Find the change in y:
$y_2 - y_1$
$600 - 200$
400

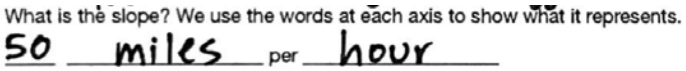
Find the change in x:
$x_2 - x_1$
$12 - 4$
8



We said at the very beginning of this slide that the slope is the change in y divided by the change in x so we do 400 divided by 8. 8 doesn't go into 4 so that's 0. 8 goes into 40, 5 times. I subtract 40 and have 0. So this next place is 0.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

“What is the slope?” 50! “We use the words at each axis to show what it represents.” It was y divided by x so we use the y words then the x words. This is 50 miles per hour. Because that’s what we did, right? We took the difference in miles and split them up by the hours.



Now let’s review the big ideas. The slope is found by doing the change in y divided by the change in x. A proportion always has a constant slope, which we can see because it is a straight line. That means that this would be 50 miles per hour no matter where we decided to mark our points and find the slope.

Let’s Try It (Slide 6): Let’s interpret the y-intercept and the slope of graphs together now! I will walk you through step by step.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

WARM WELCOME

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Today we will make meaning of the y-intercept and slope on a graph of a proportion.

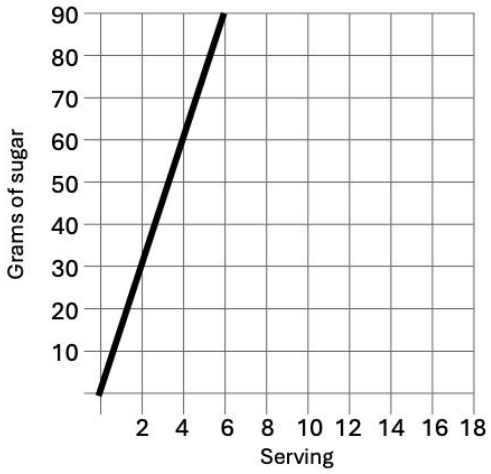
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Review:

The graph of a proportion always has two special features.

How do we know if the graph below shows a proportion?

Lea used the graph to show the amount of sugar in different amounts of Vitamin Water.

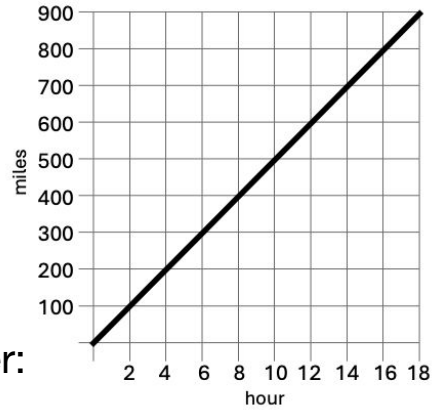


CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk:

The y-intercept of a graph is where it crosses the y-axis and where x = 0.

The graph shows the distance of the train from NY to Orlando, FL travels when moving at its average speed.



A proportion always crosses the y-axis at (____, ____)

which means the y-intercept is always ____.

We can explain what this means using words for each number:

_____ _____ and ____ _____

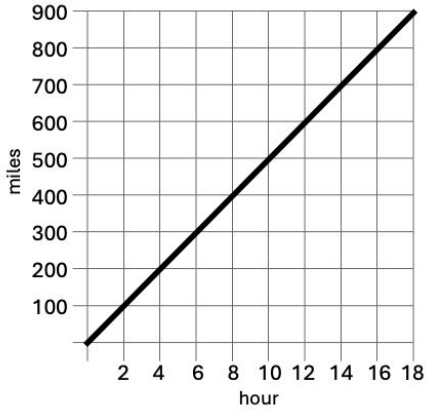
So, what does the y-intercept represent?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

The slope of a graph is how it increases or decreases. It is measured by the change in y divided by the change in x.

The graph shows the distance of the train from NY to Orlando, FL travels when moving at its average speed.



A proportion always has a _____ slope.

We use two points to show the change in y and change in x.

Find the change in y: Find the change in x:

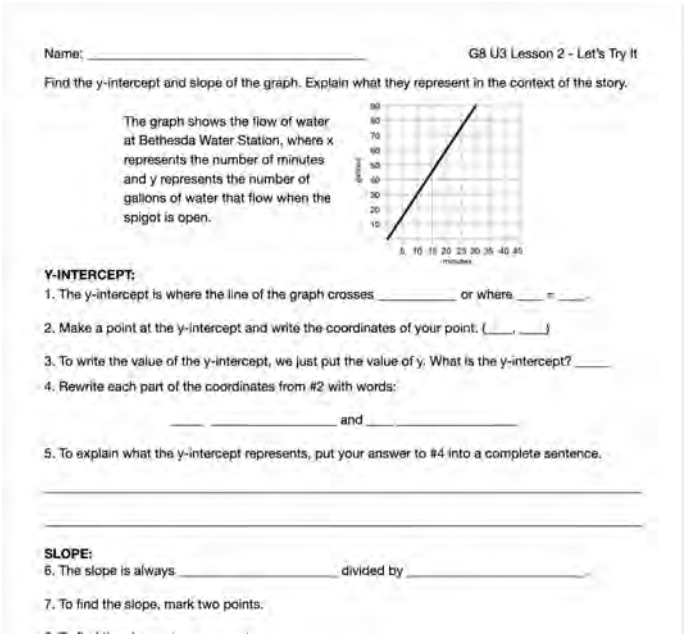
What is the slope? We use the words at each axis to show what it represents.

_____ _____ per _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Try It:

Let's interpret the y-intercept and the slope of graphs together!



Name: _____ G8 U3 Lesson 2 - Let's Try It

Find the y-intercept and slope of the graph. Explain what they represent in the context of the story.

The graph shows the flow of water at Bethesda Water Station, where x represents the number of minutes and y represents the number of gallons of water that flow when the spigot is open.

Y-INTERCEPT:

1. The y-intercept is where the line of the graph crosses _____ or where ___ = ___.
2. Make a point at the y-intercept and write the coordinates of your point: (___, ___)
3. To write the value of the y-intercept, we just put the value of y. What is the y-intercept? ___
4. Rewrite each part of the coordinates from #2 with words:

___ _____ and ___ _____

5. To explain what the y-intercept represents, put your answer to #4 into a complete sentence.

_____

_____

SLOPE:

6. The slope is always _____ divided by _____.
7. To find the slope, mark two points.

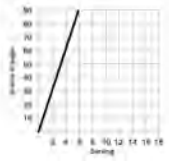
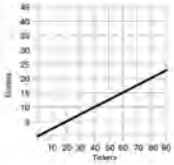
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

On your Own:

Now it's time for you to do it on your own.

Name: _____ G8 U3 Lesson 2 - Independent Work

Find the y-intercept and slope of each graph. Explain what they represent in the context of the story.

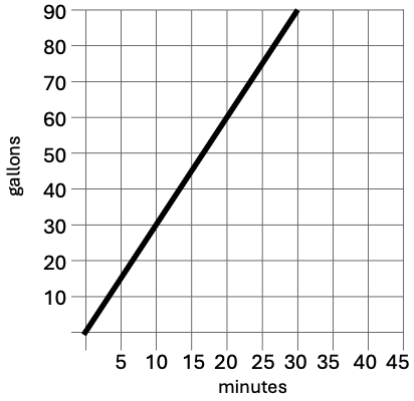
The graph below shows the amount of sugar in different amounts of Lucky Charms cereal. 	1. What is the y-intercept? ____ 2. What does it represent? 3. What is the slope? ____ 4. What does it represent?
Tim graphed the price of tickets for the County Fair rides. 	5. What is the y-intercept? ____ 6. What does it represent? 7. What is the slope? ____ 8. What does it represent?
The graph below shows the amount of yarn needed to make a tapestry.	9. What is the y-intercept? ____ 10. What does it represent?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Name: _____ G8 U3 Lesson 2 - Let's Try It

Find the y-intercept and slope of the graph. Explain what they represent in the context of the story.

The graph shows the flow of water at Bethesda Water Station, where x represents the number of minutes and y represents the number of gallons of water that flow when the spigot is open.



Y-INTERCEPT:

1. The y-intercept is where the line of the graph crosses _____ or where ____ = ____.

2. Make a point at the y-intercept and write the coordinates of your point. (____, ____)

3. To write the value of the y-intercept, we just put the value of y. What is the y-intercept? _____

4. Rewrite each number of the coordinates from #2 with words:

_____ _____ and ____ _____

5. To explain what the y-intercept represents, put your answer to #4 into a complete sentence.

_____

_____

SLOPE:

6. The slope is always _____ divided by _____.

7. To find the slope, mark two points.

8. To find the change in y, we must _____.

9. What is the change in y? _____-_____= _____

10. To find the change in x, we must _____.

11. What is the change in x? _____-_____= _____

12. Use your answers to #9 and #11 to find the slope. _____

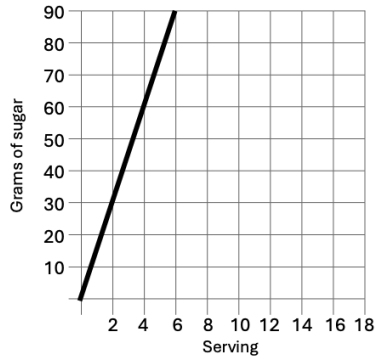
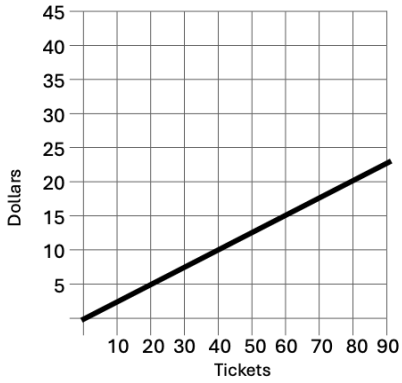
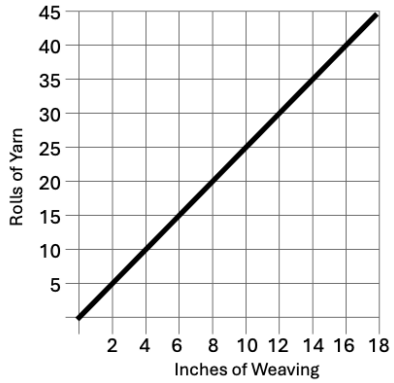
13. To explain what the slope represents, use the words at each axis, y words then x words.

_____ _____ per _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

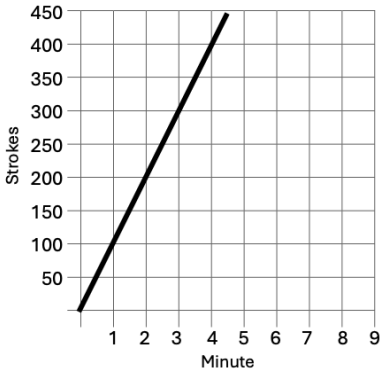
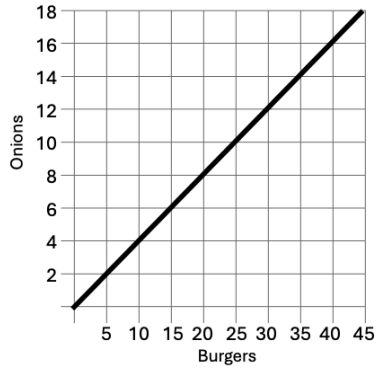
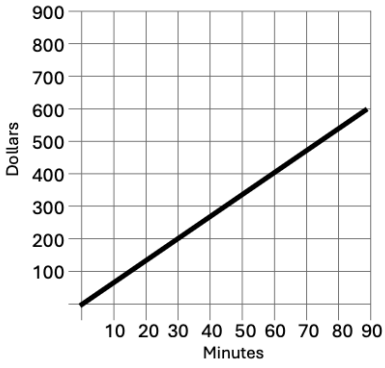
Name: _____ G8 U3 Lesson 2 - Independent Work

Find the y-intercept and slope of each graph. Explain what they represent in the context of the story.

The graph below shows the amount of sugar in different amounts of Lucky Charms cereal.  	1. What is the y-intercept? _____ 2. What does it represent? 3. What is the slope? _____ 4. What does it represent?
Tim graphed the price of tickets for the County Fair rides.  	5. What is the y-intercept? _____ 6. What does it represent? 7. What is the slope? _____ 8. What does it represent?
The graph below shows the amount of yarn needed to make a tapestry.  	9. What is the y-intercept? _____ 10. What does it represent? 11. What is the slope? _____ 12. What does it represent?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Find the y-intercept and slope of each graph. Explain what they represent in the context of the story.

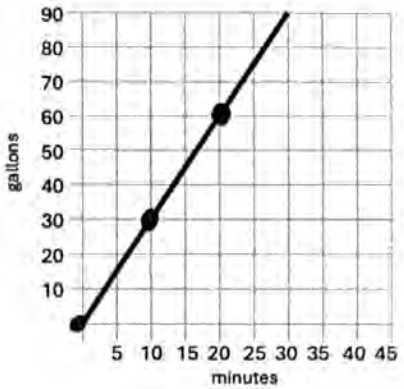
The graph below shows the amount that GW's rowing team can row at a constant rate over time.  	13. What is the y-intercept? _____ 14. What does it represent? 15. What is the slope? _____ 16. What does it represent?
Chef uses the graph to determine how many onions to buy based on the number of burgers he is going to cook.  	17. What is the y-intercept? _____ 18. What does it represent? 19. What is the slope? _____ 20. What does it represent?
Dan made a graph to show how much he bills clients based on the length of a meeting.  	21. What is the y-intercept? _____ 22. What does it represent? 23. What is the slope? _____ 24. What does it represent?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

Find the y-intercept and slope of the graph. Explain what they represent in the context of the story.

The graph shows the flow of water at Bethesda Water Station, where x represents the number of minutes and y represents the number of gallons of water that flow when the spigot is open.



Y-INTERCEPT:

1. The y-intercept is where the line of the graph crosses y-axis or where x = 0.
2. Make a point at the y-intercept and write the coordinates of your point. (0, 0)
3. To write the value of the y-intercept, we just put the value of y. What is the y-intercept? 0
4. Rewrite each number of the coordinates from #2 with words:

0 minutes and 0 gallons

5. To explain what the y-intercept represents, put your answer to #4 into a complete sentence.

When the spigot is open for 0 minutes then 0 gallons of water has flowed.

SLOPE:

6. The slope is always change in y divided by change in x.
7. To find the slope, mark two points.
8. To find the change in y, we must subtract $y_2 - y_1$.
9. What is the change in y? 60 - 30 = 30
10. To find the change in x, we must subtract $x_2 - x_1$.
11. What is the change in x? 20 - 10 = 10
12. Use your answers to #9 and #11 to find the slope. $30 \div 10 = 3$
13. To explain what the slope represents, use the words at each axis, y words then x words.

3 gallons per minute

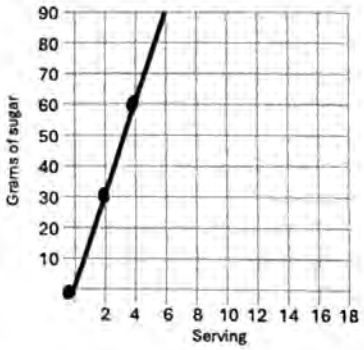
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

G8 U3 Lesson 2 - Independent Work

Find the y-intercept and slope of each graph. Explain what they represent in the context of the story.

The graph below shows the amount of sugar in different amounts of Lucky Charms cereal.



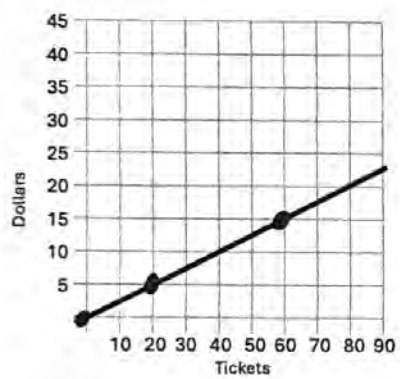
1. What is the y-intercept? 0
2. What does it represent?

When there are 0 servings then there are 0 grams of sugar.

3. What is the slope? 15 $\frac{60-30}{4-2} = \frac{30}{2} = 15$
4. What does it represent?

15 grams of sugar per serving

Tim graphed the price of tickets for the County Fair rides.



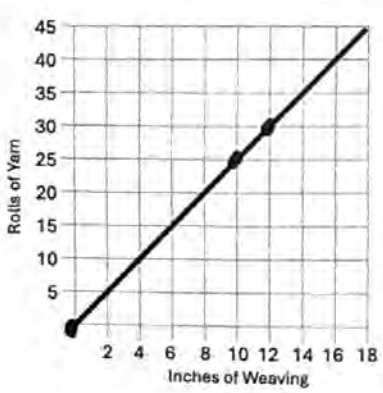
5. What is the y-intercept? 0
6. What does it represent?

When Tim buys 0 tickets, then he pays 0 dollars

7. What is the slope? $\frac{1}{4}$ $\frac{15-5}{60-20} = \frac{10}{40} = \frac{1}{4}$
8. What does it represent?

$\frac{1}{4}$ dollar per ticket

The graph below shows the amount of yarn needed to make a tapestry.



9. What is the y-intercept? 0
10. What does it represent?

When there are 0 inches of weaving, then 0 rolls of yarn were needed.

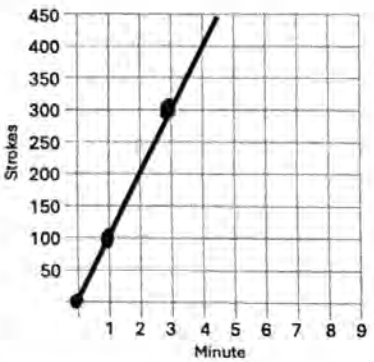
11. What is the slope? $1\frac{1}{2}$ $\frac{30-25}{12-10} = \frac{5}{2} = 1\frac{1}{2}$
12. What does it represent?

$1\frac{1}{2}$ rolls of yarn per inch of weaving

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Find the y-intercept and slope of each graph. Explain what they represent in the context of the story.

The graph below shows the amount that GW's rowing team can row at a constant rate over time.



13. What is the y-intercept? 0

14. What does it represent?

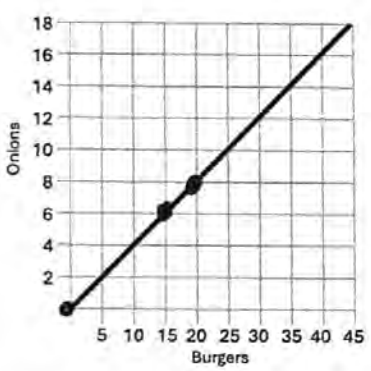
When GW's rowing team has rowed 0 min then they would have done 0 strokes.

15. What is the slope? ____ $\frac{300-100}{3-1} = \frac{200}{2} = 100$

16. What does it represent?

100 strokes per minute

Chef uses the graph to determine how many onions to buy based on the number of burgers he is going to cook.



17. What is the y-intercept? 0

18. What does it represent?

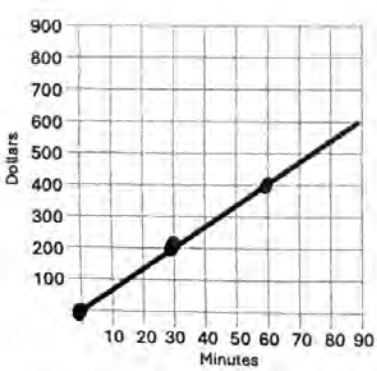
When chef is going to make 0 burgers then he needs 0 onions.

19. What is the slope? $\frac{2}{5}$ $\frac{8-6}{20-15} = \frac{2}{5}$

20. What does it represent?

$\frac{2}{5}$ onions per burger

Dan made a graph to show how much he bills clients based on the length of a meeting.



21. What is the y-intercept? 0

22. What does it represent?

When Dan has a 0 minute meeting then he bills clients 0 dollars.

23. What is the slope? $6\frac{2}{3}$ $\frac{400-200}{60-30} = \frac{200}{30}$

24. What does it represent?

$$\begin{array}{r} 006 \\ 30\overline{)200} \\ -180 \\ \hline 20 \end{array}$$

$6\frac{2}{3}$ dollars per minute

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education
© 2023 CityBridge Education. All Rights Reserved.

G8 U3 Lesson 3
Find the rate of change of a proportional relationship given the graph, equation, table, or situation.

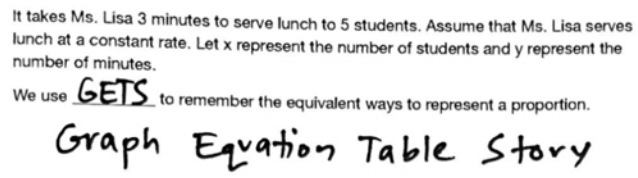
G8 U3 Lesson 3 - Today we will connect the meaning of the unit rate, the constant of proportionality and the slope.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will connect the meaning of the unit rate, the constant of proportionality and the slope. In our last lesson we practiced finding the y-intercept and slope on a graph. Now we are going to connect those ideas to corresponding parts of a table and an equation. This is the coolest thing about math - that all the tools we use are connected and reinforce the same fundamental ideas. It's going to be awesome! Let's go!

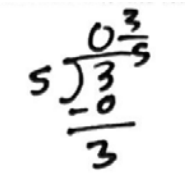
Let's Review (Slide 3): In our last lessons, we answered this question, "What ways do we have to represent a proportion?" We have a story about a proportional relationship here. Read along silently while I read it out loud. *Read the story out loud.* I know this is a proportion because it says that she serves lunch at a constant rate. That constant rate means there is a proportional relationship and when one quantity changes, the other changes proportionally. What are different ways that I could represent this proportional relationship? Possible Student Answers, Key Points:

- You can draw a picture.
- You can make a table.
- You can write an equation.
- You can make a graph.



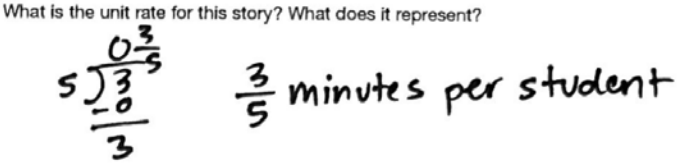
I heard so many great ideas. We can use the acronym, "GETS," to remember all the ways we represent a proportion. G stands for graph. E stands for equation. T stands for table. S stands for story. All of these can be used to show what is described in this story and what happens when the proportional relationship in this story keeps going.

Let's Talk (Slide 4): This is the main idea for today, "In all our forms of representation, there is always a form of the unit rate." I am going to show you what I mean in this example below. Read along with me silently as I read out loud. *Read the problem out loud.* Now we said that there is always a form of the unit rate so the first thing we are going to do to explore this idea is answer this question, "What is the unit rate for this story? What does it represent?" First, it might be helpful if I remind you what the unit rate is. It is the amount of something for just 1 of the other thing. Unit means one. So the unit rate is the amount of something for 1 of the other thing.



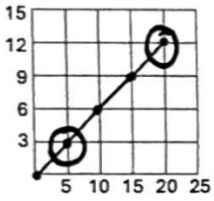
If I want to split something up equally to find the amount for our group, that would be division, right? Division tells us the amount in each group. So in this case, we're going to divide to find the amount in each unit. It will always be y divided by x which is 3 divided by 5. 5 doesn't go into 3. We get 0 and our numbers can only be represented with a fraction, 3 fifths.

We never want to have a number without words, and that will help us know what our unit rate represents. We can figure it out by thinking about what we divided. 3 was the minutes and the 5 was the students. So we have 3 fifths minutes per student. That means it takes 3 fifth of a minute for every 1 student. Whenever we have a unit rate, it will always have two sets of words representing

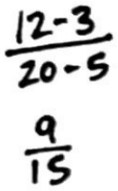


CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

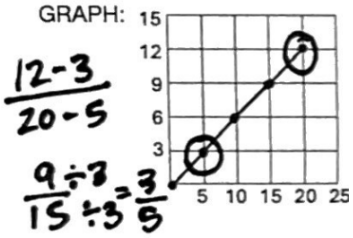
some quantity for ONE of the other quantity. In this case minutes per ONE student.



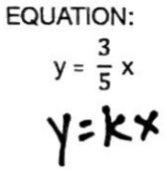
Let's Think (Slide 5): Now let's see how the unit rate shows up in the other forms. This says, "The unit rate is the slope on a graph and in an equation. It is the constant of proportionality on a table." We have the same story but now we've been given a graph, equation and table to match. Let's start by finding the slope. We practiced this in our last lesson. It is the change in y divided by the change in x. So let's select two points. I will select (5,3) and (20,12). *Circle the points.*



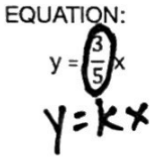
Now we do y_2 minus y_1 which is 12 minus 3. That will be divided by x_2 minus x_1 which is 20 minus 5. That's 9 divided by 15.



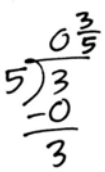
This is less than 1 whole, right? If we divide it, we'd get zero. So the only thing we can do is simplify it. I will divide the top by 3 and the bottom by 3. I get 3 fifths. This is the big idea of our lesson: the unit rate we found on the last slide is the same as the slope of the graph on this slide.



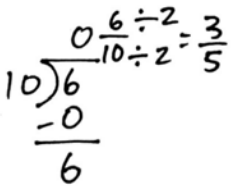
That means it is also the same as the slope in our equation. The equation for a proportion is always written in the form y = kx where k is whatever number is multiplying x. *Write y=kx underneath our equation on the slide.*



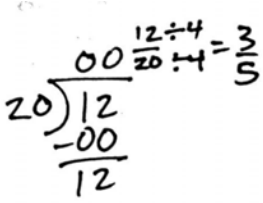
K is the slope of the equation. And we can see that in this case, it is 3 fifths. *Circle 3 fifths in the equation.* So this is the next part of our big idea: the unit rate we found on the last slide is the same as the slope of the graph on this slide AND it is the same as the slope of the equation on this slide.



We can check all this by finding the constant of proportionality on the table. Hopefully you did a bit of that back in 6th grade but we'll practice again here. It is y divided by x. So, for this first row, we have 3 divided by 5, which is 3 fifths.



Let's do the next row. It is 6 divided by 10, which is 6 tenths. We can simplify that by dividing the numerator and denominator by 2. We get 3 fifths. It is the same! That's why it's called the CONSTANT of proportionality - because it's constant.



We could keep going. Let's skip down to the bottom row for fun. We have 12 divided by 20. That is zero. We get 12 twentieths. We can simplify that by dividing the numerator and denominator by 4. We get 3 fifths. It is the same too! This is the final part of our big idea: the unit rate we found on the last slide is the same as the slope of the graph on this slide and it is the same as the

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

slope of the equation on this slide AND it is the same as the constant of proportionality in the table on this slide.

Let's Try It (Slide 6): Let's find the unit rate, slope and constant of proportionality together! I will walk you through each step.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

WARM WELCOME

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Today we will connect the meaning of the unit rate, the constant of proportionality and the slope.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Review:

What ways do we have to represent a proportion?

It takes Ms. Lisa 3 minutes to serve lunch to 5 students. Assume that Ms. Lisa serves lunch at a constant rate. Let x represent the number of students and y represent the number of minutes.

We use _____ to remember the equivalent ways to represent a proportion.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk:

In all our forms of representation, there is always a form of the unit rate.

It takes Ms. Lisa 3 minutes to serve lunch to 5 students. Assume that Ms. Lisa serves lunch at a constant rate. Let x represent the number of students and y represent the number of minutes.

What is the unit rate for this story? What does it represent?

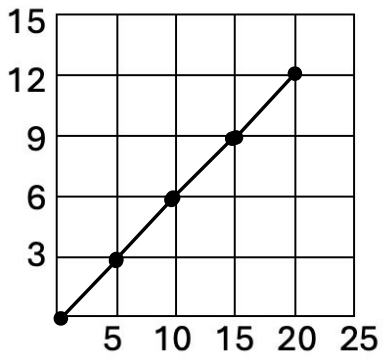
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

The unit rate is the slope on a graph and in an equation. It is the constant of proportionality on a table.

It takes Ms. Lisa 3 minutes to serve lunch to 5 students. Assume that Ms. Lisa serves lunch at a constant rate. Let x represent the number of students and y represent the number of minutes.

GRAPH:



EQUATION:

$$y = \frac{3}{5}x$$

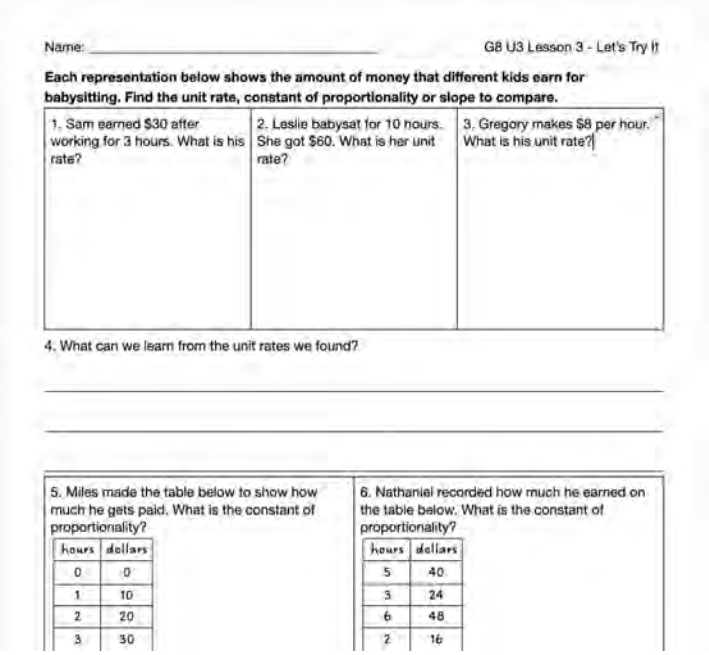
TABLE:

x	y
0	0
5	3
10	6
15	9
20	12

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Try It:

Let's find the unit rate, slope and constant of proportionality together!



Name: _____ G8 U3 Lesson 3 - Let's Try It

Each representation below shows the amount of money that different kids earn for babysitting. Find the unit rate, constant of proportionality or slope to compare.

1. Sam earned $30 after working for 3 hours. What is his rate?	2. Leslie babysat for 10 hours. She got $60. What is her unit rate?	3. Gregory makes $8 per hour. What is his unit rate?

4. What can we learn from the unit rates we found?

_____

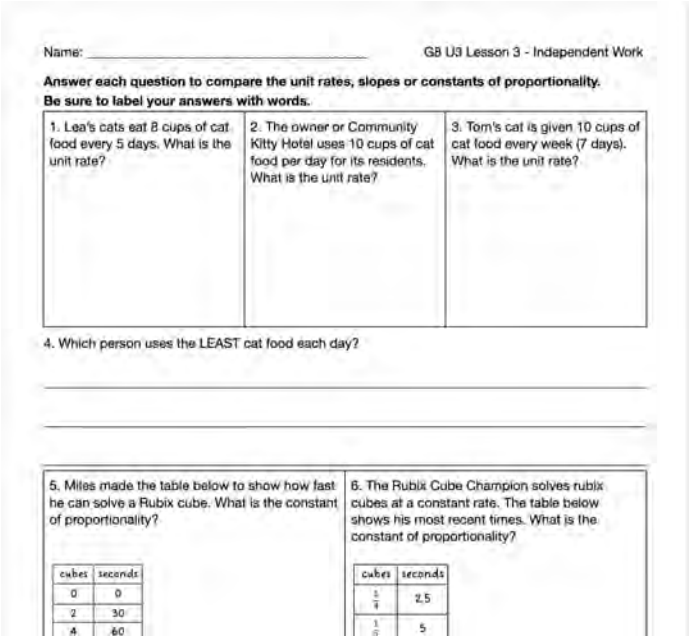
_____

5. Miles made the table below to show how much he gets paid. What is the constant of proportionality?		6. Nathaniel recorded how much he earned on the table below. What is the constant of proportionality?	
hours	dollars	hours	dollars
0	0	5	40
1	10	3	24
2	20	6	48
3	30	2	16

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

On your Own:

Now it's time for you to do it on your own.



Name: _____ G8 U3 Lesson 3 - Independent Work

Answer each question to compare the unit rates, slopes or constants of proportionality. Be sure to label your answers with words.

1. Lea's cats eat 8 cups of cat food every 5 days. What is the unit rate?	2. The owner or Community Kitty Hotel uses 10 cups of cat food per day for its residents. What is the unit rate?	3. Tom's cat is given 10 cups of cat food every week (7 days). What is the unit rate?

4. Which person uses the LEAST cat food each day?

_____

_____

5. Miles made the table below to show how fast he can solve a Rubix cube. What is the constant of proportionality?

cubes	seconds
0	0
2	30
4	60

6. The Rubix Cube Champion solves rubix cubes at a constant rate. The table below shows his most recent times. What is the constant of proportionality?

cubes	seconds
$\frac{1}{4}$	2.5
$\frac{1}{2}$	5

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Each representation below shows the amount of money that different kids earn for babysitting. Find the unit rate, constant of proportionality or slope to compare.

1. Sam earned $30 after working for 3 hours. What is his rate?	2. Leslie babysat for 10 hours. She got $60. What is her unit rate?	3. Gregory makes $8 per hour. What is his unit rate?

4. What can we learn from the unit rates we found?

5. Miles made the table below to show how much he gets paid. What is the constant of proportionality?

hours	dollars
0	0
1	10
2	20
3	30
4	40

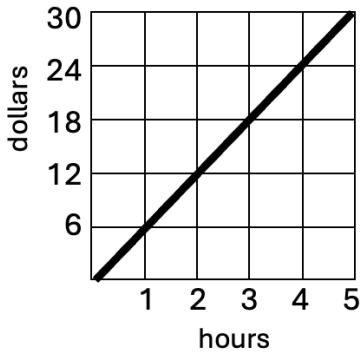
6. Nathaniel recorded how much he earned on the table below. What is the constant of proportionality?

hours	dollars
5	40
3	24
6	48
2	16

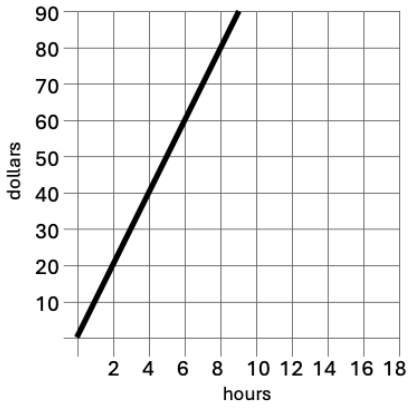
7. What can we learn from the constants of proportionality we found?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

8. Rose made a graph of what she charges for different amounts of hours. What is the slope of her graph?



9. The graph shows Matt's earnings for babysitting based on hours he works. What is the slope of the graph?



10. What can we learn from the slopes we found?

11. Dave uses the equation y=8x to calculate his charges where x is the number of hours and y is the number of dollars. What is the slope?

12. The equation, 10x = y, could be used to find the amount that Colby earns where x represents the number of hours and y represents the number of dollars. What is slope?

13. What can we learn from the slopes we found?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: _____ G8 U3 Lesson 3 - Independent Work

Answer each question to compare the unit rates, slopes or constants of proportionality. Be sure to label your answers with words.

1. Lea's cats eat 8 cups of cat food every 5 days. What is the unit rate?	2. The owner or Community Kitty Hotel uses 10 cups of cat food per day for its residents. What is the unit rate?	3. Tom's cat is given 10 cups of cat food every week (7 days). What is the unit rate?

4. Which person uses the LEAST cat food each day?

5. Miles made the table below to show how fast he can solve a Rubix cube. What is the constant of proportionality?

cubes	seconds
0	0
2	30
4	60
5	90

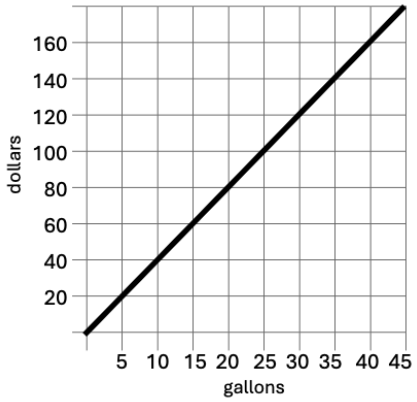
6. The Rubix Cube Champion solves rubix cubes at a constant rate. The table below shows his most recent times. What is the constant of proportionality?

cubes	seconds
$\frac{1}{4}$	2.5
$\frac{1}{2}$	5
$\frac{3}{4}$	7.5
1	10

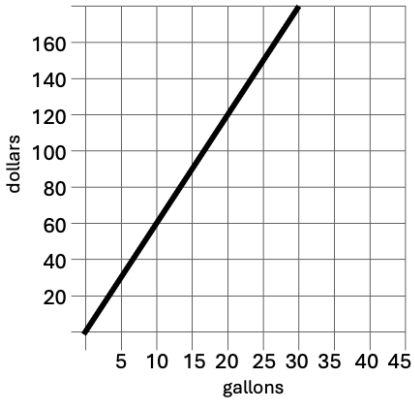
7. How much faster (in seconds per cube) is the Champion than Miles?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

8. The prices for gas at QuickFill Gas station is shown on the graph below. What is the slope of the graph?



9. The prices for gas at SuperPump Gas station is shown on the graph below. What is the slope of the graph?



10. Which gas station is more expensive?

11. The equation y=12x shows the number of children, y, allowed at a nursery school based on the number of teachers, x. What is the slope?

12. At a school, the equation 14x = y is used to determine how many teachers must be hired depending on the number of students, where x is the number of teachers and y is the number of students. What is the slope?

13. Which school has a higher ratio of students to teachers?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

Each representation below shows the amount of money that different kids earn for babysitting. Find the unit rate, constant of proportionality or slope to compare.

1. Sam earned $30 after working for 3 hours. What is his rate?

$$\begin{array}{r} 10 \\ 3\overline{)30} \\ -3 \\ \hline 00 \end{array}$$

10 dollars per hour

2. Leslie babysat for 10 hours. She got $60. What is her unit rate?

$$\begin{array}{r} 06 \\ 10\overline{)60} \\ -60 \\ \hline 00 \end{array}$$

6 dollars per hour

3. Gregory makes $\boxed{\$8 \text{ per hour.}}$ What is his unit rate?

$8 dollars per hour

4. What can we learn from the unit rates we found?

Sam has the highest rate in dollars per hour.

5. Miles made the table below to show how much he gets paid. What is the constant of proportionality?

hours	dollars
0	0
1	10
2	20
3	30
4	40

$$\begin{array}{r} 10 \\ 1\overline{)10} \\ -10 \\ \hline 00 \end{array} \qquad \begin{array}{r} 10 \\ 3\overline{)30} \\ -3 \\ \hline 00 \end{array}$$

10 dollars per hour

6. Nathaniel recorded how much he earned on the table below. What is the constant of proportionality?

hours	dollars
5	40
3	24
6	48
2	16

$$\begin{array}{r} 08 \\ 5\overline{)40} \\ -40 \\ \hline 00 \end{array} \qquad \begin{array}{r} 08 \\ 2\overline{)16} \\ -16 \\ \hline 00 \end{array}$$

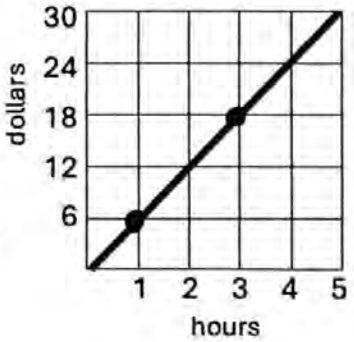
8 dollars per hour

7. What can we learn from the constants of proportionality we found?

Miles has a higher rate in dollars per hour than Nathaniel.

CONFIDENTIAL INFORMATION Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

8. Rose made a graph of what she charges for different amounts of hours. What is the slope of her graph?



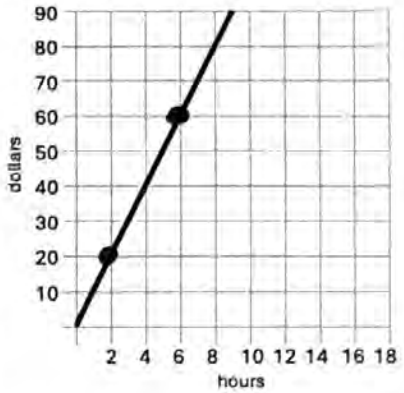
$\frac{18-6}{3-1}$

$\frac{12}{2}$

6

6 dollars per hour

9. The graph shows Matt's earnings for babysitting based on hours he works. What is the slope of the graph?



$\frac{60-20}{6-2}$

$\frac{40}{4}$

10

10 dollars per hour

10. What can we learn from the slopes we found?

Matt has a higher rate in dollars per hour than Rose.

11. Dave uses the equation $y=8x$ to calculate his charges where x is the number of hours and y is the number of dollars. What is the slope?

8 dollars per hour

12. The equation, $10x = y$, could be used to find the amount that Colby earns where x represents the number of hours and y represents the number of dollars. What is slope?

10 dollars per hour

13. What can we learn from the slopes we found?

Colby has a higher rate in dollars per hour than Dave.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
©2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

G8 U3 Lesson 3 - Independent Work

Answer each question to compare the unit rates, slopes or constants of proportionality. Be sure to label your answers with words.

1. Lea's cats eat 8 cups of cat food every 5 days. What is the unit rate?

$5\overline{)8}$ → 1, -5, 3

$1\frac{3}{5}$ cups per day

2. The owner or Community Kitty Hotel uses 10 cups of cat food per day for its residents. What is the unit rate?

10 cups per day

3. Tom's cat is given 10 cups of cat food every week (7 days). What is the unit rate?

$7\overline{)10}$ → 01, -7, 3

$1\frac{3}{7}$ cups per day

4. Which person uses the LEAST cat food each day?

Tom uses the least cat food per day.

5. Miles made the table below to show how fast he can solve a Rubix cube. What is the constant of proportionality?

cubes	seconds
0	0
2	30
4	60
5	90

$2\overline{)30}$ → 15, $-2\downarrow$, 10, -10, 00

$4\overline{)60}$ → 15, $-4\downarrow$, 20, -20, 00

15 seconds per cube

6. The Rubix Cube Champion solves rubix cubes at a constant rate. The table below shows his most recent times. What is the constant of proportionality?

cubes	seconds
$\frac{1}{4}$	2.5
$\frac{1}{2}$	5
$\frac{3}{4}$	7.5
1	10

$2.5 \div \frac{1}{4}$

$2.5 \times \frac{4}{1}$

10

$10 \div 1$

$2.5 \times 4 = 10.0$

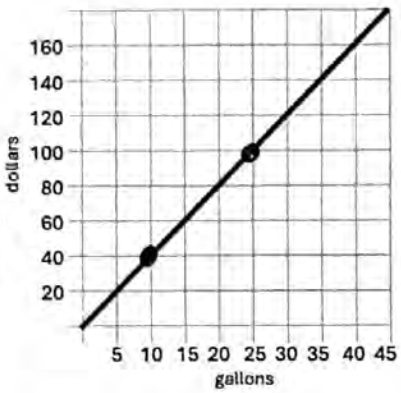
10 seconds per cube

7. How much faster (in seconds per cube) is the Champion than Miles?

The champion is 5 seconds per cube faster.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

8. The prices for gas at QuickFill Gas station is shown on the graph below. What is the slope of the graph?



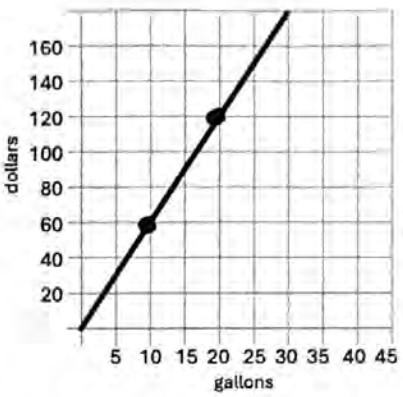
100-40 / 25-10

60 / 15

04
15)60
-60
00

4 dollars per gallon

9. The prices for gas at SuperPump Gas station is shown on the graph below. What is the slope of the graph?



120-60 / 20-10

60 / 10

06
10)60
-60
00

6 dollars per gallon

10. Which gas station is more expensive?

SuperPump Gas Station is more expensive.

11. The equation y=12x shows the number of children, y, allowed at a nursery school based on the number of teachers, x. What is the slope?

12 children per teacher

12. At a school, the equation 14x = y is used to determine how many teachers must be hired depending on the number of students, where x is the number of teachers and y is the number of students. What is the slope?

14 children per teacher

13. Which school has a higher ratio of students to teachers?

The second school has a higher ratio.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

G8 U3 Lesson 4
Make meaning of pairs of values that satisfy or do not satisfy a given equation or graph.

G8 U3 Lesson 4 - Today we will make meaning of values that satisfy or do not satisfy a given equation or graph.

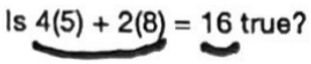
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will make meaning of values that satisfy or do not satisfy a given equation or graph. Yesterday we learned more about the rate of change for a proportion. Now we're going to see what happens when we find pairs of numbers that fit a particular proportion. Let's go!

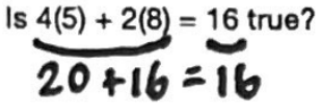
Let's Review (Slide 3): "How do we know when an equation is true?" Possible Student Answers, Key Points:

- They have to be equal.
- The equation has to be the same on both sides.
- The equation has to be balanced.
- You can do the math and check if it works.

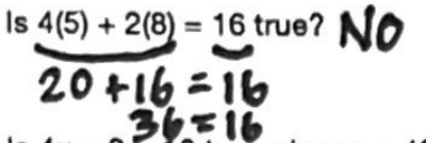
I heard a lot of ways of saying the same idea but I want to make sure I spell out the concept. A lot of times we think about the equal sign like it is telling us to do math from left to right. And sometimes that is correct. But we can also think of it like a balance. It says "equal" right out there, which means what is on this whole side is equal or the same as on this whole side. *Underline each side of the equation.*



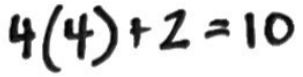
We have to understand the equal sign meaning "the same as" or "balanced" and then we do the math from left to right like we're used to. We have to follow order of operations which you might have learned as PEMDAS. You're not going to see a lot of parentheses today. But you might see multiplication and division, and you always have to do those before you do addition and subtraction.



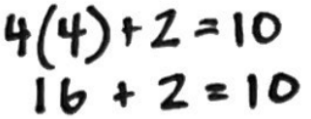
Let's begin. I will do 4 times 5 which is 20, and I will do 2 times 8 which is 16. *Be sure to write these numbers directly understand the corresponding place in the equation.* This had an addition sign between them so I bring that down. I bring down the equals 16 just to keep it all in line.



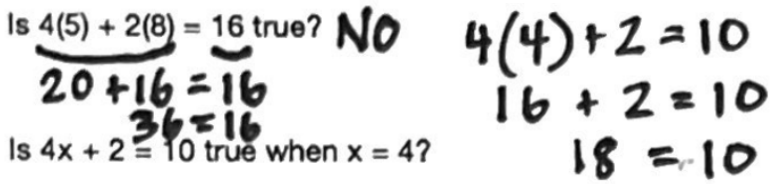
Now I do 20 plus 16. That's 36 and if I bring down the rest, I see 36 = 16. Nope! Unbalanced! This equation is NOT true.



Let's try the next one. It says, "Is 4x + 2 = 10 true when x = 4? I will need to plug in 4 for x. I am going to recopy it to the side. It is 4 x 4 + 2 = 10.



Now I do the multiplication and division first so I do 4 x 4 is 16 and I always recopy it after each step. Now it says 16 + 2 = 10.



That becomes 18 = 10. Nope! Unbalanced! This equation is NOT true.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

$4(2)+2=10$

Let's try the next one. It says, "Is 4x + 2 = 10 true when x = 2? I will need to plug in 2 for x. I am going to recopy it to the side. It is 4 x 2 + 2 = 10.

$4(2)+2=10$
$8+2=10$

Now I do the multiplication and division first so I do 4 x 2 is 8 and I always recopy it after each step. Now it says 8 + 2 = 10.

Is 4x + 2 = 10 true when x = 2? YES

$4(2)+2=10$
$8+2=10$
$10=10$

That becomes 10 = 10. Yes! It's balanced! That is TRUE.

$4(0)+2(5)=10$

Let's do the final one, 4x + 2y = 10. I need to recopy it with x as 0 and y as 5. It becomes 4 x 0 + 2 x 5 = 10.

$4(0)+2(5)=10$
$0+10=10$

I do the multiplication and division first. That becomes 0 plus 10 equals 10.

$4(0)+2(5)=10$
$0+10=10$
$10=10$

We get 10 = 10. Yes! It's balanced! That is TRUE! As we work with equations and graphs from proportions today it is going to work the same way. We plug in values and evaluate if the equation is true or if it fits the line.

Is 4x + 2y = 10 true when x = 0 and y = 5? YES

Create a table to show the different values of x and y that would satisfy the equation.

x	y

Let's Talk (Slide 4): "We say a point 'satsifies' or 'solves' the equation when the numbers can be plugged in and it stays true." Let's see what we mean. I am going to read the problem out loud and I'd like you to read along silently in your mind. *Read the problem.* This is asking us to "create a table to show the different values of x and y that would satisfy the equation." You guys already know how to do this. I am going to draw a table labeled with x and y.

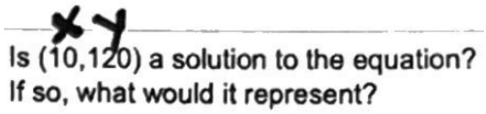
Create a table to show the different values of x and y that would satisfy the equation.

x	y
0	0
1	12
2	24
3	36

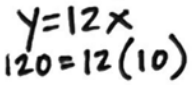
It is always a good idea to start with 0. If I plug 0 into the place of x. It is 12 times 0, which is 0. So I write (0,0). Next we can do 1. If I plug 1 into the place of x. It is 12 times 1, which is 12. So I write (1,12). Next we can do 2. If I plug 2 into the place of x. It is 12 times 2, which is 24. So I write (2,24). Next we can do 3. If I plug 3 into the place of x. It is 12 times 3, which is 36. So I write (3,36). And we could keep going but this is pretty good. Each one of these pairs is a solution that satisfies the equation.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

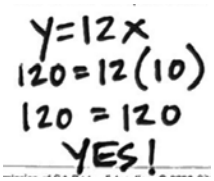
The next question asks, “Is (10,120) a solution to the equation? If so, what would it represent?” This sounds so much more complicated that it is. The only thing you really need to know is that (10,120) is



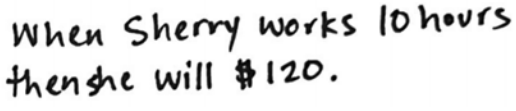
a secret way of saying what x equals and what y equals. The first number is always x and the second number is always y. I am going to label those on top so we can see it.



Now I just plug those numbers into the equation and see if it is balanced or true. I will write y = 12x and then underneath it. It would be 120 equals 12 times 10.

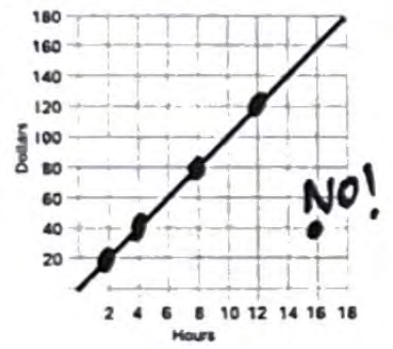


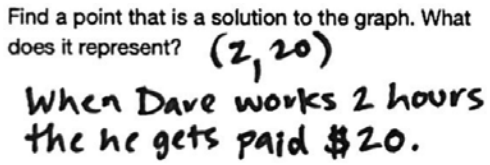
Now we have to evaluate it. 12 times 10 is 120 so we get 120 = 120. That’s balanced. So, is (10,120) a solution? Yes!



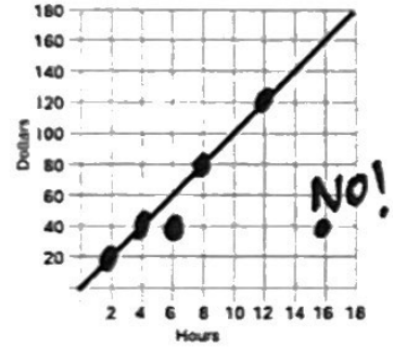
The problem asked what it would represent. To explain that, we need to use the right words with the right numbers. It says x is the number of hours. So I write, “When Sherry works 10 hours…” It says y is the number of dollars. So I write, “then she will get $120.”

Let’s Think (Slide 5): Just like it is helpful to know the numbers to fit an equation, it is helpful to know the numbers that fit a graph. “We say a point ‘satisfies’ or ‘solves’ the graph when the numbers are on the line.” I will show you what this means with this example. Read along silently while I read out loud. *Read the problem.* This says to find a point that is a solution to the graph. You know that when you make a graph, you use points and then connect them with the line. So you can look anywhere on the line and any of those points is a solution. *Mark a point on the line.* This is a solution. *Mark a point on the line.* This is a solution. *Mark a point on the line.* This is a solution. *Put a point that is NOT on the line and label it NO.* This is NOT a solution. *Put a point that is NOT on the line and label it NO.* This is NOT a solution.





So, we could take the point (2,20) that is a dot on the line and that is one solution. To figure out what it represents, we just have to use the words. X was hours so we write, “When Dave works 2 hours…” and y was dollars so we write, “then he will get paid $20.”



Next, this question says, “Is (6,40) a solution to the graph. How do you know?” We said the points on the line are solutions to the graph so let’s check if this is a point on the line. I find 6 on the x-axis and 40 on the y axis. Then I see where they line up. That would be a point here.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Is (6,40) a solution to the graph. How do you know?
(6,40) is not a point on the line so it is not a solution to the graph.

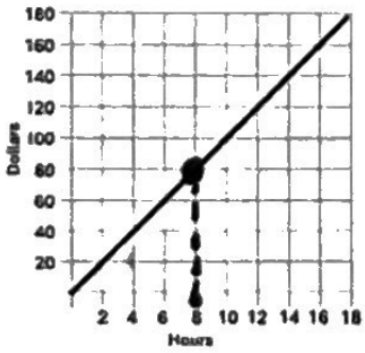
Let's write our answer. (6,40) is not a point on the line so it is not a solution to the graph.

Let's Think (Slide 6): The last thing we can do while we're looking for solutions is find x when given y or find y when given x. This says, "We can use one value to find the other value as a solution to an equation." It wants us to "Find the solution when x = 8. Explain what it means." Here's the story. *Read the story.* You can probably guess what we're going to do. I mean, we've been plugging numbers in, right? Let's plug in x = 8. I am going to rewrite the equation with 8 in place of x. It becomes y = 12 times 8. I will just do 12 times 8 off to the side here. Y = 96 so now we know the full solution is (8,96).

y = 12(8)
y = 96

When Sherry works 8 hrs then she will get paid $96.

To explain what it means, we just use words. It told us x is hours and y is dollars. So we write, "When Sherry works 8 hours then she will get paid $96."



Let's Think (Slide 7): This is the last thing to check out. It says, "We can use one value to find the other value as a solution to a graph." The problem wants us to "Find the solution when x = 8. Explain what it means." Here's the story. *Read the story.* We know that when we were finding solutions on a graph, we are looking at points that are on the line, and points that are off the line are NOT solutions. So we need to see where x = 8 makes a point on the line. I am going to find 8 on the x-axis since x = 8. Then I go up until I hit the line. Here is the point that we are looking for.

(8,80)
When Dave works 8 hrs, then he will get paid $80.

Let's see what y is for this point. It is in line with 80 on the y-axis. Y = 80 so we get (8,80) as our solution. To explain what it means, we just use words. It told us x is hours and y is dollars. So we write, "When Dave works 8 hours then she will get paid $80." Poor Dave doesn't get paid as much as Sherry.

Let's Try It (Slide 8): Let's look at points in the equation or line together! I will walk you through each step.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

WARM WELCOME

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Today we will make meaning of values that satisfy or do not satisfy a given equation or graph.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Review:

How do we know when an equation is true?

Is $4(5) + 2(8) = 16$ true?

Is $4x + 2 = 10$ true when $x = 4$?

Is $4x + 2 = 10$ true when $x = 2$?

Is $4x + 2y = 10$ true when $x = 0$ and $y = 5$?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk:

We say a point "satisfies" or "solves" the equation when the numbers can be plugged in and it stays true.

Sherry uses the equation $y = 12x$ to find the amount of dollars she would get paid when working different amounts of time. Let x represent the number of hours and y represent the number of dollars.

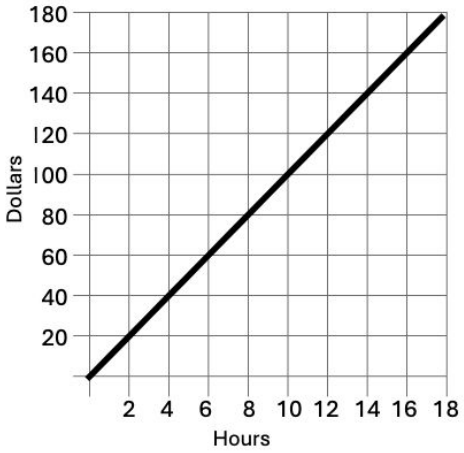
Create a table to show the different values of x and y that would satisfy the equation.	Is (10,120) a solution to the equation? If so, what would it represent?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

We say a point "satisfies" or "solves" the graph when the numbers are on the line.

The graph below shows the amount of dollars Dave would get paid when working different amounts of time. Let x represent the number of hours and y represent the number of dollars.



Find a point that is a solution to the graph. What does it represent?

Is (6,40) a solution to the graph. How do you know?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

We can use one value to find the other value as a solution to an equation.

Find the solution when x = 8. Explain what it means.

Sherry uses the equation y = 12x to find the amount of dollars she would get paid when working different amounts of time. Let x represent the number of hours and y represent the number of dollars.

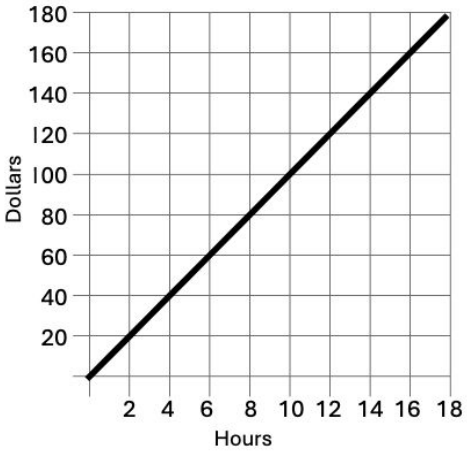
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

We can use one value to find the other value as a solution to a graph.

Find the solution when x = 8. Explain what it means.

The graph below shows the amount of dollars Dave would get paid when working different amounts of time. Let x represent the number of hours and y represent the number of dollars.



CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Try It:

Let's look at points in the equation or line together!

Name: _____ G8 U3 Lesson 4 - Let's Try It

The equation and graph show the amount two people get paid for babysitting where x is the number of hours and y is the number of dollars. **Steps:**	y = 4x	
1. Start with x = 0 and find y. **2. Then use the next x that makes sense to find y.** **3. Keep going.**	Make a table of solutions:	Make a table of solutions.
1. If necessary, find the slope to write an equation in the form y=kx. **2. Plug the value into the equation. If it is true, then the values are a solution.** **3. Explain the meaning of x and y by attaching words to each number and using the words "when" and "then" in a sentence.**	Is (3,12) a solution to the equation?	Is (20,10) a solution to the graph?
1. Use the value that is given to find the other value.	Find the solution when x = 10. Explain what it means in the	Find the solution when x = 10. Explain what it means in the

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

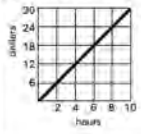
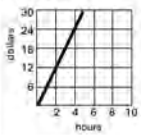
On your Own:

Now it's time for you to do it on your own!

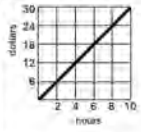
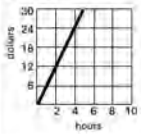
Name: _____ G8 U3 Lesson 4 - Independent Work

The equation and graphs show the relationship between the cost of calls for three different phone plans. Let x represent the number of hours and y represent the cost in dollars.

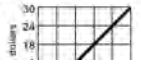
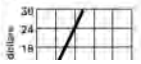
1. Make a table of solutions.

(a) Domestic	(b) International	(c) Pre-paid
$y = \frac{1}{3}x$		

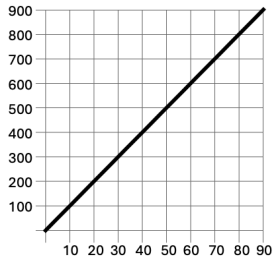
2. Is (3,9) a solution?

(a) Domestic	(b) International	(c) Pre-paid
$y = \frac{1}{3}x$		

3. What is the solution when x = 12?

(a) Domestic	(b) International	(c) Pre-paid
$y = \frac{1}{3}x$		

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

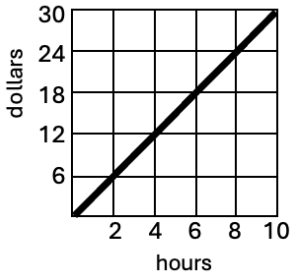
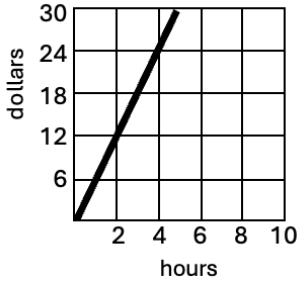
The equation and graph show the amount two people get paid for babysitting where x is the number of hours and y is the number of dollars. **Steps:**	$y = 4x$	
1. Start with x = 0 and find y. **2. Then use the next x that makes sense to find y.** **3. Keep going.**	Make a table of solutions:	Make a table of solutions.
1. If necessary, find the slope to write an equation in the form y=kx. **2. Plug the value into the equation. If it is true, then the values are a solution.** **3. Explain the meaning of x and y by attaching words to each number and using the words "when" and "then" in a sentence.**	Is (3,12) a solution to the equation?	Is (20,10) a solution to the graph?
1. Use the value that is given to find the other value. **2. Explain the meaning of x and y by attaching words to each number and using the words "when" and "then" in a sentence.**	Find the solution when x = 10. Explain what it means in the context of the problem.	Find the solution when x = 10. Explain what it means in the context of the problem.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

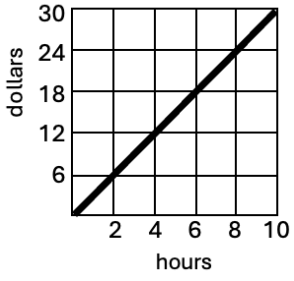
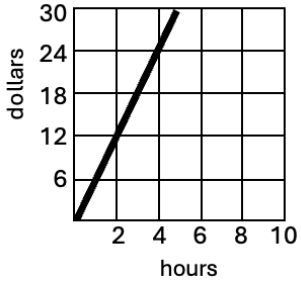
© 2023 CityBridge Education. All Rights Reserved.

The equation and graphs show the relationship between the cost of calls for three different phone plans. Let x represent the number of hours and y represent the cost in dollars.

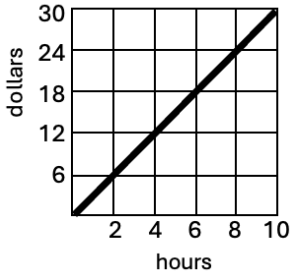
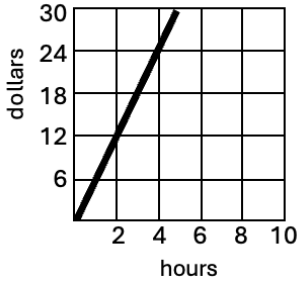
1. Make a table of solutions.

(a) Domestic $y = \frac{1}{3}x$	(b) International	(c) Pre-paid
		

2. Is (3,9) a solution?

(a) Domestic $y = \frac{1}{3}x$	(b) International	(c) Pre-paid
		

3. What is the solution when x = 12?

(a) Domestic $y = \frac{1}{3}x$	(b) International	(c) Pre-paid
		

4. Explain what each solution in #3 represents in words.

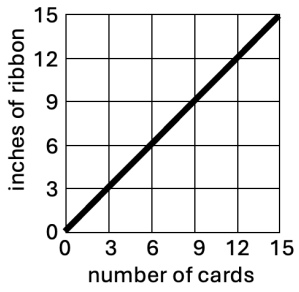
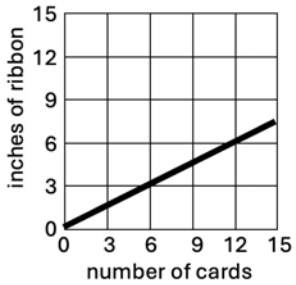
(a)	(b)	(c)

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

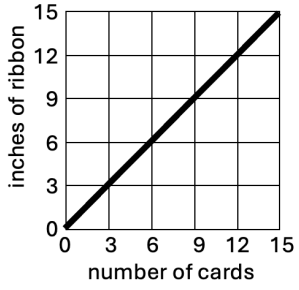
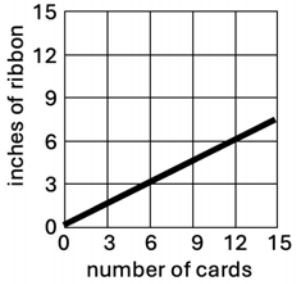
© 2023 CityBridge Education. All Rights Reserved.

The Hallmark Card Company uses the equation and graphs below show the the amount of ribbon required for different types of cards, where x is the number of cards and y is the inches of ribbon.

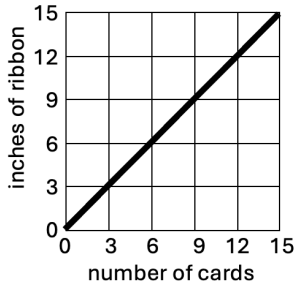
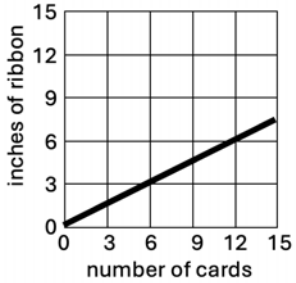
1. Make a table of solutions.

(a) Birthday y = 2x	(b) Anniversary	(c) Congratulations
		

2. Is (3,9) a solution?

(a) Birthday y = 2x	(b) Anniversary	(c) Congratulations
		

3. What is the solution when y = 100?

(a) Birthday y = 2x	(b) Anniversary	(c) Congratulations
		

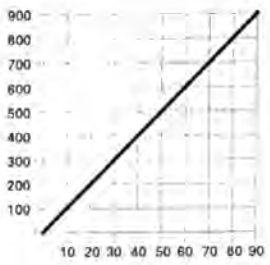
4. Explain what each solution in #3 represents in words.

(a)	(b)	(c)

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

The equation and graph show the amount two people get paid for babysitting where x is the number of hours and y is the number of dollars. **Steps:**	y = 4x	
1. Start with x = 0 and find y. **2. Then use the next x that makes sense to find y.** **3. Keep going.**	Make a table of solutions: x | y 0 | 0 1 | 4 2 | 8 3 | 12	Make a table of solutions. x | y 0 | 0 10 | 100 20 | 200 30 | 300
1. If necessary, find the constant of proportionality to write an equation in the form y=kx. **2. Plug the value into the equation. If it is true, then the values are a solution.** **3. Explain the meaning of x and y by attaching words to each number and using the words "when" and "then" in a sentence.**	Is (3,12) a solution to the equation? $y = 4x$ $12 = 4 \cdot 3$ $12 = 12$ YES!	Is (20,10) a solution to the graph? $10\overline{)100}$ = 010, −10, 00 $20\overline{)200}$ = 010, −20, 00 $y = 10x$ $10 = 10 \cdot 20$ $10 = 200$ NO!
1. Use the value that is given to find the other value. **2. Explain the meaning of x and y by attaching words to each number and using the words "when" and "then" in a sentence.**	Find the solution when x = 10. Explain what it means in the context of the problem. $y = 4x$ $y = 4 \cdot 10$ $\boxed{y = 40}$ When the person has babysat for 10 hours, then they get paid \$40.	Find the solution when x = 10. Explain what it means in the context of the problem. $y = 10x$ $y = 10 \cdot 10$ $\boxed{y = 100}$ When the person has babysat for 10 hours, then they get paid \$100.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

G8 U3 Lesson 4 - Independent Work

The equation and graphs show the relationship between the cost of calls for three different phone plans. Let x represent the number of hours and y represent the cost in dollars.

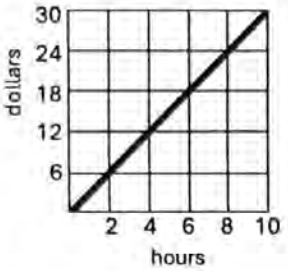
1. Make a table of solutions.

(a) Domestic

$y = \frac{1}{3}x$

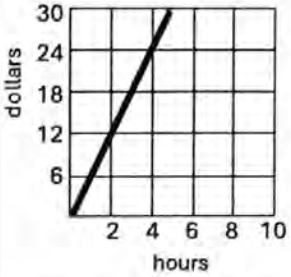
x	y
0	0
1	$\frac{1}{3}$
2	$\frac{2}{3}$
3	1

(b) International



x	y
0	0
2	6
4	12

(c) Pre-paid



x	y
0	0
2	12
4	24

2. Is (3,9) a solution?

(a) Domestic

$y = \frac{1}{3}x$

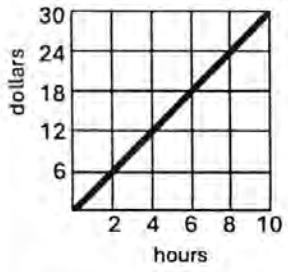
$9 = \frac{1}{3} \cdot 3$

$9 = \frac{3}{3}$

$9 = 1$

NO!

(b) International



$2\overline{)6}$ = 3, -6, 0

$4\overline{)12}$ = 03, -12, 00

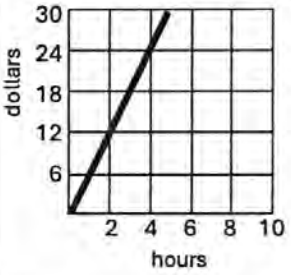
$y = 3x$

$9 = 3 \cdot 3$

$9 = 9$

YES!

(c) Pre-paid



$2\overline{)12}$ = 6, -12, 00

$4\overline{)24}$ = 06, -24, 00

$y = 6x$

$9 = 6 \cdot 3$

$9 = 18$

NO!

3. What is the solution when x = 12?

(a) Domestic

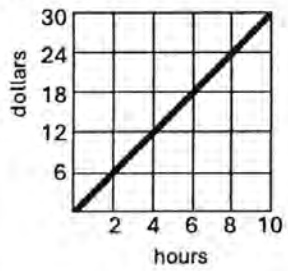
$y = \frac{1}{3}x$

$y = \frac{1}{3} \cdot 12$

$y = \frac{12}{3}$

$\boxed{y = 4}$

(b) International

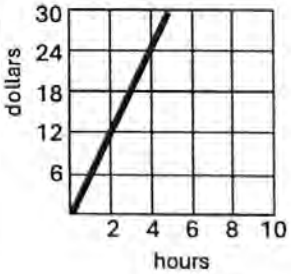


$y = 3x$

$y = 3 \cdot 12$

$\boxed{y = 36}$

(c) Pre-paid



$y = 6x$

$y = 6 \cdot 12$

$\boxed{y = 72}$

4. Explain what each solution in #3 represents in words.

(a)

When a call is 12 hours then the cost is \$4.

(b)

When a call is 12 hours then the cost is \$36.

(c)

When a call is 12 hours then the cost is \$72.

CONFIDENTIAL INFORMATION Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

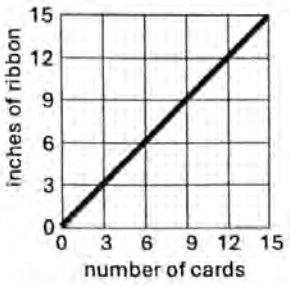
The Hallmark Card Company uses the equation and graphs below show the the amount of ribbon required for different types of cards, where x is the number of cards and y is the inches of ribbon.

1. Make a table of solutions.

(a) Birthday
$y = 2x$

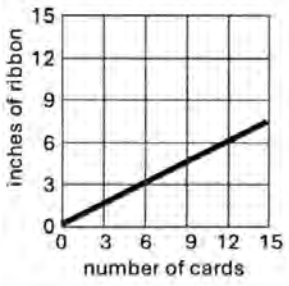
x	y
0	0
1	2
2	4
3	6

(b) Anniversary



x	y
0	0
3	3
6	6
9	9

(c) Congratulations

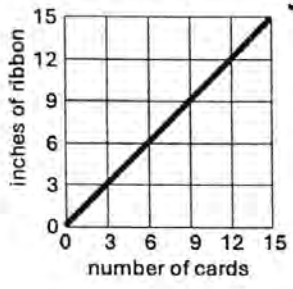


x	y
0	0
6	3
12	6

2. Is (3,9) a solution?

(a) Birthday
$y = 2x$
$9 = 2 \cdot 3$
$9 = 6$
NO!

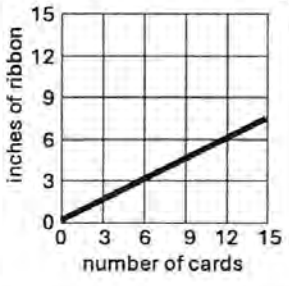
(b) Anniversary



$3\overline{)3}$ $6\overline{)6}$ $9\overline{)9}$
-3 -6 -9
0 0 0

$y = 1x$
$9 = 1 \cdot 3$
$9 = 3$
NO!

(c) Congratulations



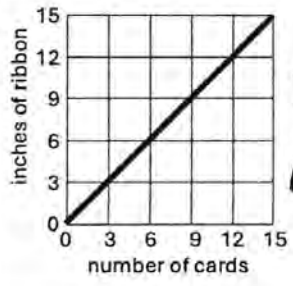
$6\overline{)3}$ $12\overline{)6}$
-0 -0
3 6

$y = \frac{1}{2}x$
$9 = \frac{1}{2} \cdot 3$
$9 = \frac{3}{2}$
NO!

3. What is the solution when y = 100?

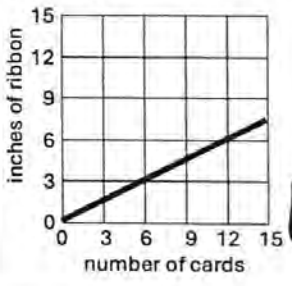
(a) Birthday
$y = 2x$
$\frac{100}{2} = \frac{2x}{2}$
$x = 50$

(b) Anniversary



$y = 1x$
$100 = 1x$
$100 = x$

(c) Congratulations



$y = \frac{1}{2}x$
$100 = \frac{1}{2}x$
$\cdot 2 \quad \cdot 2$
$200 = x$

4. Explain what each solution in #3 represents in words.

(a)
When there are 50 cards then 100 inches of ribbon are needed.

(b)
When there are 100 cards then 100 inches of ribbon are needed.

(c)
When there are 200 cards then 100 inches of ribbon are needed.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

G8 U3 Lesson 5
Represent linear relationships with a graph, equation, table and story.

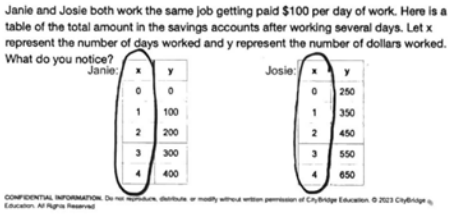
G8 U3 Lesson 5 - Today we will represent linear relationships with a graph, equation, table and story.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will represent linear relationships with a graph, equation, table and story. In our last lessons, you did the final step that you needed with proportions. A lot of that was review from previous grades. But we wanted to make sure we had the concepts because now we are going to apply them to a larger category of relationships called linear relationships. You will see that most of what we learn is just the same. It's going to be great!

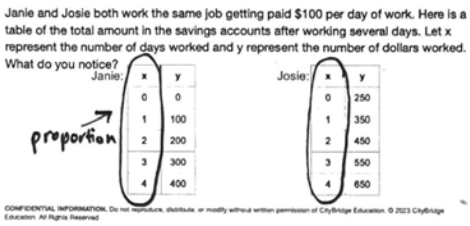
Let's Review (Slide 3): This says, "Compare the two tables to understand a relationship that is NOT a proportion. Read the problem silently with me while I read it out loud. *Read the story.* So, what do you notice? Possible Student Answers, Key Points:

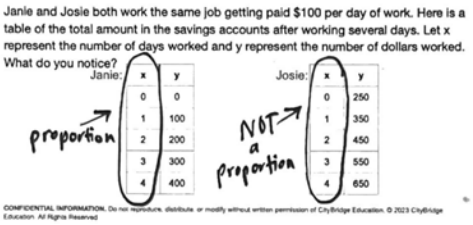
- The first column is 0, 1, 2, 3, 4 for both tables.
- Both tables have x and y.
- Janie's table counts up by 100s.
- Josie's table goes up be 100s too but it starts at 250 instead of 0.



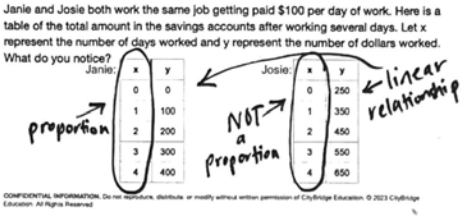
There are so many important things to notice here. The x column of both tables is the same: 0, 1, 2, 3 and 4. *Circle the x column on both tables.* The x column represents the number of days worked. *Point to that line in the text.*

So we are comparing when Janie and Josie work the same number of days. But the y column isn't exactly the same. *Point to the numbers as you say them.* Janie's starts with 0 and then it keeps going up by hundreds. 100 - 200 - 300 - 400. Josie's starts with 250 and then it actually keeps going up by hundreds. You can see 250 - 350 - 450 - 550 - 650. So they both go up by hundreds but they don't start with the same number. Let's figure out what that means using the language from the problem. We are talking about the y column so I pay attention to what y represents. This says, "y represents the number of dollars worked." *Point to the line in the text.* So if these didn't start the same that means Janie and Josie didn't start with the same amount of dollars. Maybe Josie had some money that she had already saved up. But then they each went up by $100, which makes sense because they each got paid the same amount, $100 per day. Janie's table shows a PROPORTION. We know this because it has that y-intercept of (0,0) and it has a constant of proportionality. 100 divided by 1 is 100. 200 divided by 2 is 100. 300 divided by 3 is 100. This is a proportion.





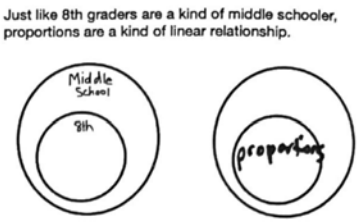
This table is NOT a proportion. It does not have that y-intercept of (0,0) and it does not have a constant of proportionality. Look, 350 divided by 1 is 350. 450 divided by 2 is 225. But we are going to see this in a few more slides - it still makes a line.

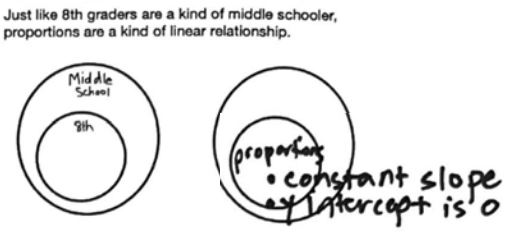


These are both called a LINEAR RELATIONSHIP, which is what we are going to learn about today.

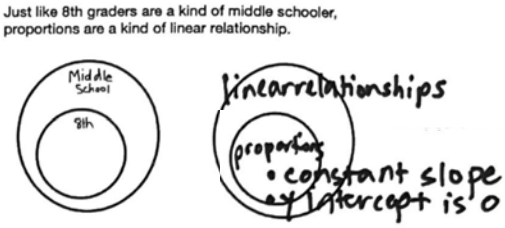
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk (Slide 4): "Linear relationships have constant slope or rate of change. Proportions do too but their y-intercept is zero." One way to understand this is to think of an analogy. You all are 8th graders. You are part of a middle school. You can see that in this picture. A circle labeled 8th is inside the circle labeled middle school. Well, "just like 8th graders are a kind of middle schooler, proportions are a kind of linear relationship." You've been learning about proportions since 6th grade. I am going to label this small circle "proportions." *Label the inner circle.*



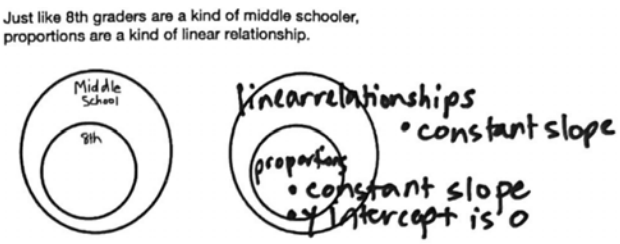


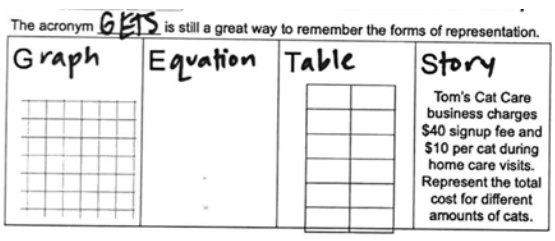
Proportins go through (0,0) and they have a constant slope. *Make notes on inner circle.*



This sentence says the analogy, "Just like 8th graders are a kind of middle schooler, proportions are a kind of linear relationship." So this bigger circle is linear relationships. *Label the outer circle.*

We are going to see throughout the rest of this unit that linear relationships also have a constant slope. *Make notes on outer circle.* Sometimes linear relationships have a y-intercept and then they are called proportions. But sometimes they don't. Just like in the Janie and Josie tables we just saw. Proportions are inside the linear relationship family just like 8th graders are part of middle school. Are all middle schoolers in 8th grade? No! Are all 8th graders in middle school? Yes! The same idea applies here. Are all linear relationships a proportion? No! Are all proportions linear relationships? Yes! The good news is that everything you have learned about proportions applies to linear relationships. You can make the exact same representations and answer questions the exact same way.

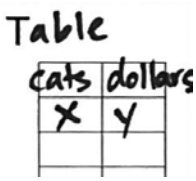




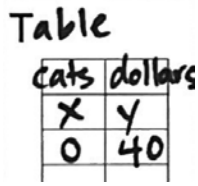
Let's Think (Slide 5): We can make a graph, equation and table to represent a linear relationship. This is going to work exactly the way we've practiced in previous lessons. Only now the y-intercept might not always be 0. The acronym GETS is still a great way to remember the forms of representation. G stands for graph. E stands for equation. T stands for table. S stands for story.

Read this story silently in your head while I read it out loud. *Read the story.* Now, it is usually useful to start with the table. And if you need to, you can always sketch a picture of what is happening to the

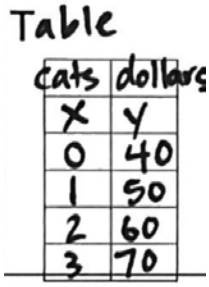
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.



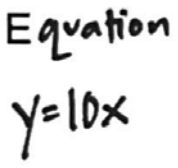
side to make sense of the problem. I am going to put x and y on my table. X will be the number of cats so I will put cats and y will be the number of dollars so I will put dollars.



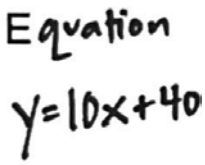
Now, we always start with x = 0 so we'll do that here too. Except we can't just put y = 0 like we usually do. This time, we are hearing that there is a $40 signup fee. That means that even before Tom charges based on the number of cats, he charges $40. So I am going to put 40.



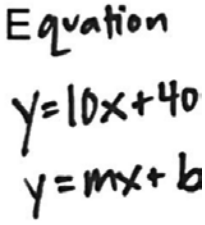
Next we think about x = 1. That means 1 cat. It says that Tom charges $10 per cat. That's just $10 for the 1 cat. But the $40 doesn't just disappear, right? So the total cost would be $50. Next we think about x = 2. That means 2 cats. We just keep going. It's still $10 for each cat but now there are two cats. That's $20 plus the $40 from before. It doesn't just disappear. So the total cost would be $60. You get the idea, right? If I add another cat, it will be another $10. That's 3 cats cost $70. If I add another cat, it will be another $10. That's 4 cats cost $80. The way I can tell this will make a straight line is that from the first row, the x column keeps going up by 1 and the y column keeps going up by 10. That's a constant rate of change, which will make a constant slope. But there isn't a constant of proportionality. If I do 50 divided by 1, it's 50. But 60 divided by 2 is 30.



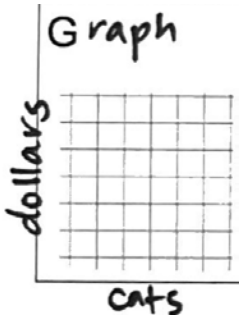
Now let's think about the equation. We can't look across the table and see an obvious operation like we are used to. But we know that we are getting y each time so I'll put y equals. We also know that it is $10 per cat. That's $10 times the number of cats. That's 10x.



And everytime we added that starting fee of $40. Let's check in our heads if this equation works for each row. If x is 0 then it is 10 times 0 makes 0 plus 40 is 40. That works. If x is 1 then it is 10 times 1 makes 10 plus 40 is 50. That works. And we could keep going.



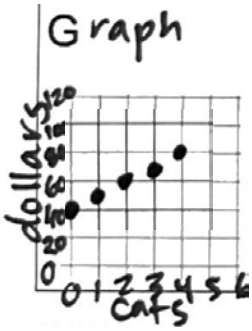
This equation is not in y = kx form like a proportion. This is in y = mx + b form. The slope or rate of change is m. The y-intercept or initial value is b.



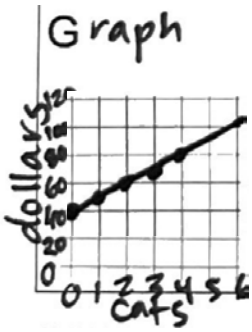
And finally, let's look at the graph. I am going to label the axes. X is cats and y is dollars.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

I need my x-axis to go up to 4 so I will count by 1s on the x-axis, starting with 0, 1, 2, 3, 4, 5, 6. I need my y-axis to go up to 80 so it won't work to count by ones. Let's try tens. *You are modelling a Guess and Check strategy here.* 0, 10, 20, 30, 40, 50, 60. That's not enough. I guess we will skipcount by twenties. 0, 20, 40, 60, 80, 100, 120.



And now I can put my points. I am going to start with (0,40). Then (1,50). That is going right in between 40 and 60. Then (2,60). Then (3,70). Then (4,80).



Now I can connect the dots! I get a straight line. See? That's why it's a linear equation! But it doesn't cross (0,0). So it's not a proportion.

Let's Try It (Slide 6): Let's practice filling out GETS together now. I will walk you through each step.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

WARM WELCOME

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Today we will represent linear relationships with a graph, equation, table and story.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Review:

Compare the two tables to understand a relationship that is NOT a proportion.

Janie and Josie both work the same job getting paid $100 per day of work. Here is a table of the total amount in the savings accounts after working several days. Let x represent the number of days worked and y represent the number of dollars worked. What do you notice?

Janie:

x	y
0	0
1	100
2	200
3	300
4	400

Josie:

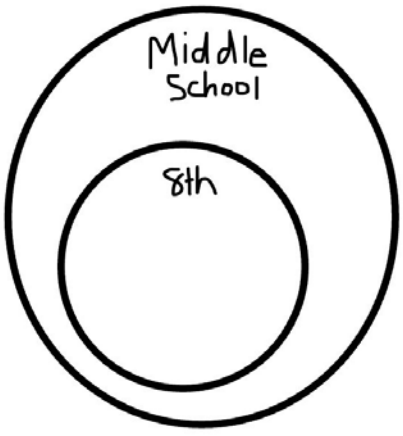
x	y
0	250
1	350
2	450
3	550
4	650

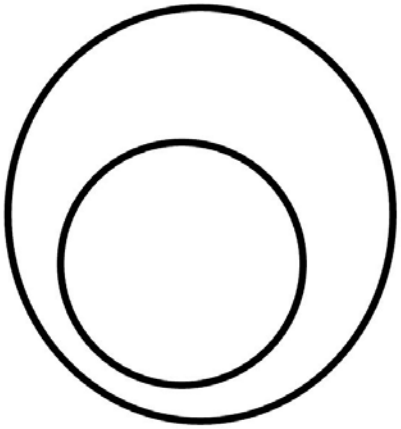
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk:

Linear relationships have a constant slope or rate of change. Proportions do too but their y-intercept is zero.

Just like 8th graders are a kind of middle schooler, proportions are a kind of linear relationship.



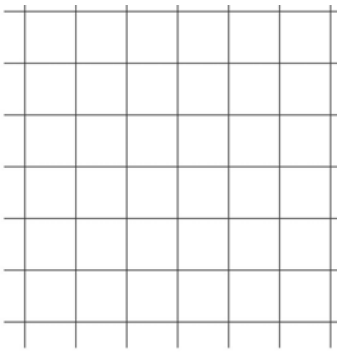
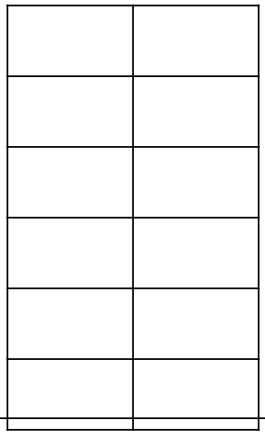


CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

We can make a graph, equation and table to represent a linear relationship

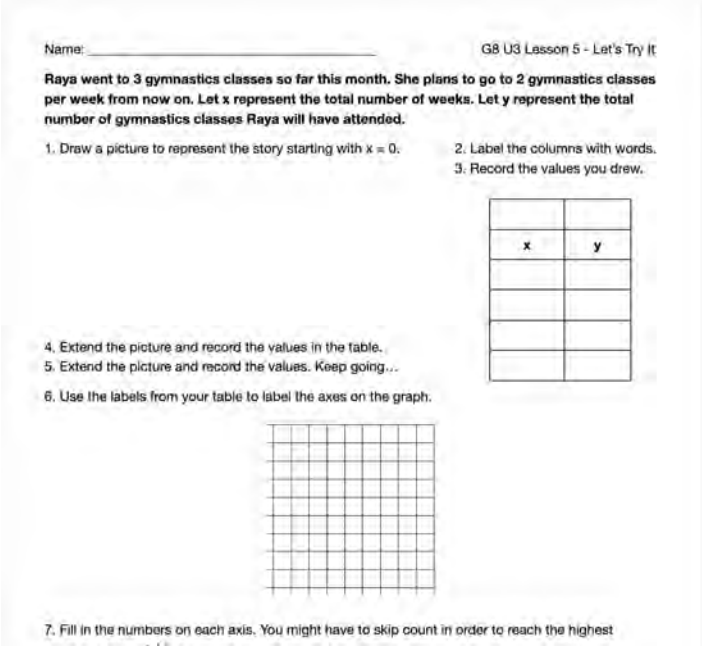
The acronym _____ is still a great way to remember the forms of representation.

G	E	T	S
			Tom's Cat Care business charges $40 signup fee and $10 per cat during home care visits. Represent the total cost for different amounts of cats.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Try It:

Let's make a graph, equation and table for a linear relationship together!



Name: _____ G8 U3 Lesson 5 - Let's Try It

Raya went to 3 gymnastics classes so far this month. She plans to go to 2 gymnastics classes per week from now on. Let x represent the total number of weeks. Let y represent the total number of gymnastics classes Raya will have attended.

1. Draw a picture to represent the story starting with x = 0.
2. Label the columns with words.
3. Record the values you drew.

x	y

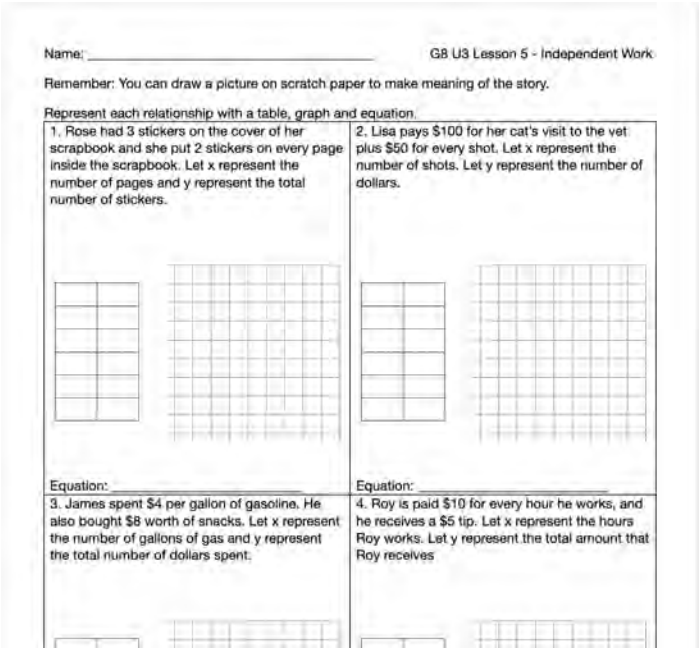
4. Extend the picture and record the values in the table.
5. Extend the picture and record the values. Keep going…
6. Use the labels from your table to label the axes on the graph.

7. Fill in the numbers on each axis. You might have to skip count in order to reach the highest

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

On your Own:

Now it's time for you to do it on your own!



Name: _____ G8 U3 Lesson 5 - Independent Work

Remember: You can draw a picture on scratch paper to make meaning of the story.

Represent each relationship with a table, graph and equation.

1. Rose had 3 stickers on the cover of her scrapbook and she put 2 stickers on every page inside the scrapbook. Let x represent the number of pages and y represent the total number of stickers. Equation: _____	2. Lisa pays $100 for her cat's visit to the vet plus $50 for every shot. Let x represent the number of shots. Let y represent the number of dollars. Equation: _____
3. James spent $4 per gallon of gasoline. He also bought $8 worth of snacks. Let x represent the number of gallons of gas and y represent the total number of dollars spent.	4. Roy is paid $10 for every hour he works, and he receives a $5 tip. Let x represent the hours Roy works. Let y represent the total amount that Roy receives

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Name: _____ G8 U3 Lesson 5 - Let's Try It

Raya went to 3 gymnastics classes so far this month. She plans to go to 2 gymnastics classes per week from now on. Let x represent the total number of weeks. Let y represent the total number of gymnastics classes Raya will have attended.

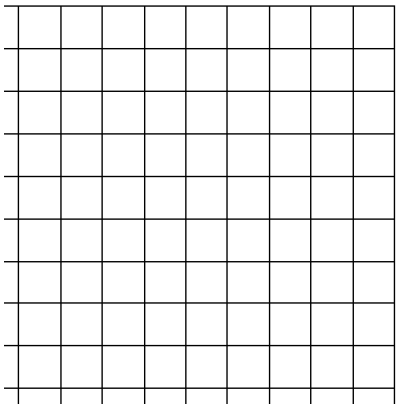
1. Draw a picture to represent the story starting with x = 0.

2. Label the columns with words.
3. Record the values you drew.

x	**y**

4. Extend the picture and record the values in the table.
5. Extend the picture and record the values. Keep going…

6. Use the labels from your table to label the axes on the graph.



7. Fill in the numbers on each axis. You might have to skip count in order to reach the highest number on your table.
8. Use each row of the table as a set of coordinates.
9. What was the value of y when x was 0 (also known as the y-intercept)? _____ That is b.

10. What is the rate of change (also known as the slope)? _____ That is m.

11. Write an equation in y = mx + b form. _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

Name: _____ G8 U3 Lesson 5 - Independent Work

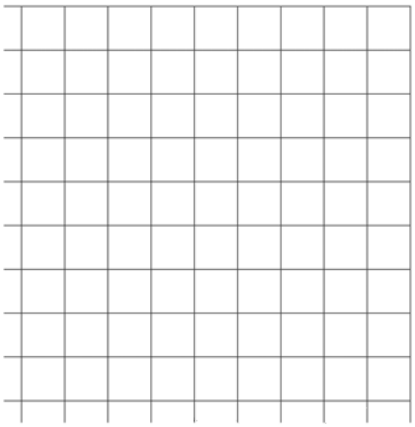
Remember: You can draw a picture on scratch paper to make meaning of the story.

Represent each relationship with a table, graph and equation.

1. Rose had 3 stickers on the cover of her scrapbook and she put 2 stickers on every page inside the scrapbook. Let x represent the number of pages and y represent the total number of stickers.

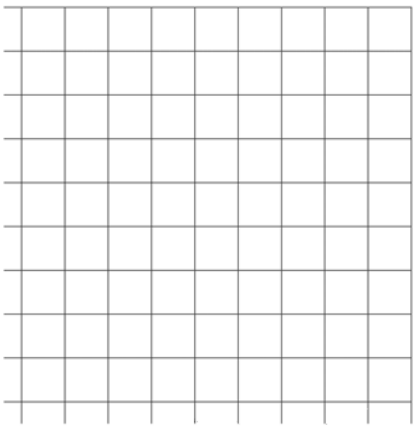
Equation: _____

2. Lisa pays $100 for her cat's visit to the vet plus $50 for every shot. Let x represent the number of shots. Let y represent the number of dollars.



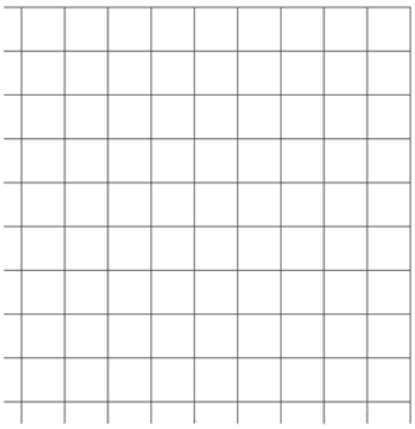
Equation: _____

3. James spent $4 per gallon of gasoline. He also bought $8 worth of snacks. Let x represent the number of gallons of gas and y represent the total number of dollars spent.



Equation: _____

4. Roy is paid $10 for every hour he works, and he receives a $5 tip. Let x represent the hours Roy works. Let y represent the total amount that Roy receives



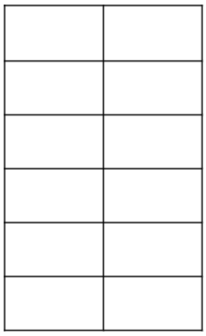
Equation: _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

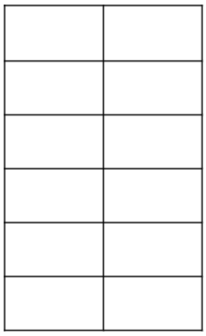
Represent each relationship with a table, graph and equation.

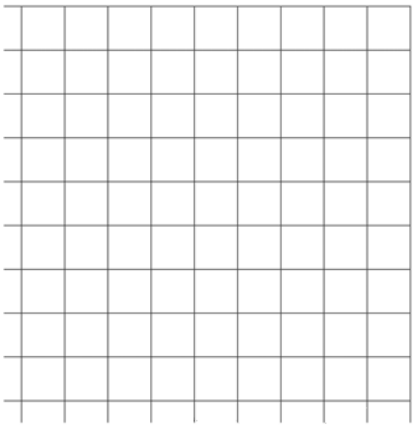
5. Polly bought a plant that was 5 inches tall. It grew 1 inch per week after she brought it home. Let x represent the number of weeks. Let y represent the total height of the plant in inches.



Equation: _____

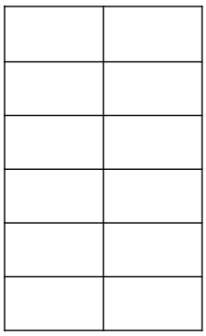
6. Nathaniel knew 100 Spanish words when he started his first Spanish class. Then he learned 50 words per week. Let x represent the number of weeks. Let y represent the number of words.

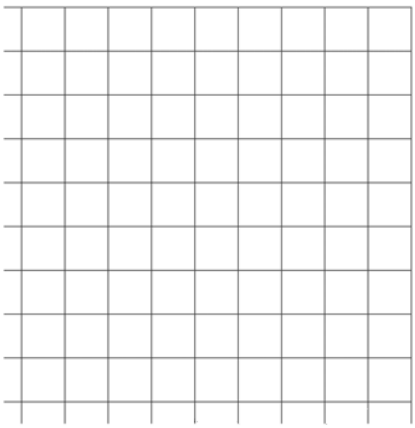




Equation: _____

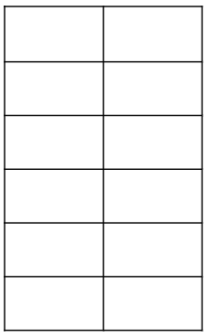
7. The theater department raised $500 at each of the performances they did this year. They also got a donation of $2000. Let x represent the number of performances. Let y represent the number of dollars.

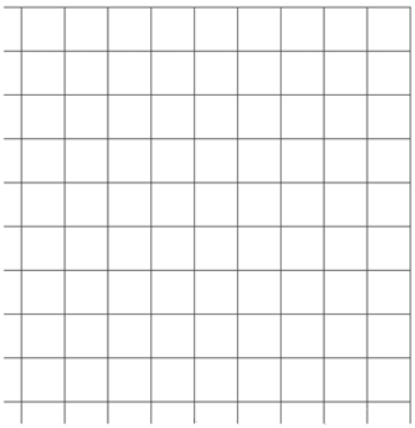




Equation: _____

8. Ethan's father said that he would pay him $5 every time he rakes up leaves. His grandmother gave him $20 for his birthday. Let x represent the number of times he rakes. Let y represent the number of dollars Ethan has.





Equation: _____

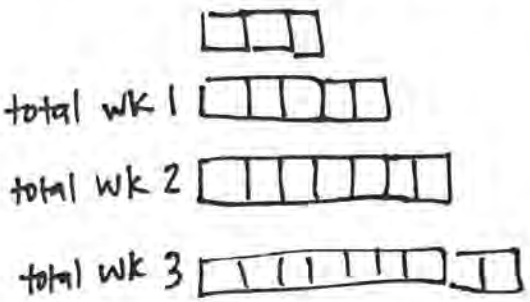
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

Raya went to 3 gymnastics classes so far this month. She plans to go to 2 gymnastics classes per week from now on. Let x represent the total number of weeks. Let y represent the total number of gymnastics classes Raya will have attended.

1. Draw a picture to represent the story starting with x = 0.

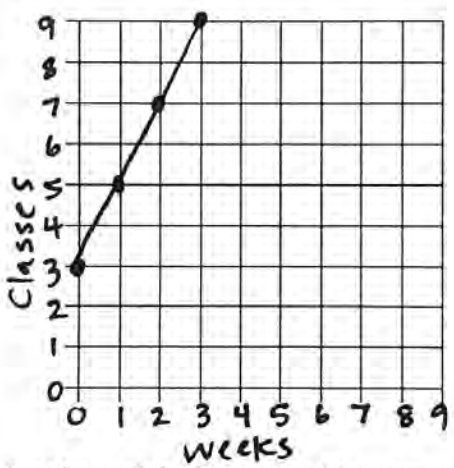


2. Label the columns with words.
3. Record the values you drew.

weeks	classes
x	y
0	3
1	5
2	7
3	9

4. Extend the picture and record the values in the table.
5. Extend the picture and record the values. Keep going...

6. Use the labels from your table to label the axes on the graph.



7. Fill in the numbers on each axis. You might have to skip count in order to reach the highest number on your table.
8. Use each row of the table as a set of coordinates.
9. What was the value of y when x was 0 (also known as the y-intercept)? 3 That is b.

10. What is the rate of change (also known as the slope)? 2 That is m.

11. Write an equation in y = mx + b form. y = 2x + 3

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

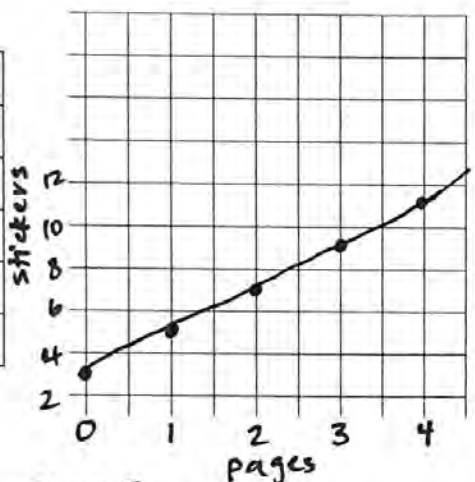
G8 U3 Lesson 5 - Independent Work

Remember: You can draw a picture on scratch paper to make meaning of the story.

Represent each relationship with a table, graph and equation.

1. Rose had 3 stickers on the cover of her scrapbook and she put 2 stickers on every page inside the scrapbook. Let x represent the number of pages and y represent the total number of stickers.

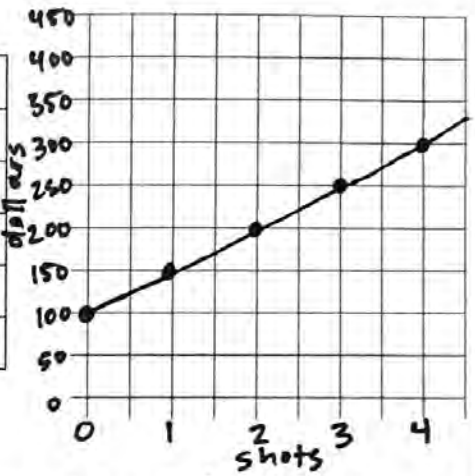
x	y
0	3
1	5
2	7
3	9
4	11



Equation: $y = 2x + 3$

2. Lisa pays $100 for her cat's visit to the vet plus $50 for every shot. Let x represent the number of shots. Let y represent the number of dollars.

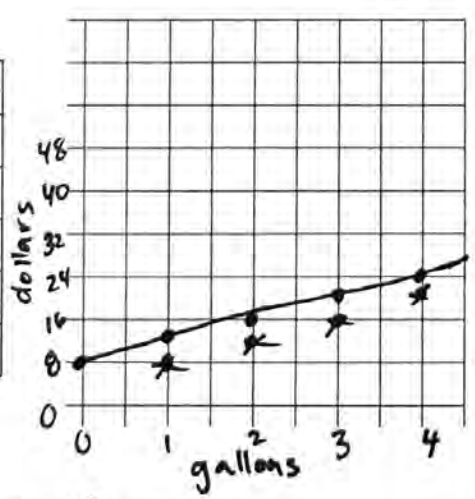
x	y
0	100
1	150
2	200
3	250
4	300



Equation: $y = 50x + 100$

3. James spent $4 per gallon of gasoline. He also bought $8 worth of snacks. Let x represent the number of gallons of gas and y represent the total number of dollars spent.

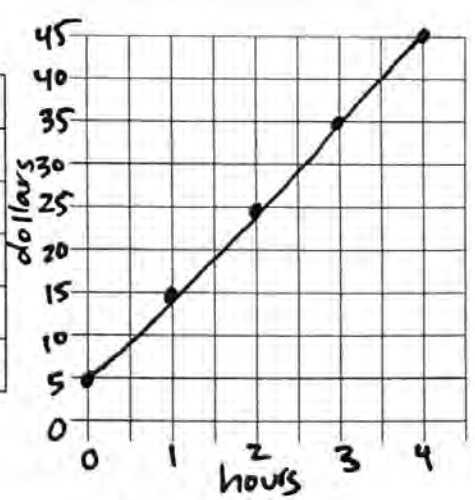
x	y
0	8
1	12
2	16
3	20
4	24



Equation: $y = 4x + 8$

4. Roy is paid $10 for every hour he works, and he receives a $5 tip. Let x represent the hours Roy works. Let y represent the total amount that Roy receives

x	y
0	5
1	15
2	25
3	35
4	45



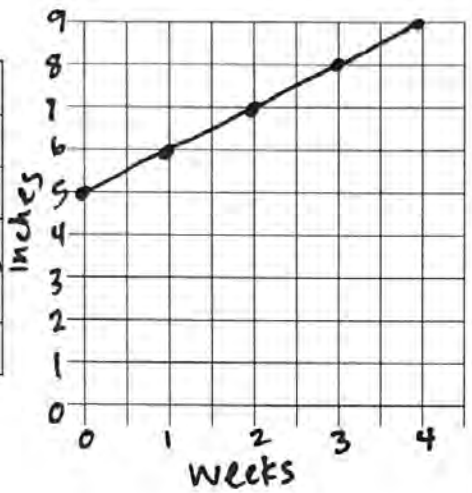
Equation: $y = 10x + 5$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Represent each relationship with a table, graph and equation.

5. Polly bought a plant that was 5 inches tall. It grew 1 inch per week after she brought it home. Let x represent the number of weeks. Let y represent the total height of the plant in inches.

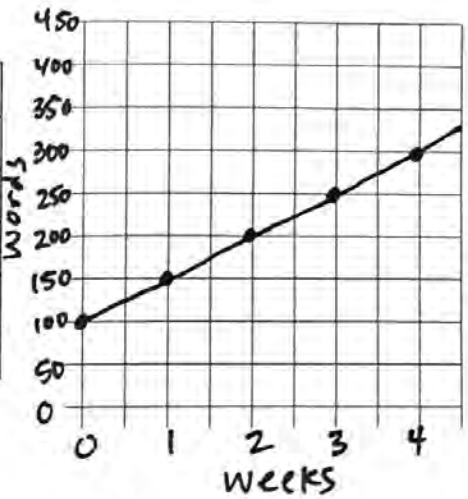
x	y
0	5
1	6
2	7
3	8
4	9



Equation: $y = 1x + 5$

6. Nathaniel knew 100 Spanish words when he started his first Spanish class. Then he learned 50 words per week. Let x represent the number of weeks. Let y represent the number of words.

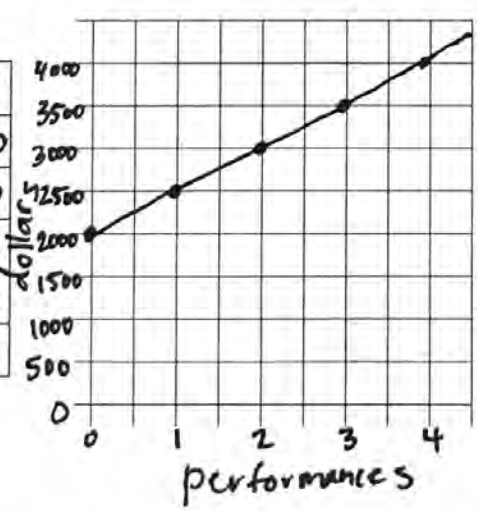
x	y
0	100
1	150
2	200
3	250
4	300



Equation: $y = 50x + 100$

7. The theater department raised $500 at each of the performances they did this year. They also got a donation of $2000. Let x represent the number of performances. Let y represent the number of dollars.

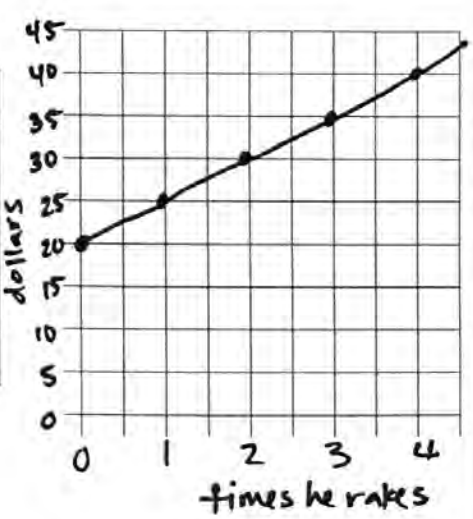
x	y
0	2000
1	2500
2	3000
3	3500
4	4000



Equation: $y = 500x + 2000$

8. Ethan's father said that he would pay him $5 every time he rakes up leaves. His grandmother gave him $20 for his birthday. Let x represent the number of times he rakes. Let y represent the number of dollars Ethan has.

x	y
0	20
1	25
2	30
3	35
4	40



Equation: $y = 5x + 20$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

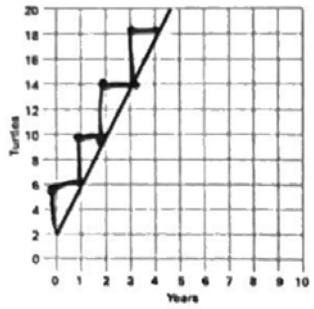
G8 U3 Lesson 6
Interpret the y-intercept and slope for linear graphs. Determine if they are proportions.

G8 U3 Lesson 6 - Today we will interpret the y-intercept and slope for linear graphs and determine if they are proportions.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will interpret the y-intercept and slope for linear graphs and determine if they are proportions. In our last lesson we started learning about linear relationships. Today we will interpret the y-intercept and slope on graphs of linear relationships. You have already practiced doing this with proportions so you're going to be great.

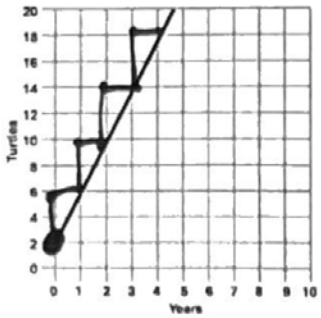
Let's Review (Slide 3): You learned this in earlier lessons: "The graph of a proportion has two special features." This helps us know when a graph is a proportion. "How do we know if the graph below shows a proportion?" I will read the story out loud while you read along in your head. *Read the story.*



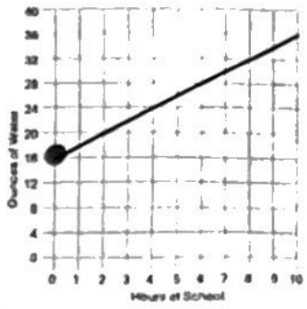
So, how do we know if the graph below shows a proportion? Possible Student Answers, Key Points:

- It is a straight line.
- It has a constant slope.
- It doesn't go through (0,0).
- It doesn't have a y-intercept of zero.

I heard a lot of important ideas. But we need to remember that the graph has to have two things together. It has to be a straight line, which means it has a constant slope. That's like a nice even staircase going up and over, up and over up and over. Does this have a constant slope? Yes!



It also needs to go through the origin, which is (0,0). I am going to make a dot at the origin. Another way of saying that is that it has to have a y-intercept of zero. Does this have a y-intercept of zero? No! So, is this a proportion? No! But it still makes a straight line so it is still a linear relationship even though it's not a proportion. So, we can still find the y-intercept and interpret it. We can still find the slope and interpret it. And that's what we're going to do today.



Let's Talk (Slide 4): This says, "The y-intercept of a graph is where it crosses the y-axis and where x = 0." We know that from proportions, right? It's just it was super easy with proportions because it was always zero. And now it's not. Let's figure out what it is. I am going to read the story out loud while you read along silently in your head. *Read the story.* We know the y-intercept of a graph is where it crosses the y-axis. Sometimes people think of it as where the line starts because our graphs using start at the y-axis where x = 0. I am going to put a point at that place for this line.

The point where the line crosses the y-axis is (0, 16)
so the y-intercept is 16.

"The point where the line crosses the y-axis is…" (0,16). "So the y-intercept is…" 16. This is where we have been getting zero for the last few days. But now we're not.

But this is actually really interesting information for whatever story we are learning about because just like it shows where our line begins, it shows where our story begins. "We can explain what this means using works for each number." The 0 is x and in this case x is the hours at school. The 16 is y and in

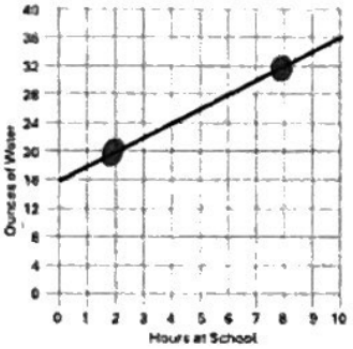
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

this case y is the total ounces of water. We use the "when" and "then" sentences that we used in previous lessons. When Raia has been at school for 0 hours then she has had 16 ounces of water. In other words, before Raia starts school, she's already had 16 ounces of water. It is kind of fun to take a point on a graph and turn it into a story like that! Now let's look at the other feature we've been focusing on.

We can explain what this means using words for each number:
When Raia has been at school for 0 hours then she has had 16 ounces of water.

Let's Think (Slide 5): "The slope of a graph is how it increases or decreases. It is measured by the change in y divided by the change in x." We already knew this, right? Let's read the story. I will say it out loud while you read along silently. *Read the story.* So we need to find the slope. First, we need to remember, a straight line always has a CONSTANT slope. That means that whichever points we use to find it, we'll get the same answer.

A straight line always has a Constant slope.



"We choose two points and use our usual formula to find it." I am going to mark these. *Mark (2,20) and (8,32) and label them.*

We choose two points and use our usual formula to find it:
$\frac{y_2-y_1}{x_2-x_1} = \frac{32-20}{8-2} = \frac{12}{6} = 2$

The formula is $y_2 - y_1$ over $x_2 - x_1$. Now we plug the numbers. We get 32 - 20 over 8 - 2. 32 - 20 is 12 and 8 - 2 is 6. So we get 12 over 6. 12 divided by 6 is 2 so our slope is 2! Nice!

This is asking, "What is the slope? We use the words at each axis to show what it represents." So that is 2 and then the first words we want are the y words because we started with $y_2 - y_1$. That's ounces of water. Then we need the x words. That's hours at school. So, Raia has 2 ounces of water per hour at school. Now we have a picture of her day, right? She start off with 16 ounces of water at breakfast and then when she goes to school, she has 2 ounces every hour. She must go to the water fountain. The y-intercept and the slope help us tell a story about whatever we are representing.

What is the slope? We use the words at each axis to show what it represents.
2 ounces of water per hour

Let's Try It (Slide 6): Let's interpret the y-intercepts and slopes on graphs together. I will walk you through each step.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

WARM WELCOME

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Today we will interpret the y-intercept and slope for linear graphs and determine if they are proportions.

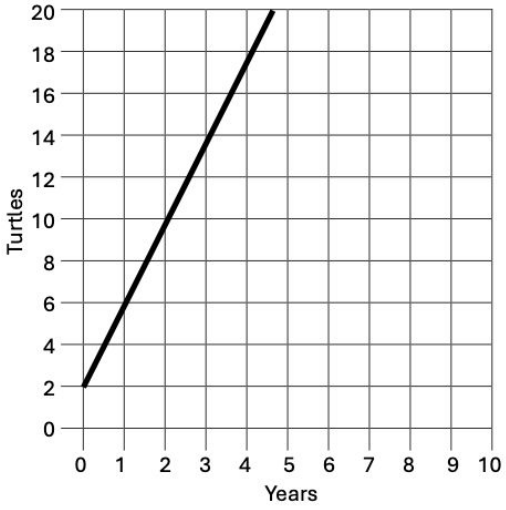
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Review:

The graph of a proportion always has two special features.

How do we know if the graph below shows a proportion?

The Baltimore Aquarium got two sea turtles. They used the graph to show the total amount of turtles after new turtles were born each year.

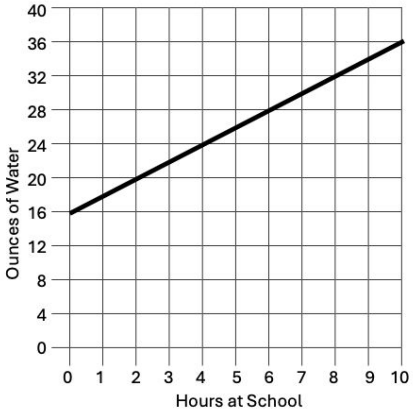


CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk:

The y-intercept of a graph is where it crosses the y-axis and where x = 0.

Raia has water with breakfast and then she takes water breaks at school. The graph shows the amount of water Raia drinks each day where x is the hours at school and y is the total ounces of water.



The point where the line crosses the y-axis is (___, ___)

so the y-intercept is _____.

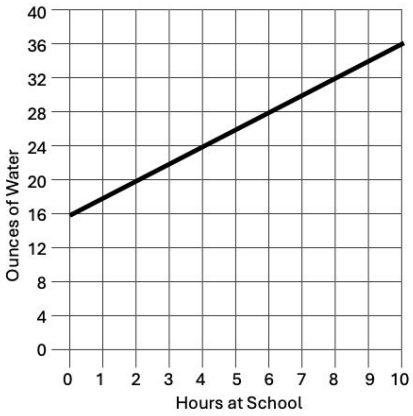
We can explain what this means using words for each number:

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

The slope of a graph is how it increases or decreases. It is measured by the change in y divided by the change in x.

Raia has water with breakfast and then she takes water breaks at school. The graph shows the amount of water Raia drinks each day where x is the hours at school and y is the total ounces of water.



A straight line always has a _____ slope.

We choose two points and use our usual formula to find it:

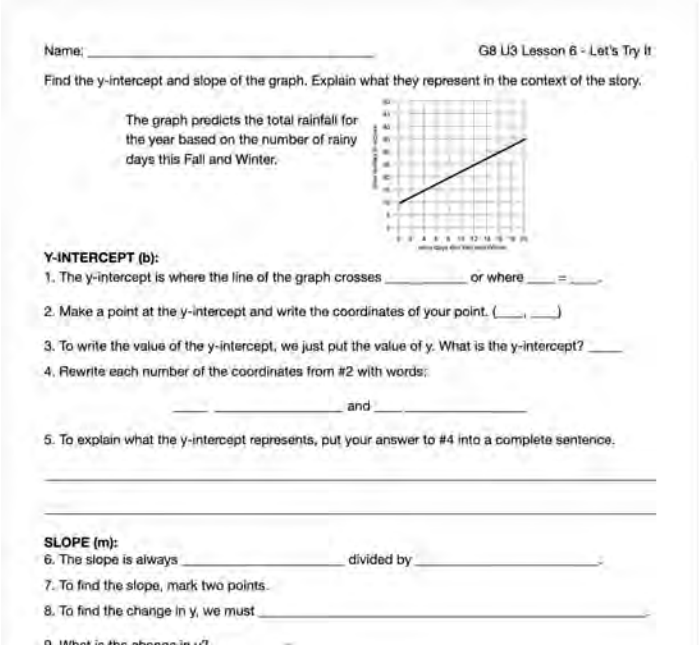
What is the slope? We use the words at each axis to show what it represents.

_____ _____ per _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Try It:

Let's interpret the y-intercepts and slopes on graphs together!



Name: _____ G8 U3 Lesson 6 - Let's Try It

Find the y-intercept and slope of the graph. Explain what they represent in the context of the story.

The graph predicts the total rainfall for the year based on the number of rainy days this Fall and Winter.

Y-INTERCEPT (b):

1. The y-intercept is where the line of the graph crosses _____ or where ____ = ____.
2. Make a point at the y-intercept and write the coordinates of your point. (____, ____)
3. To write the value of the y-intercept, we just put the value of y. What is the y-intercept? ____
4. Rewrite each number of the coordinates from #2 with words:

____ _____ and ____ _____

5. To explain what the y-intercept represents, put your answer to #4 into a complete sentence.

_____

_____

SLOPE (m):

6. The slope is always _____ divided by _____.
7. To find the slope, mark two points.
8. To find the change in y, we must _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

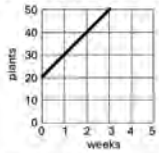
On your Own:

Now it's time for you to do it on your own!

Name: _____ G8 U3 Lesson 6 - Independent Work

Find the y-intercept and slope of each graph. Explain what they represent in the context of the story.

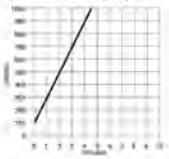
Lily is upgrading her garden. She plants new flowers each day. The graph shows the total plants she has.



Is it a proportion? ____

1. What is the y-intercept? ____
2. What does it represent?
3. What is the slope? ____
4. What does it represent?
5. Write an equation. _____

After special guests enter, people with tickets are let into the stadium hourly. The graph shows total people.



Is it a proportion? ____

6. What is the y-intercept? ____
7. What does it represent?
8. What is the slope? ____
9. What does it represent?
10. Write an equation. _____

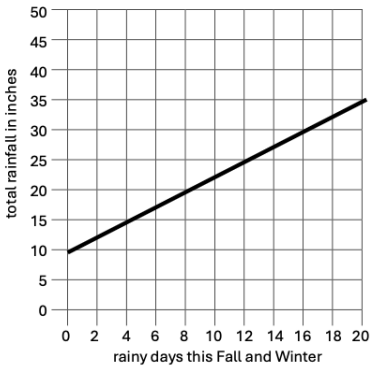
Alex is shipping out orders from his art shop. The graph below shows the total orders for the day based on the hours

11. What is the y-intercept? ____
12. What does it represent?

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Find the y-intercept and slope of the graph. Explain what they represent in the context of the story.

The graph predicts the total rainfall for the year based on the number of rainy days this Fall and Winter.



Y-INTERCEPT (b):

1. The y-intercept is where the line of the graph crosses _____ or where ____ = ____.

2. Make a point at the y-intercept and write the coordinates of your point. (____, ____)

3. To write the value of the y-intercept, we just put the value of y. What is the y-intercept? _____

4. Rewrite each number of the coordinates from #2 with words:

_____ _____ and ____ _____

5. To explain what the y-intercept represents, put your answer to #4 into a complete sentence.

_____

_____

SLOPE (m):

6. The slope is always _____ divided by _____.

7. To find the slope, mark two points.

8. To find the change in y, we must _____.

9. What is the change in y? _____-_____= _____

10. To find the change in x, we must _____.

11. What is the change in x? _____-_____= _____

12. Use your answers to #9 and #11 to find the slope. _____

13. To explain what the slope represents, use the words at each axis, y words then x words.

_____ _____ per _____

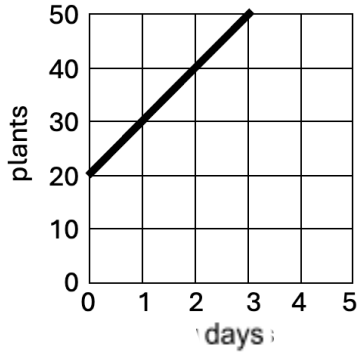
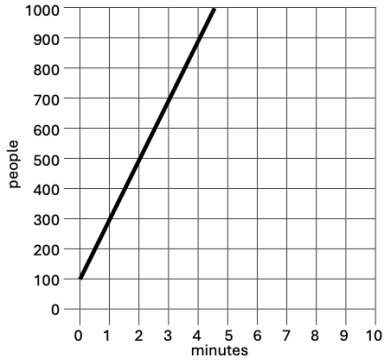
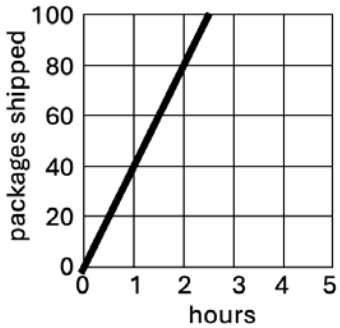
14. Write an equation in y = mx + b form. _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

Name: _____ G8 U3 Lesson 6 - Independent Work

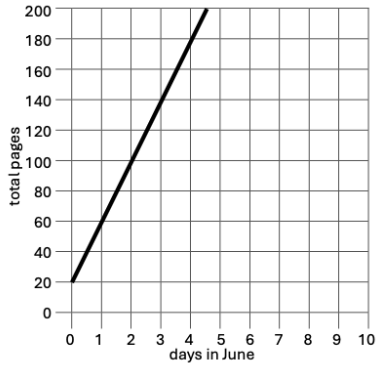
Find the y-intercept and slope of each graph. Explain what they represent in the context of the story.

Lily is upgrading her garden. She plants new flowers each day. The graph shows the total plants she has.  Is it a proportion? _____	1. What is the y-intercept? _____ 2. What does it represent? 3. What is the slope? _____ 4. What does it represent? 5. Write an equation. _____
After special guests enter, people with tickets are let into the stadium hourly. The graph shows total people.  Is it a proportion? _____	6. What is the y-intercept? _____ 7. What does it represent? 8. What is the slope? _____ 9. What does it represent? 10. Write an equation. _____
Alex is shipping out orders from his art shop. The graph below shows the total orders for the day based on the hours he works this afternoon.  Is it a proportion? _____	11. What is the y-intercept? _____ 12. What does it represent? 13. What is the slope? _____ 14. What does it represent? 15. Write an equation. _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Find the y-intercept and slope of each graph. Explain what they represent in the context of the story.

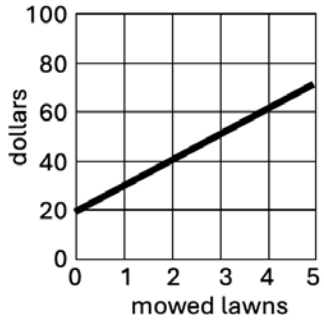
Jordan started a book in May. The graph shows the total pages he'll have read based on days he reads in June.



Is it a proportion? _____

16. What is the y-intercept? _____
17. What does it represent?
18. What is the slope? _____
19. What does it represent?
20. Write an equation. _____

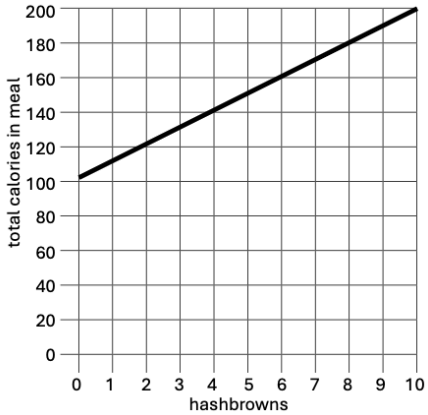
While saving for a new phone, Samantha gets a job mowing lawns. She uses the graph shown to calculate her total savings.



Is it a proportion? _____

21. What is the y-intercept? _____
22. What does it represent?
23. What is the slope? _____
24. What does it represent?
25. Write an equation. _____

Dunkin Donuts calculates the total calories in the egg and hashbrown meal based on the number of calories per hashbrown.



Is it a proportion? _____

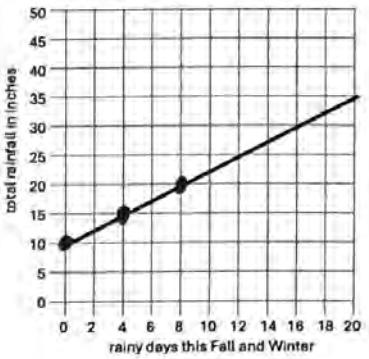
26. What is the y-intercept? _____
27. What does it represent?
28. What is the slope? _____
29. What does it represent?
30. Write an equation. _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

Find the y-intercept and slope of the graph. Explain what they represent in the context of the story.

The graph predicts the total rainfall for the year based on the number of rainy days this Fall and Winter.



Y-INTERCEPT (b):

1. The y-intercept is where the line of the graph crosses y-axis or where x = 0.
2. Make a point at the y-intercept and write the coordinates of your point. (0, 10)
3. To write the value of the y-intercept, we just put the value of y. What is the y-intercept? 10
4. Rewrite each number of the coordinates from #2 with words:

   0 rainy days and 10 inches of rainfall

5. To explain what the y-intercept represents, put your answer to #4 into a complete sentence.

   When it rains 0 days in Fall and Winter then there is a total of 10 inches of rainfall predicted.

SLOPE (m):

6. The slope is always change in y divided by change in x.
7. To find the slope, mark two points.
8. To find the change in y, we must $y_2 - y_1$.
9. What is the change in y? 8 - 4 = 4
10. To find the change in x, we must $x_2 - x_1$.
11. What is the change in x? 20 - 15 = 5
12. Use your answers to #9 and #11 to find the slope. $\frac{4}{5}$
13. To explain what the slope represents, use the words at each axis, y words then x words.

    $\frac{4}{5}$ inches of rain per rainy day

14. Write an equation in y = mx + b form. $y = \frac{4}{5}x + 10$

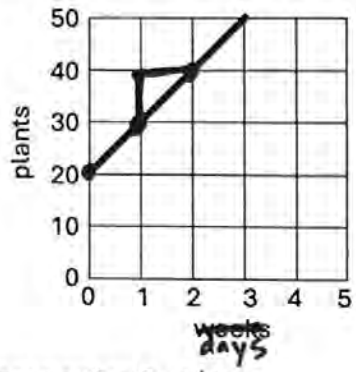
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

G8 U3 Lesson 6 - Independent Work

Find the y-intercept and slope of each graph. Explain what they represent in the context of the story.

Lily is upgrading her garden. She plants new flowers each day. The graph shows the total plants she has.



Is it a proportion? NO

1. What is the y-intercept? 20
2. What does it represent?

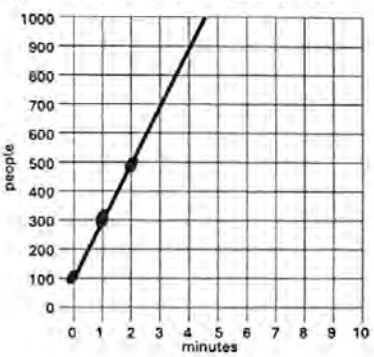
When Lily has planted 0 days, she has 20 plants.

3. What is the slope? 10 $\frac{40-30}{2-1} = \frac{10}{1} = 10$
4. What does it represent?

Lily plants 10 plants per day.

5. Write an equation. $y = 10x + 20$

After special guests enter, people with tickets are let into the stadium hourly. The graph shows total people.



Is it a proportion? NO

6. What is the y-intercept? 100
7. What does it represent?

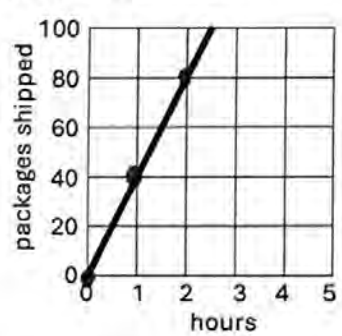
When people have been let in for 0 min, there will be 100 total people in the stadium.

8. What is the slope? 200 $\frac{500-300}{2-1} = \frac{200}{1} = 200$
9. What does it represent?

They let in 200 people per minute.

10. Write an equation. $y = 200x + 100$

Alex is shipping out orders from his art shop. The graph below shows the total orders for the day based on the hours he works this afternoon.



Is it a proportion? YES

11. What is the y-intercept? 0
12. What does it represent?

When Alex works for 0 hours he has shipped 0 packages.

13. What is the slope? 40 $\frac{80-40}{2-1} = \frac{40}{1} = 40$
14. What does it represent?

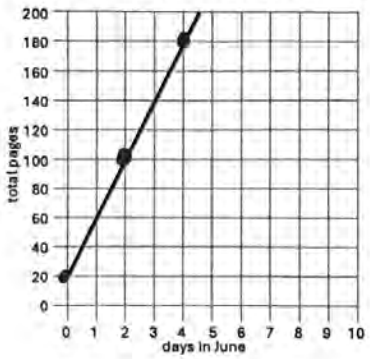
Alex ships 40 packages per hour.

15. Write an equation. $y = 40x$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Find the y-intercept and slope of each graph. Explain what they represent in the context of the story.

Jordan started a book in May. The graph shows the total pages he'll have read based on days he reads in June.



Is it a proportion? NO

16. What is the y-intercept? 20

17. What does it represent?

When Jordan has read 0 days in June he has read 20 pages.

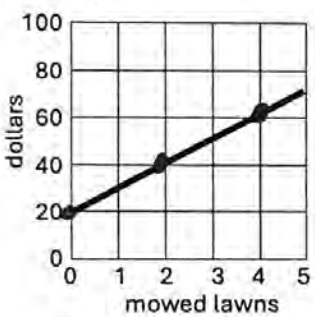
18. What is the slope? 40 $\frac{180-100}{4-2} = \frac{80}{2} = 40$

19. What does it represent?

Jordan reads 40 pages per day in June.

20. Write an equation. $y = 40x + 20$

While saving for a new phone, Samantha gets a job mowing lawns. She uses the graph shown to calculate her total savings.



Is it a proportion? NO

21. What is the y-intercept? 20

22. What does it represent?

When Samantha has mowed 0 lawns, she has $20.

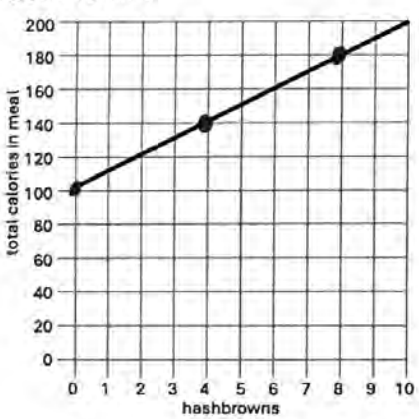
23. What is the slope? 10 $\frac{60-40}{4-2} = \frac{20}{2} = 10$

24. What does it represent?

Samantha gets $10 per lawn.

25. Write an equation. $y = 10x + 20$

Dunkin Donuts calculates the total calories in the egg and hashbrown meal based on the number of calories per hashbrown.



Is it a proportion? NO

26. What is the y-intercept? 100

27. What does it represent?

When there are 0 hashbrowns, then the meal has 100 calories.

28. What is the slope? 10 $\frac{180-140}{8-4} = \frac{40}{4} = 10$

29. What does it represent?

There are 10 calories per hash brown.

30. Write an equation. $y = 10x + 100$

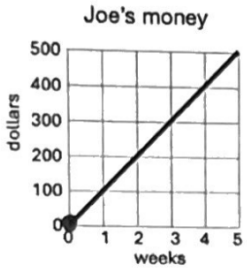
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

G8 U3 Lesson 7
Write an equation for the line by using two points to find the y-intercept.

G8 U3 Lesson 7 - Today we will write an equation for the line by using two points to find the y-intercept.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will write an equation for the line by using two points to find the y-intercept. In our last lesson we found the y-intercept and slope of graphs so we could write equations. We're going to do that but with one extra little challenge. You've got all the skills you need to do it so I know it will be great.



Let's Review (Slide 3): We already know this idea. It says, "The y-intercept is where the line crosses the y-axis and x = 0." We're going to find it below. This says, "The graphs below show the amount of money that three brothers saved this summer. Find the y-intercept of each." Let's start with Joe. What is the y-intercept? Possible Student Answers, Key Points:

- It is (0,0).
- It is 0.

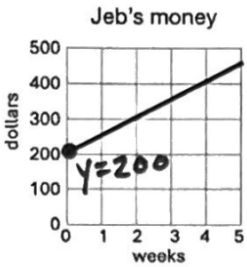
The line crosses the y-intercept here. *Draw a dot a (0,0).*

At that point, x = 0 and y = 0 too! So the y-intercept is zero. *Label the point with y = 0.* That helps us know that when the weeks are 0, meaning it's the start of the summer, Joe had $0.

What about Jeb's money? What is the y-intercept? Possible Student Answers, Key Points:

- It is (0,200).
- It is 200.

The line crosses the y-intercept here. *Draw a dot a (0,200).*

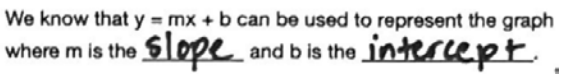


At that point, x = 0 and y = 200. So the y-intercept is 200. *Label the point with y = 200.* That helps us know that when the weeks are 0, meaning it's the start of the summer, Joe had $200. He must have had some money already saved up.

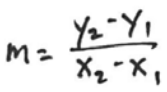
Now I want to find the y-intercept for the graph of John's money. When I look, I see that it is not exactly at 100 and it is not exactly at 200. It is in between. And it's not even exactly halfway between. I can't really tell what it is. I could estimate it. But I can't know for sure. That is what we're going to learn how to do today. And we're going to use two clear points on our graph to do it. But the big idea here is that sometimes you can see the y-intercept with your eyes and it's super obvious. But sometimes you're going to have to solve for it.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

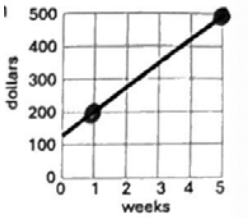
Let's Talk (Slide 4): We have the same graph on this next slide. And this says, "To find the y-intercept, we must find the slope in the formula: y = mx + b." There are a few steps in the reasoning for this.



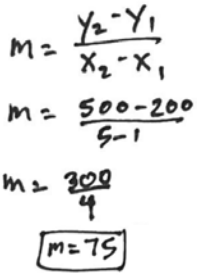
First, "we know that y = mx + b can be used to represent the graph" because it's a linear graph "where m is the…" SLOPE "and b is the… Y-INTERCEPT. We already knew that from our last two lessons.



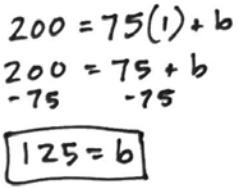
"We also know that if we only have one variable in an equation then we can solve to find it." What that means is if we can plug in a value for y and x and m then we can solve for b because it's the only one left. It's easy to figure out an x and an y. So let's figure out m. That's the slope. We know what to do. I am going to write m equals y_2 - y_1 over x_2 - x_1.



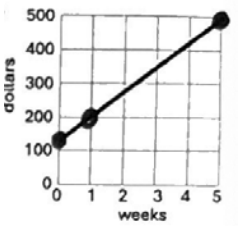
Let's mark two points that we can use to fill that in. Now, we have to be careful because there are lots of points that look kind of close to an intersection but they have to be right on a nice clear coordinate. I am going to mark this one and the only other one I can really mark is this one. *Mark a point at (1,200) and (5,500).*



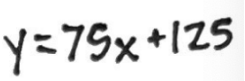
Now we can fill our numbers in. I do 500 - 200 over 5 - 1. That is equal to 300 over 4. I am going to do that division over to the side, and my answer is 75! So m = 75



Now that we know the slope, m, we can substitute a value for x, y and m into our equation and solve for b, the y-intercept. You can pick any x,y pair but I will just do (1,200). So, 200 = 75 times 1 + b. Let's simplify this by doing 75 times 1 equals 75. I am going to rewrite the expression: 200 = 75 + b. I want b by itself so I will subtract 75 from both sides. That gives me 125 = b.



When I look to my graph, I see that it looks right. And it means that this point is (0,125) and the y-intercept is 125. But also, it means that John must have started out with $125 at the beginning of the summer.

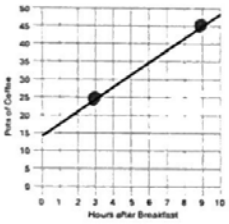


Now I can write the final equation in y=mx+b form. Y = 75x + 125. That's the equation. Here's the big idea - if we can't get the y-intercept by looking, then we can find it by finding the slope and then solving for it in an equation.

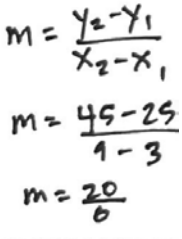
Let's Think (Slide 5): The awesome thing about knowing how to write an equation even when the y-intercept isn't obvious is that then you can find a value that isn't on the graph just by using the equation you come up with. This says, "If we want to find a value that's not on a graph, we have to write an equation first." That means we're going to have to figure out the slope and sometimes, if we can't see it just by looking, that means we'll have to solve for the y-intercept. I am going to read this problem out loud and I want you to read along with me silently in your head. *Read the story.* We have

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

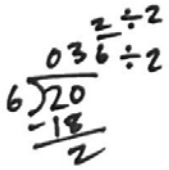
solved problems like this before but we always could either see it on the graph or plug it into an equation we were given. If I look for 12 hours on my graph, that's the x-axis and I don't have a 12 in my graph. And we don't have an equation so we'll have to come up with one. The first step is finding the slope. I will write m equals y_2 - y_1 over x_2 - x_1.



Let's mark two points that we can use to fill that in. Now, we have to be careful because there are lots of points that look kind of close to an intersection but they have to be right on a nice clear coordinate. I am going to mark this one and the only other one I can really mark is this one. *Mark a point at (3,25) and (9,45).*

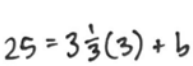


Now we can fill our numbers in. I do 45 - 25 over 9 - 3. That is equal to 20 over 6.

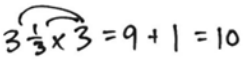


I am going to do that division over to the side. 6 doesn't go into 2 so I put a zero. 6 goes into 20 three times. I subtract 18 and I have 2 leftover. I can't divide that so I turn it into a fraction - 2 sixths. Let's simplify that by dividing the top and bottom by 2. It's 3 and 1 third.

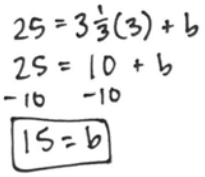
So m = $3\frac{1}{3}$. That's the slope.



Now that we know the slope, m, we can substitute a value for x, y and m into our equation and solve for b, the y-intercept. You can pick any x,y pair but I will just do (3,25). So, 25 = $3\frac{1}{3}$ times 3 + b.



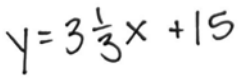
Let's simplify this by doing $3\frac{1}{3}$ times 3. It is a little tricky. I have to do 3 x 3 which is 9 and $\frac{1}{3}$ times 3, which is 1. That's 10 altogether.



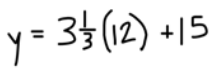
So I am going to rewrite the expression: 25 = 10 + b.I want b by itself so I will subtract 10 from both sides.

That gives me 15 = b. When I look to my graph, I see that this intercept is actually at 15 after all. It didn't look like it to me. But now we know for sure. And it means that this point is (0,15) and the y-intercept is 15. But also, it means that Marriot must have started out with 15 pots of coffee at breakfast.

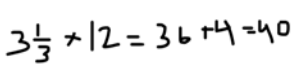
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.



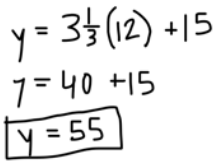
Now I can write the final equation in y=mx+b form. y = $3\frac{1}{3}$x + 15. That's the equation.



Now, can you believe that we did all that and we didn't even answer the question?!?! Finally, we can plug 12 hours into the equation and solve. That would be y = $3\frac{1}{3}$ times 12 + 15.



I do the math on this side 3 times 12 is 36. $\frac{1}{3}$ times 12 is 4. So that would be 40 altogether. That gives us y = 40 + 15.



We do that math and get y = 55. Phew! That's a lot of algebra. Do you see how I kept it in three separate sections here? And do you see how I always had my letters at the top so I knew what I was working on? That is key! And now we have this answer that we can interpret. When 12 hours have passed, the Marriot will have brewed 55 pots of coffee. Wow! That's a lot of coffee. It must be a big hotel.

Let's Try It (Slide 6): Let's find y-intercepts and equations for graphs together. I will walk you through each step.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

WARM WELCOME

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Today we will write an equation for the line by using two points to find the y-intercept.

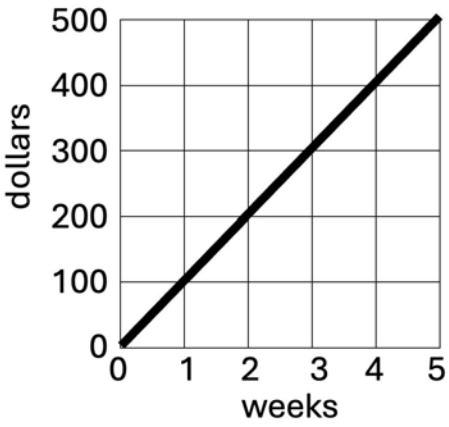
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Review:

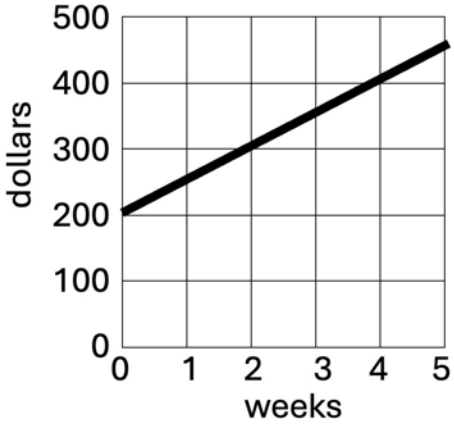
The y-intercept is where the line crosses the y-axis and x = 0.

The graphs below show the amount of money that three brothers saved this summer. Find the y-intercept of each.

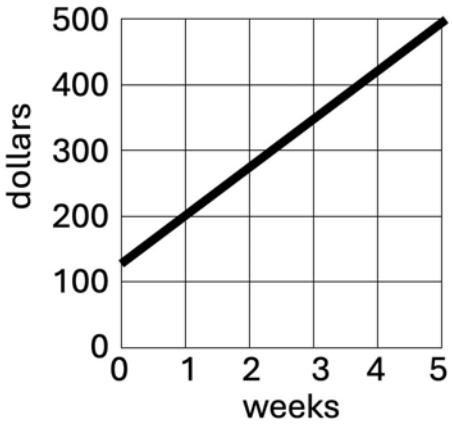
Joe's money



Jeb's money



John's money



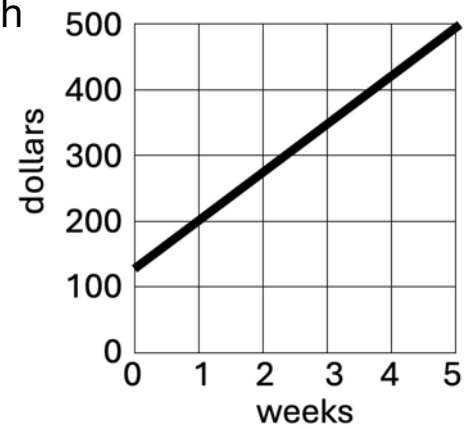
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk:

To find the y-intercept, we must find the slope in the formula: y = mx + b.

We know that y = mx + b can be used to represent the graph where m is the _____ and b is the _____.

We also know that if we only have one variable in an equation then we can solve to find it. So let's figure out m.



Slope:

Then substitute x, y and m:

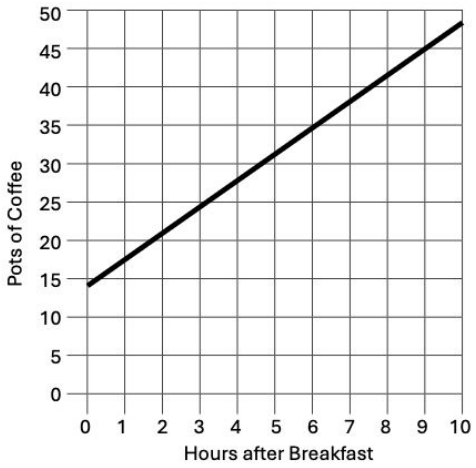
y = mx + b

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

If we want to find a value that's not on a graph, we have to write an equation first.

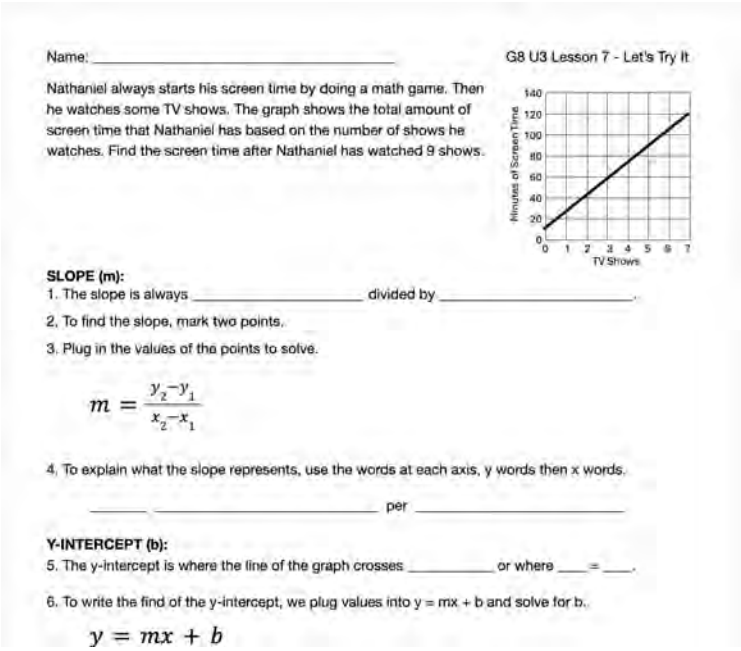
At the Marriot Hotel, they make coffee for breakfast then they have coffee set out for people to get throughout the day. The graph below shows the total amount of coffee pots brewed, x, based on hours after the breakfast service, y. How many pots will be brewed after 12 hours?



CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Try It:

Let's find y-intercepts and equations for graphs together!



Name: _____

G8 U3 Lesson 7 - Let's Try It

Nathaniel always starts his screen time by doing a math game. Then he watches some TV shows. The graph shows the total amount of screen time that Nathaniel has based on the number of shows he watches. Find the screen time after Nathaniel has watched 9 shows.

SLOPE (m):

1. The slope is always _____ divided by _____.
2. To find the slope, mark two points.
3. Plug in the values of the points to solve.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

4. To explain what the slope represents, use the words at each axis, y words then x words.

_____ _____ per _____

Y-INTERCEPT (b):

5. The y-intercept is where the line of the graph crosses _____ or where ____ = ____.
6. To write the find of the y-intercept, we plug values into y = mx + b and solve for b.

$$y = mx + b$$

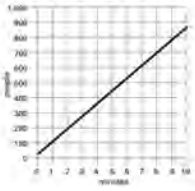
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

On your Own:

Now it's time for you to do it on your own!

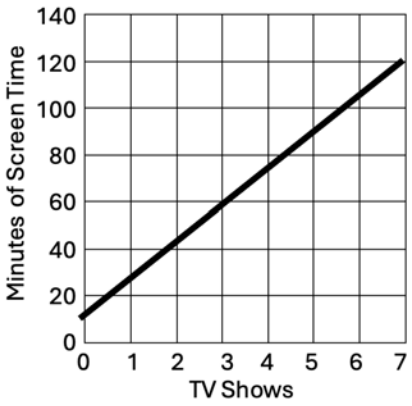
Name: _____ G8 U3 Lesson 7 - Independent Work

Use the slope and a point to find the y-intercept and write an equation for each graph.

Lily is upgrading her garden. She plants new flowers each day. The graph shows the total plants she has.	1. Write an equation for the line.
After special guests enter, people with tickets are let into the stadium hourly. The graph shows total people. 	2. Write an equation for the line.
Alex is shipping out orders from his art shop. The graph below shows the total	3. Write an equation for the line.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Nathaniel always starts his screen time by doing a math game. Then he watches some TV shows. The graph shows the total amount of screen time that Nathaniel has based on the number of shows he watches. Find the screen time after Nathaniel has watched 9 shows.



SLOPE (m):

1. The slope is always _____ divided by _____.

2. To find the slope, mark two points.

3. Plug in the values of the points to solve.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

4. To explain what the slope represents, use the words at each axis, y words then x words.

_____ _____ per _____

Y-INTERCEPT (b):

5. The y-intercept is where the line of the graph crosses _____ or where ____ = ____.

6. To write the find of the y-intercept, we plug values into y = mx + b and solve for b.

$$y = mx + b$$

7. To explain what the y-intercept represents, put your answer to #6 into a complete sentence.

_____

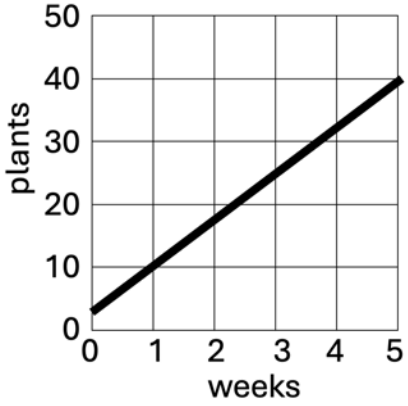
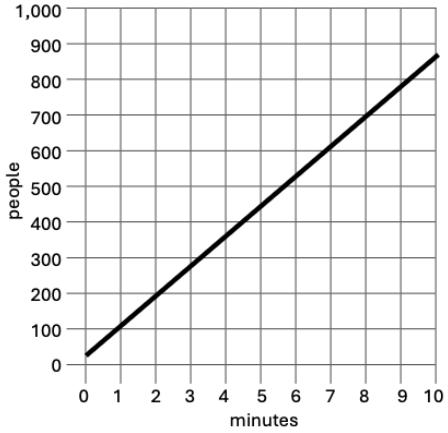
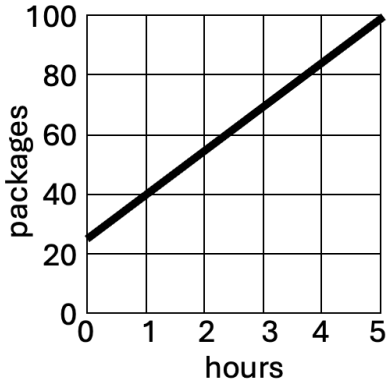
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

8. Use the answers you found to write an equation in y = mx + b form. _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

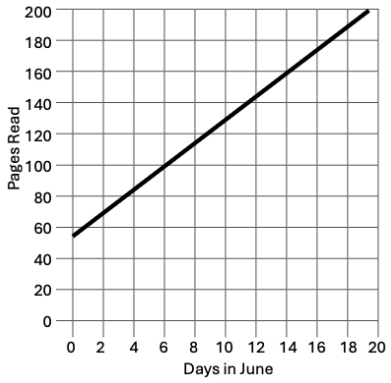
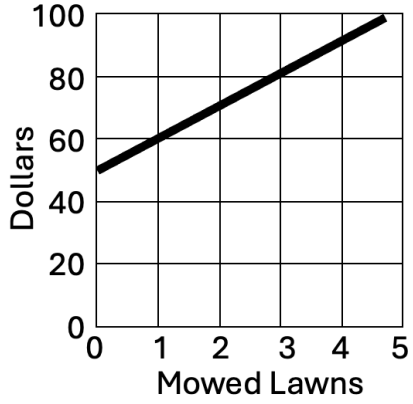
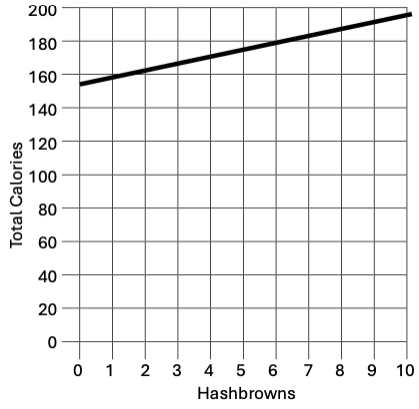
Use the slope and a point to find the y-intercept and write an equation for each graph.

Lily is upgrading her garden. She plants new flowers each day. The graph shows the total plants she has.  	1. Write an equation for the line.
After special guests enter, people with tickets are let into the stadium hourly. The graph shows total people.  	2. Write an equation for the line.
Alex is shipping out orders from his art shop. The graph below shows the total orders for the day based on the hours he works this afternoon.  	3. Write an equation for the line.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

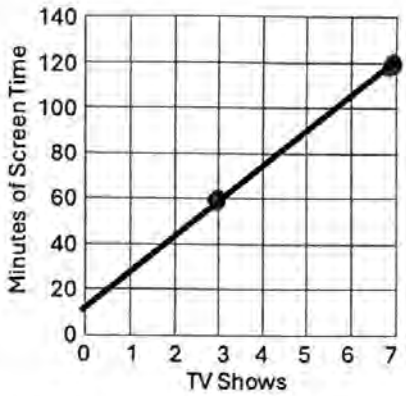
Find the equation for the line. Then use the equation to answer the question.

Jordan started a book in May. The graph shows the total pages he'll have read based on days he reads in June.  	4. Write an equation for the line.
While saving for a new phone, Samantha gets a job mowing lawns. She uses the graph shown to calculate her total savings.  	5. Write an equation for the line.
Dunkin Donuts calculates the total calories in the egg and hashbrown meal based on the number of calories per hashbrown.  	6. Write an equation for the line.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

Nathaniel always starts his screen time by doing a math game. Then he watches some TV shows. The graph shows the total amount of screen time that Nathaniel has based on the number of shows he watches. Find the screen time after Nathaniel has watched 9 shows.



SLOPE (m):

1. The slope is always $y_2 - y_1$ divided by $x_2 - x_1$.
2. To find the slope, mark two points.
3. Plug in the values of the points to solve.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \qquad \frac{120 - 60}{7 - 3} = \frac{60}{4} = 15$$

$$4\overline{)60} \quad 15, \; -4, \; 20, \; -20, \; 00$$

4. To explain what the slope represents, use the words at each axis, y words then x words.

15 minutes per TV show

Y-INTERCEPT (b):

5. The y-intercept is where the line of the graph crosses y-axis or where x = 0.
6. To write the find of the y-intercept, we plug values into y = mx + b and solve for b.

$y = mx + b$

$60 = 15(3) + b$

$60 = 45 + b$

$-45 \quad -45$

$\boxed{15 = b}$

7. To explain what the y-intercept represents, put your answer to #6 into a complete sentence.

When Nathaniel has watched 0 TV shows, he has had 15 minutes of screen time.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

8. Use the answers you found to write an equation in y = mx + b form. $y = 15x + 15$

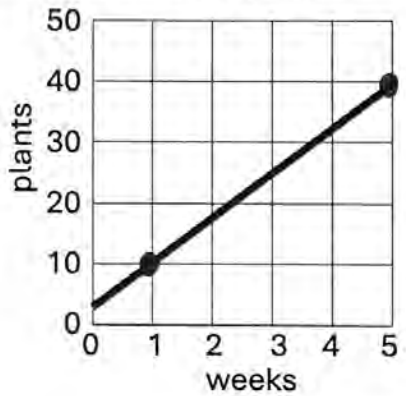
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

G8 U3 Lesson 7 - Independent Work

Use the slope and a point to find the y-intercept and write an equation for each graph.

Lily is upgrading her garden. She plants new flowers each day. The graph shows the total plants she has.



1. Write an equation for the line.

$m = \frac{40-10}{5-1} = \frac{30}{4} = 7\frac{2}{4}$

$4\overline{)30}\ 7\frac{2}{4}$, -28, 2

$y = mx + b$

$10 = 7\frac{1}{2}(1) + b$

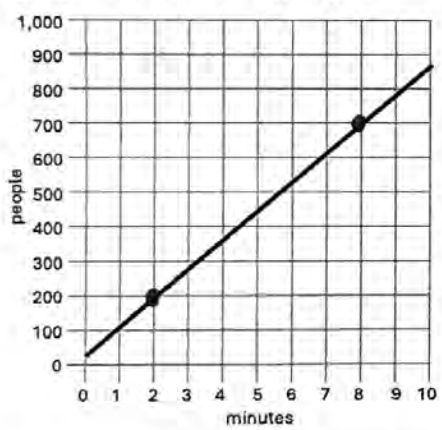
$10 = 7\frac{1}{2} + b$

$-7\frac{1}{2} \quad -7\frac{1}{2}$

$2\frac{1}{2} = b$

$y = 7\frac{1}{2}x + 2\frac{1}{2}$

After special guests enter, people with tickets are let into the stadium hourly. The graph shows total people.



2. Write an equation for the line.

$m = \frac{700-200}{8-2} = \frac{500}{6} = 83\frac{1}{3}$

$6\overline{)500}\ 83\frac{2}{6}$, -48, 20, -18, 2

$y = mx + b$

$200 = 83\frac{1}{3}(2) + b$

$200 = 166\frac{2}{3} + b$

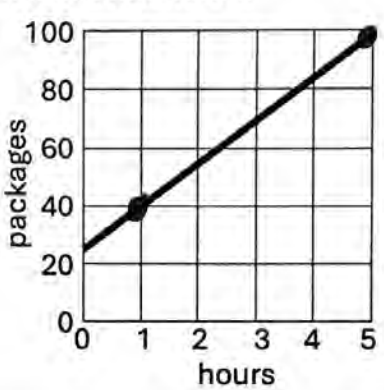
$-166\frac{2}{3} \quad -166\frac{2}{3}$

$33\frac{1}{3} = b$

$199\frac{3}{3} - 166\frac{2}{3} = 33\frac{1}{3}$

$y = 83\frac{1}{3}x + 33\frac{1}{3}$

Alex is shipping out orders from his art shop. The graph below shows the total orders for the day based on the hours he works this afternoon.



3. Write an equation for the line.

$m = \frac{100-40}{5-1} = \frac{60}{4} = 15$

$y = mx + b$

$40 = 15(1) + b$

$40 = 15 + b$

$-15 \quad -15$

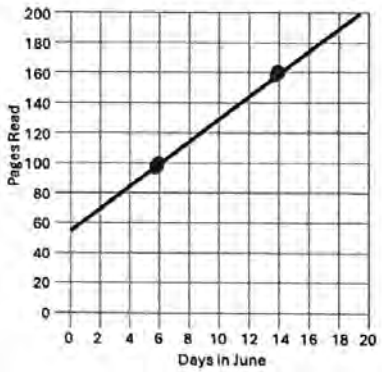
$25 = b$

$y = 15x + 25$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Find the equation for the line. Then use the equation to answer the question.

Jordan started a book in May. The graph shows the total pages he'll have read based on days he reads in June.



4. Write an equation for the line.

$m = \frac{160-100}{14-6} = \frac{60}{8} = 7\frac{1}{2}$

$8\overline{)60}$ = 06, −48, 12

$8\overline{)60}$ = 07, −56, 4

$7\frac{1}{2} \times 6 = 42 + 3$

$y = mx + b$

$100 = 7\frac{1}{2}(6) + b$

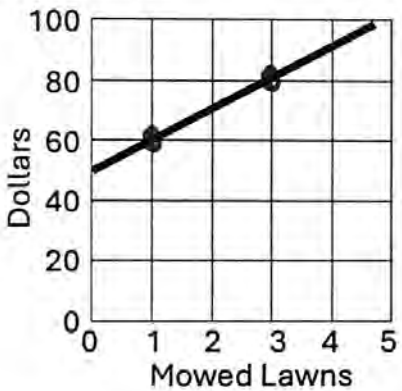
$100 = 45 + b$

$-45 \quad -45$

$\boxed{55 = b}$

$y = 7\frac{1}{2}x + 55$

While saving for a new phone, Samantha gets a job mowing lawns. She uses the graph shown to calculate her total savings.



6. Write an equation for the line.

$m = \frac{80-60}{3-1} = \frac{20}{2} = 10$

$y = mx + b$

$60 = 10(1) + b$

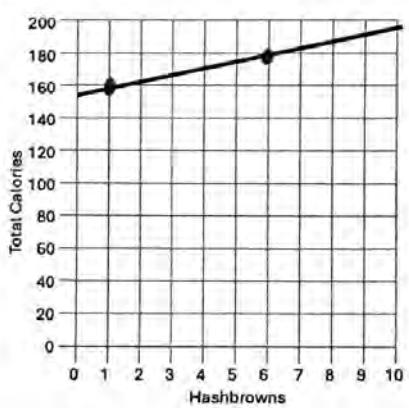
$60 = 10 + b$

$-10 \quad -10$

$50 = b$

$y = 10x + 50$

Dunkin Donuts calculates the total calories in the egg and hashbrown meal based on the number of calories per hashbrown.



8. Write an equation for the line.

$m = \frac{180-160}{6-1} = \frac{20}{5} = 4$

$y = mx + b$

$160 = 4(1) + b$

$160 = 4 + b$

$-4 \quad -4$

$156 = b$

$y = 4x + 156$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

G8 U3 Lesson 8
Compare linear relationships using the given context.

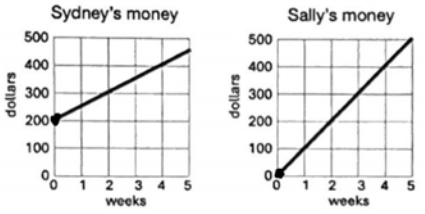
G8 U3 Lesson 8 - Today we will compare linear relationships using the given context.

Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): Today we will compare linear relationships using the given context. There isn't going to be anything new that we really learn. We are just going to put it all together and use it to answer questions. This is big league stuff for 8th grade! We are going to answer the ultimate 8th grade kind of questions!

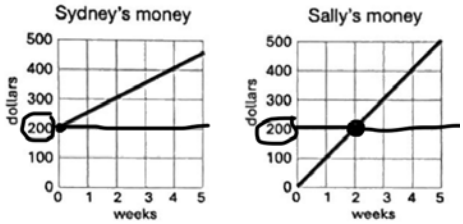
Let's Review (Slide 3): The first thing for us to know is, "There are 4 different things that we can compare in linear relationships." This will help us when we read a question because we can narrow it down to 4 possibilities of what we need to find. Let's explore this example. Read along silently in your head while I read out loud. *Read the problem.* What do you think? What different aspects of their graphs might we compare? Possible Student Answers, Key Points:

- We can compare where they start.
- We can compare their y-intercepts.
- We can compare their slopes.
- We can compare different points.
- We can compare where they stop.

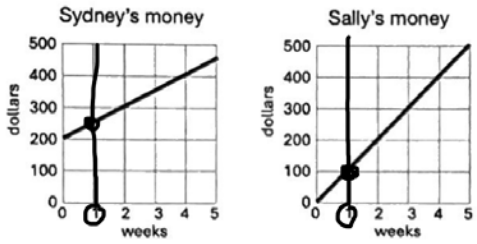


There are 4 things we can compare. The first thing is the y-intercepts. That is where the line hits the y-axis, which is where x = 0 so I can see that that this line has a y-intercept here and this line has a y-intercept here. *Mark the y-intercept on both graphs. Then erase for the next part of the conversation.*

The second thing we can compare is the slopes. That is how quickly the lines go up or down. We can use y_2-y_1 over x_2-x_1. That is telling us the change in y over the change in x. *Mark the rise over run for both graphs. Then erase for the next part of the conversation.*



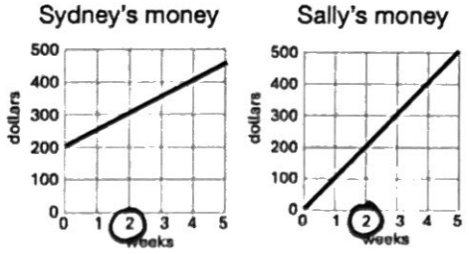
The third thing we can compare is values of x. For example, I can say, who takes longer when y = 200. And then I can see the value of x when y = 200 for each graph. *Mark a line from y = 200 on both graphs. Then erase for the next part of the conversation.*



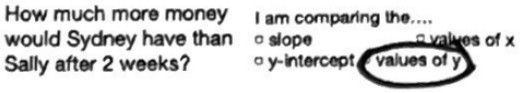
The fourth thing we can compare is value of y. For example, I can say, who is higher when x = 1. And then I can see the value of y when x = 1 for each graph. *Mark a line from x = 1 on both graphs.* So, the main idea is that we have two graphs, we can compare their y-intercepts, their slopes, their values of x or their values of y. And guess what?! That's not just for graphs! That's for tables and equations too!

Let's Talk (Slide 4): "Everytime we have a question about a linear relationship, we want to ask ourselves, 'what am I comparing?'" So here we have the same story and graphs as before. And we have four different questions. Let's read them and decide what we're comparing. First, it says, "How

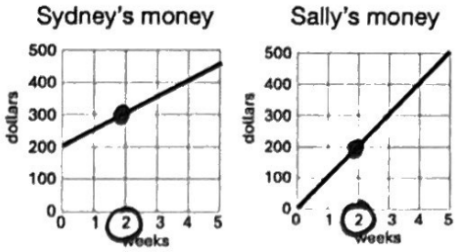
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.



much more money would Sydney have than Sally after two weeks?" This is asking about money. That's dollars. Which is over here on the y-axis. And it says "after two weeks." I can find two weeks on the x-axis here. *Circle 2 on the x-axis of both graphs.*

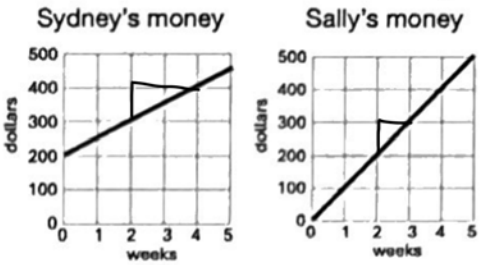


So, I know the weeks and the question is asking about the dollars. That's like I know the x values and I'm going to need to find the y values! I am comparing the values of y.



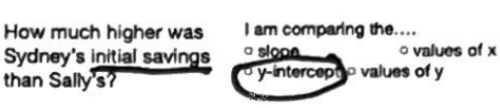
That means I am going to need to find y for each of these graphs when x = 2. In this case, Sydney has $300 at 2 weeks. *Mark a point at (2,300).* Sally has $200 at 2 weeks. *Mark a point at (2,200).* So Sydney has $100 more dollars than Sally at 2 weeks. *Erase your marks on the graphs for the next question.*

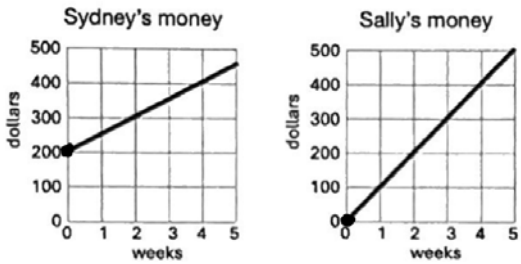
Let's do the next question. "How much higher is Sally's weekly salary than Sydney's?" This is really tricky because sometimes the thing we are looking for is disguised with a different work. This is asking how much higher the WEEKLY SALARY is. *Underline the words "weekly salary."* Weekly salary is how much a person is paid each week. That's like dollars per week. Dollars per week is slope. So I am comparing the slope of each graph.



For Sydney's money, I see she goes up $100. *Mark the rise on Sydney's graph.* And that happens over 2 weeks. *Mark the rise over run on Sydney's graph.* $100 over 2 weeks is $50 per week. For Sally's money, I see she goes up $100. *Mark the rise on Sally's graph.* And that happens over 1 week. *Mark the rise over run on Sally's graph.* That's $100 per week. So Sally gets 50 more dollars per week than Sydney. We were comparing the rates of change, the rise over run, which is the slopes of the graphs. *Erase your marks on the graphs for the next question.*

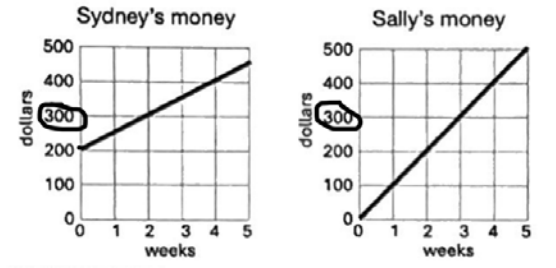
Let's do the next question. "How much higher was Sydney's initial savings than Sally's?" The thing they want us to compare here is the INITIAL SAVINGS. *Underline the words "initial savings" in the question.* That's the money at the start! That's when the weeks are 0 or x = 0. So that's the y-intercept. You can see that for every question, it is almost like we are translating the story into parts of the graph.



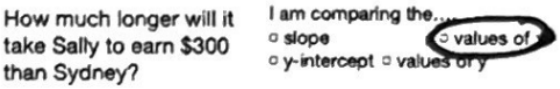


The y-intercept for Sydney is 200. *Mark a point at (0,200).* The y-intercept for Sally is 0. *Mark a point at (0,0).* So Sydney had $200 more in initial savings than Sally. *Erase your marks on the graphs for the next question.*

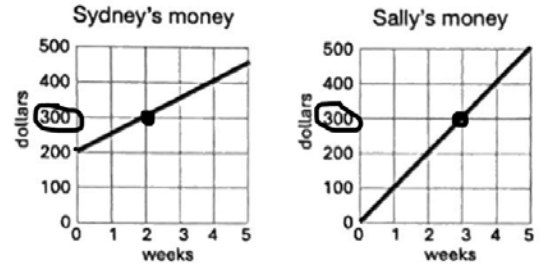
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.



Let's do the next question. "How much longer will it take Sally to earn $300 than Sydney?" This is another thing we have to kind of translate. The $300 is values on the y-axis because the y-axis is dollars. *Circle 300 on each y-axis.*

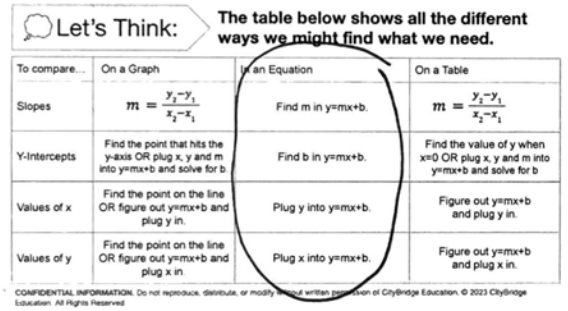


I want to know how much longer. Longer is going to be measured in weeks. So I am looking for this x value when y = 300 on each graph.



In this case, I see that Sydney gets $300 at 2 weeks. *Mark a point at (2,300).* I see that Sally gets $300 at 3 weeks. *Mark a point at (3, 300).* So Sally takes 1 more week than Sydney. You can see that each of these questions is very different and this is going to take a lot of thinking about what the problem is secretly asking every time. The big idea is that every time you solve a problem about comparing linear relationships, you need to ask yourself, "What am I comparing?" And you will need to translate the story words into parts of the graph.

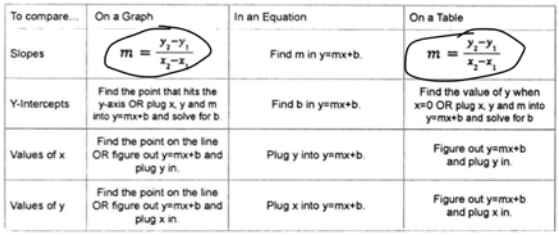
Let's Think (Slide 5): "The table below shows all the different ways we might find what we need." We are not going to work these out on this slide. It is just a summary of what you already know. It might seem a little overwhelming so let's look at it in pieces. We'll start with the equation column because that is the most consistent. *Circle the equation column.* For each thing, I am looking at parts of the equation. The slope is m so I have to find m in my equation. The y-intercept is b so I have to find b in my equation. I can plug in y and solve for x. Or I can plug in x and solve for y. I just use the equation and find the part I need. *Erase what you circled.*



Let's Think: **The table below shows all the different ways we might find what we need.**

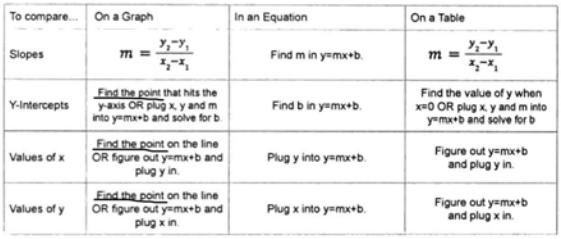
To compare...	On a Graph	In an Equation	On a Table
Slopes	$m = \frac{y_2-y_1}{x_2-x_1}$	Find m in y=mx+b.	$m = \frac{y_2-y_1}{x_2-x_1}$
Y-Intercepts	Find the point that hits the y-axis OR plug x, y and m into y=mx+b and solve for b.	Find b in y=mx+b.	Find the value of y when x=0 OR plug x, y and m into y=mx+b and solve for b
Values of x	Find the point on the line OR figure out y=mx+b and plug y in.	Plug y into y=mx+b.	Figure out y=mx+b and plug y in.
Values of y	Find the point on the line OR figure out y=mx+b and plug x in.	Plug x into y=mx+b.	Figure out y=mx+b and plug x in.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.



To compare...	On a Graph	In an Equation	On a Table
Slopes	$m = \frac{y_2-y_1}{x_2-x_1}$	Find m in y=mx+b.	$m = \frac{y_2-y_1}{x_2-x_1}$
Y-Intercepts	Find the point that hits the y-axis OR plug x, y and m into y=mx+b and solve for b.	Find b in y=mx+b.	Find the value of y when x=0 OR plug x, y and m into y=mx+b and solve for b
Values of x	Find the point on the line OR figure out y=mx+b and plug y in.	Plug y into y=mx+b.	Figure out y=mx+b and plug y in.
Values of y	Find the point on the line OR figure out y=mx+b and plug x in.	Plug x into y=mx+b.	Figure out y=mx+b and plug x in.

For slope on a graph and a table, we use the same formula we already know. *Circle the formulas.* You have already used this formula a bunch.



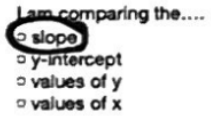
To compare...	On a Graph	In an Equation	On a Table
Slopes	$m = \frac{y_2-y_1}{x_2-x_1}$	Find m in y=mx+b.	$m = \frac{y_2-y_1}{x_2-x_1}$
Y-Intercepts	Find the point that hits the y-axis OR plug x, y and m into y=mx+b and solve for b.	Find b in y=mx+b.	Find the value of y when x=0 OR plug x, y and m into y=mx+b and solve for b
Values of x	Find the point on the line OR figure out y=mx+b and plug y in.	Plug y into y=mx+b.	Figure out y=mx+b and plug y in.
Values of y	Find the point on the line OR figure out y=mx+b and plug x in.	Plug x into y=mx+b.	Figure out y=mx+b and plug x in.

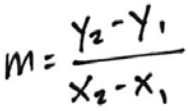
If we look down the rest of the directions for graph, you can just look to find the point you need. *Underline "find the point" for each part of the directions.* And if that doesn't work then you'll have to make an equation and use the equation. Same goe for the table. You can either find the point you need. Or if it isn't obvious then you have to make an equation. We practiced making

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

equations in our last lesson where you find the slope and y-intercept and write it as y=mx+b. I can leave this up later for you to look at while you're working as a reference.

Let's Think (Slide 6): This says, "We still ask ourselves the same question even when we are comparing different forms of representation." Like here we have a graph and a table. No problem! I'm going to walk you through this one so that you can see how I show my work. It's a lot of steps so the most important thing is that I use letters and labels to keep my work organized. I don't want it all over the paper. I want it nicely side by side. Read the story along with me silently in your head while I read the problem out loud. *Read the problem.* Now remember, before I just jump in, I ask myself, "What am I comparing?" I use the question to help me. It says, "How many more stickers is Maria putting on each page than Marjorie?" It's asking for stickers on each page. That's stickers per page. That's slope language. I am comparing the slope.





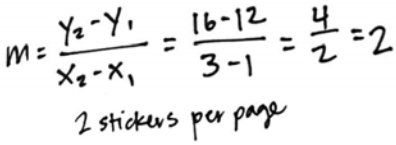
Now that I know that I need to find the slope for each thing. Let's start with Marjorie. I will use m equals y two minus y one over x two minus x one.

Marjorie

x	y
0	10
1	12
2	14
3	16

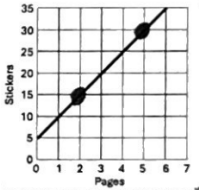
Let's use these two points. *Circle (1,12) and (3,16) on the table.*

That's m equals 16 minus 12 over 3 minus 1, which is 4 over 2. That's 2. It helps if I write the words. 2 stickers per page.

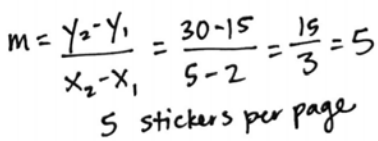


Now let's do the graph. I will use m equals y two minus y one over x two minus x one again!

Maria

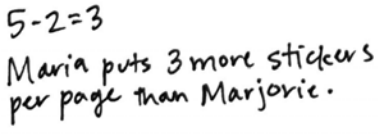


Let's use these two points. *Mark (2,15) and (5,30) on the graph.*



That's m equals 30 minus 15 over 5 minus 2, which is 15 over 3. That's 3. It helps if I write the words. 3 stickers per page.

Now I have the information I need to answer the question! "How many more stickers is Maria putting on each page than Marjorie?" She is doing 1 more sticker per page. I will write that as a complete sentence. Look at all of that! There are a few big ideas. First, we have said that we need to always ask ourselves, "What am I comparing?" Second, we had to keep our work super organized with labels and letters. Third, we used words as we were going along so it was easier to keep track of what the numbers we were finding represented. And it



CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

made it easier to answer the final question after all those in between steps.

Let's Try It (Slide 7): Let's solve another problem together now. I will walk you through each step.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

WARM WELCOME

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Today we will compare linear relationships using the given context.

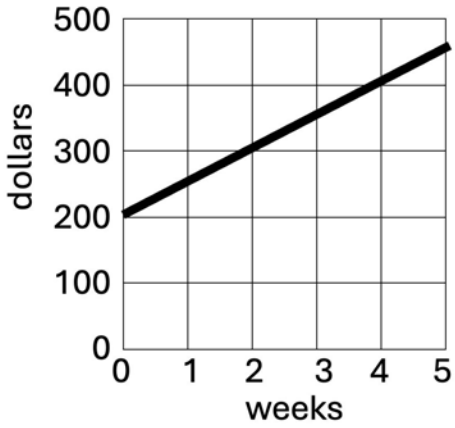
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Review:

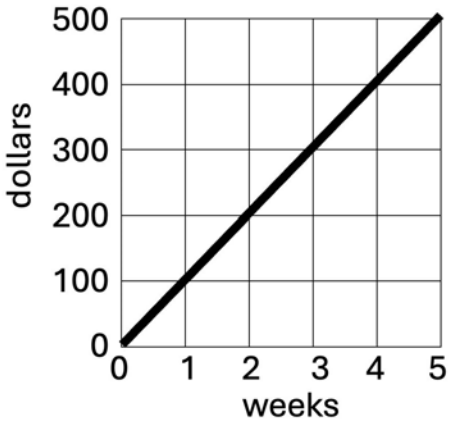
There are 4 different things that we can compare in linear relationships.

The graphs below show the amount of money that two sisters saved this summer. What different aspects of their graphs might we compare?

Sydney's money



Sally's money



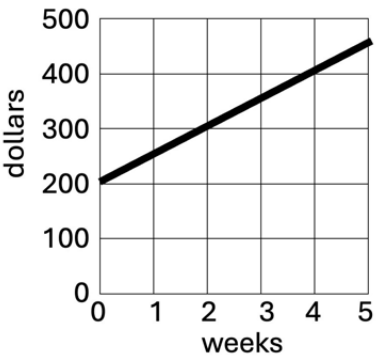
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk:

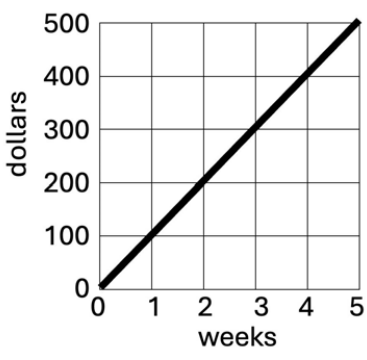
Every time we have a question about a linear relationship, we want to ask ourselves, "What am I comparing?"

The graphs below show the amount of money that two sisters saved this summer.

Sydney's money



Sally's money



How much more money would Sydney have than Sally after 2 weeks?

I am comparing the….
▢ slope ▢ values of x
▢ y-intercept ▢ values of y

How much higher is Sally's weekly salary than Sydney's?

I am comparing the….
▢ slope ▢ values of x
▢ y-intercept ▢ values of y

How much higher was Sydney's initial savings than Sally's?

I am comparing the….
▢ slope ▢ values of x
▢ y-intercept ▢ values of y

How much longer will it take Sally to earn $300 than Sydney?

I am comparing the….
▢ slope ▢ values of x
▢ y-intercept ▢ values of y

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

The table below shows all the different ways we might find what we need.

To compare…	On a Graph	In an Equation	On a Table
Slopes	$m = \frac{y_2 - y_1}{x_2 - x_1}$	Find m in y=mx+b.	$m = \frac{y_2 - y_1}{x_2 - x_1}$
Y-Intercepts	Find the point that hits the y-axis OR plug x, y and m into y=mx+b and solve for b.	Find b in y=mx+b.	Find the value of y when x=0 OR plug x, y and m into y=mx+b and solve for b
Values of x	Find the point on the line OR figure out y=mx+b and plug y in.	Plug y into y=mx+b.	Figure out y=mx+b and plug y in.
Values of y	Find the point on the line OR figure out y=mx+b and plug x in.	Plug x into y=mx+b.	Figure out y=mx+b and plug x in.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

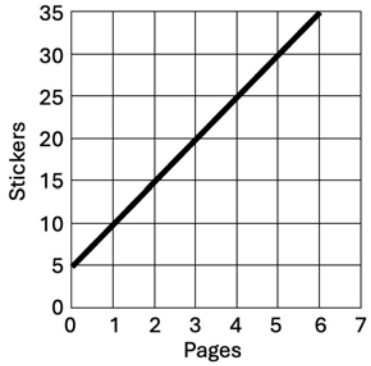
We still ask ourselves the same question even when we are comparing different forms of representation.

Marjorie is tracking the total stickers starting with the cover and then the pages of her sticker book. She uses the table below where x equals the number of pages and y equals the number of pages. Maria is using a graph to do the same. How many more stickers is Maria putting on each page than Marjorie?

Marjorie

x	*y*
0	10
1	12
2	14
3	16

Maria



I am comparing the….

- ▢ slope
- ▢ y-intercept
- ▢ values of y
- ▢ values of x

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Try It:

Let's find y-intercepts and equations for graphs together!

Name: _____ G8 U3 Lesson 8 - Let's Try It

Jeff wants to know whether the fastest way to get to the beach from his neighborhood is on the highway or on backroads. He uses a graph to show the distance from his house that his buddy's car travels on the highway where x equals minutes and y equals miles. He uses a table to record the distance from his house that his own car travels on the backroads. How much faster is the highway car than the backroads car?

Car on Highway

Car on Backroads

x	y
0	0
2	1
4	2
6	3
8	4

I am comparing the....
- ☐ slope
- ☐ y-intercept
- ☐ values of y
- ☐ values of x

1. Start with the first representation. Find the thing you are looking for.

In this case, I will need to do _____

2. Move on to the second representation. Find the thing you are looking for.

In this case, I will need to do _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

On your Own:

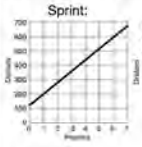
Now it's time for you to do it on your own!

Name: _____ G8 U3 Lesson 8 - Independent Work

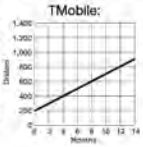
Solve the problems below. Show your work. Write your final answer in a complete sentence.

1. The graphs below show the total costs for two different cell phone carriers including the signup fee and the monthly rate. Which cell phone carrier will cost the most after 12 months?

Sprint:



TMobile:



Check one:
I am comparing the....
- ☐ slope
- ☐ y-intercept
- ☐ values of x
- ☐ values of y

Show your work:

2. For November, Francisco plans to use the equation y = 18x+100 to calculate his total savings where y is the number of dollars and x is the number of hours he works. His friend, Charlie, plans to use the equation y = 20x + 50 to calculate his total savings where y is the number of dollars and x is the number of hours he works. Who is starting out with the most money leading up to November?

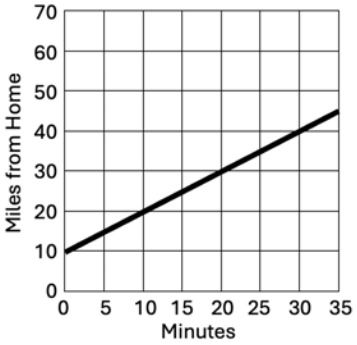
Check one:
I am comparing the....
- ☐ slope

Show your work:

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Jeff wants to know whether the fastest way to get to the beach from his neighborhood is on the highway or on backroads. He uses a graph to show the distance from his house that his buddy's car travels on the highway where x equals minutes and y equals miles. He uses a table to record the distance from his house that his own car travels on the backroads. How much faster is the highway car than the backroads car?

Car on Highway



Car on Backroads

x	*y*
0	0
2	1
4	2
6	3
8	4

I am comparing the….
- ☐ slope
- ☐ y-intercept
- ☐ values of y
- ☐ values of x

1. Start with the first representation. Find the thing you are looking for.

   In this case, I will need to do _____

2. Move on to the second representation. Find the thing you are looking for.

   In this case, I will need to do _____

3. Now do the work to answer the question.

4. Write your answer in a complete sentence.

_____

_____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

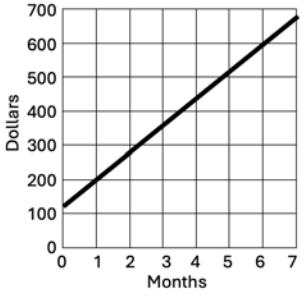
© 2023 CityBridge Education. All Rights Reserved.

Name: _____ G8 U3 Lesson 8 - Independent Work

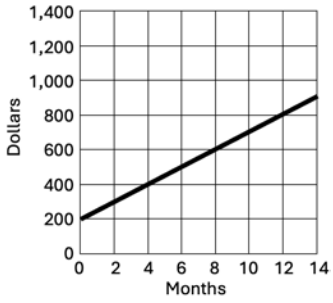
Solve the problems below. Show your work. Write your final answer in a complete sentence.

1. The graphs below show the total costs for two different cell phone carriers including the signup fee and the monthly rate. Which cell phone carrier will cost the most after 12 months?

Sprint:



TMobile:



Check one:
I am comparing the….
▢ slope
▢ y-intercept
▢ values of x
▢ values of y

Show your work:

2. For November, Francisco plans to use the equation $y = 18x+100$ to calculate his total savings where y is the number of dollars and x is the number of hours he works. His friend, Charlie, plans to use the equation $y = 20x + 50$ to calculate his total savings where y is the number of dollars and x is the number of hours he works. Who is starting out with the most money leading up to November?

Check one:
I am comparing the….
▢ slope
▢ y-intercept
▢ values of x
▢ values of y

Show your work:

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

Solve the problems below. Show your work. Write your final answer in a complete sentence.

3. Jeff was comparing the growth of two different plants that he bought at the store by measuring their height every week. The 1st plant was put in direct sunlight. The 2nd plant was put in indirect sunlight. He recorded their heights in a table where x is the number of weeks and y is the height in inches. How much faster did the first plant grow than the second?

1st Plant:

x	*y*
0	2
1	5
2	8
3	11
4	14

2nd Plant:

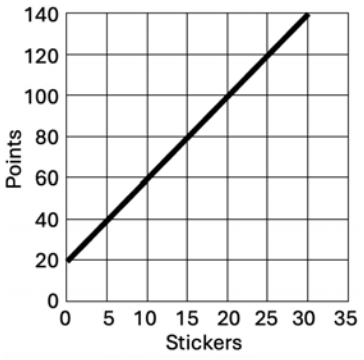
x	*y*
0	3
1	5
2	7
3	9
4	11

Check one:
I am comparing the….
▢ slope
▢ y-intercept
▢ values of x
▢ values of y

Show your work:

4. Customers at Mazzy's Sticker Store earn points by buying stickers. Then they can use the points for prizes at the end of the year. Mazzy uses the equation y = 4x where x represents the number of stickers and y represents the number of points. Mazzy also has a Super Savers Club where customers who join can get points for signing up and they earn more points for each sticker. The graph below shows the points based on the number of stickers for the Super Savers Club where x represents the number of stickers and y represents the number of points. The first prize requires 100 points. How many more stickers does someone need to buy to get 100 points if they are NOT in the Super Saver Club than if they are in the Super Saver Club?

Super Saver Club:



Check one:
I am comparing the….
▢ slope
▢ y-intercept
▢ values of x
▢ values of y

Show your work:

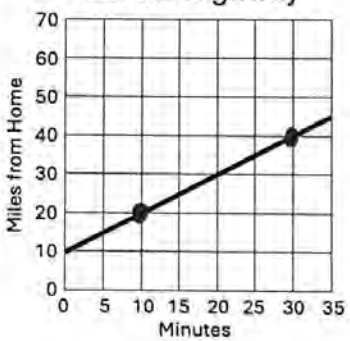
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

Jeff wants to know whether the fastest way to get to the beach from his neighborhood is on the highway or on backroads. He uses a graph to show the distance from his house that his buddy's car travels on the highway where x equals minutes and y equals miles. He uses a table to record the distance from his house that his own car travels on the backroads. How much faster is the highway car than the backroads car?

Car on Highway



Car on Backroads

x	y
0	0
2	1
4	2
6	3
8	4

I am comparing the....

- [x] slope
- [ ] y-intercept
- [ ] values of y
- [ ] values of x

1. Start with the first representation. Find the thing you are looking for.

In this case, I will need to do $(y_2 - y_1)/(x_2 - x_1)$

$$m = \frac{40-20}{30-10} = \frac{20}{10} = 2$$

2. Move on to the second representation. Find the thing you are looking for.

In this case, I will need to do $(y_2 - y_1)/(x_2 - x_1)$

$$m = \frac{6-2}{3-1} = \frac{4}{2} = 2$$

3. Now do the work to answer the question.

$2 - 2 = 0$

4. Write your answer in a complete sentence.

The highway car is 0 mph faster than the backroads car. They go the same speed.

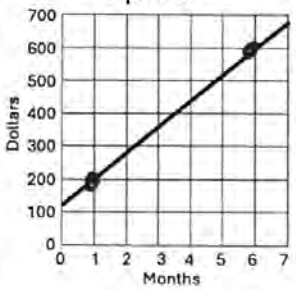
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

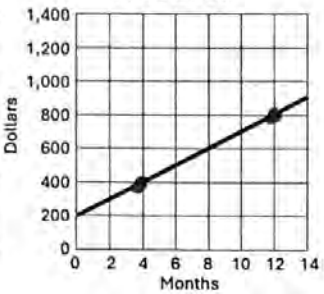
Solve the problems below. Show your work. Write your final answer in a complete sentence.

1. The graphs below show the total costs for two different cell phone carriers including the signup fee and the monthly rate. Which cell phone carrier will cost the most after 12 months?

Sprint:



TMobile:



Check one:
I am comparing the....
- ☐ slope
- ☐ y-intercept
- ☐ values of x
- ☑ values of y

Show your work:

Sprint:

$y = 80x + 120$

$y = 80(12) + 120$

$y = 960 + 120$

$y = 1080$ dollars

TMobile:

$y = 50x + 200$

$y = 50(12) + 200$

$y = 600 + 200$

$y = 800$ dollars

$m = \frac{600-200}{6-1} = \frac{400}{5} = 80$

$y = mx + b$

$200 = 80(1) + b$

$200 = 80 + b$

$-80 \quad -80$

$120 = b$

$y = 80x + 120$

$m = \frac{800-400}{12-4} = \frac{400}{8} = 50$

$y = mx + b$

$400 = 50(4) + b$

$400 = 200 + b$

$-200 \quad -200$

$200 = b$

$y = 50x + 200$

Sprint will cost the most.

2. For November, Francisco plans to use the equation $y = 18x+100$ to calculate his total savings where y is the number of dollars and x is the number of hours he works. His friend, Charlie, plans to use the equation $y = 20x + 50$ to calculate his total savings where y is the number of dollars and x is the number of hours he works. Who is starting out with the most money leading up to November?

Check one:
I am comparing the....
- ☐ slope
- ☑ y-intercept
- ☐ values of x
- ☐ values of y

Show your work:

Francisco:

$y = 18x + 100$

$b = 100$

Charlie:

$y = 20x + 50$

$b = 50$

Francisco is starting out with the most money.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Solve the problems below. Show your work. Write your final answer in a complete sentence.

3. Jeff was comparing the growth of two different plants that he bought at the store by measuring their height every week. The 1st plant was put in direct sunlight. The 2nd plant was put in indirect sunlight. He recorded their heights in a table where x is the number of weeks and y is the height in inches. How much faster did the first plant grow than the second?

1st Plant:

x	y
0	2
1	5
2	8
3	11
4	14

2nd Plant:

x	y
0	3
1	5
2	7
3	9
4	11

Check one:
I am comparing the....
- [x] slope
- [ ] y-intercept
- [ ] values of x
- [ ] values of y

Show your work:

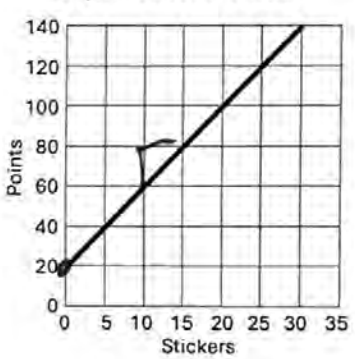
$m = \frac{11-5}{3-1} = \frac{6}{2} = 3$ $m = \frac{9-5}{3-1} = \frac{4}{2} = 2$

$3 - 2 = 1$

The 1st plant grew 1 inch per week faster than the 2nd plant.

4. Customers at Mazzy's Sticker Store earn points by buying stickers. Then they can use the points for prizes at the end of the year. Mazzy uses the equation y = 4x where x represents the number of stickers and y represents the number of points. Mazzy also has a Super Savers Club where customers who join can get points for signing up and they earn more points for each sticker. The graph below shows the points based on the number of stickers for the Super Savers Club where x represents the number of stickers and y represents the number of points. The first prize requires 100 points. How many more stickers does someone need to buy to get 100 points if they are NOT in the Super Saver Club than if they are in the Super Saver Club?

Super Saver Club:



$y = 4x + 20$

$100 = 4x + 20$
$-20 \quad -20$
$80 = 4x$
$\frac{80}{4} = \frac{4x}{4}$
$x = 20$

Check one:
I am comparing the....
- [ ] slope
- [ ] y-intercept
- [x] values of x
- [ ] values of y

NOT in club
regular:
$y = 4x$

$\frac{100}{4} = \frac{4x}{4}$

$25 = x$

Show your work:

$25 - 20 = 5$

They would need to buy 5 more stickers than someone in the Super Saver Club.

CONFIDENTIAL INFORMATION Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

G8 U3 Lesson 9
Represent and interpret linear relationships with negative rates of change.

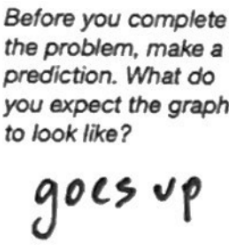
G8 U3 Lesson 9 - Today we will represent and interpret linear relationships with negative rates of change.

Warm Welcome (Slide 1): Tutor choice

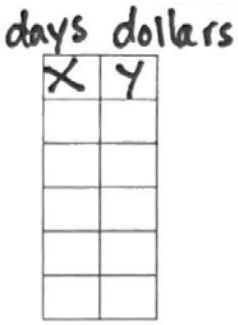
Frame the Learning/Connect to Prior Learning (Slide 2): Today we will represent and interpret linear relationships with negative rates of change. This is all going to be based on things you already know. The hardest part for kids is just if they don't know that it is possible for negative rates of change or negative slopes to exist at all. But once you know that, you can keep doing all the great math you've been doing. Let's go!

Let's Review (Slide 3): We know that linear relationships look a certain way when graphed. I am going to read this story out loud. Read silently along with me in your head. *Read the problem.* Now, there is a little extra part here. It says, "Before you complete the problem, make a prediction. What do you expect the graph to look like?" What do you think? What is your prediction? Possible Student Answers, Key Points:

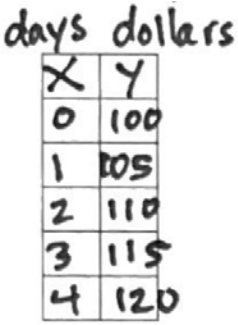
- I expect it to be a straight line.
- I expect it to be diagonal.
- I expect it to go up.
- I expect it to cross the y-axis.
- I expect it to go through points.



We've talked a lot about linear relationships having a y-intercept and a straight line with a constant slope. But we haven't spelled out the fact that every linear relationship we've seen so far has had a straight line that GOES UP. All of our examples so far have had a POSITIVE SLOPE. But they don't have to be that way. Let's finish this problem here and then we will do a problem with a negative slope.

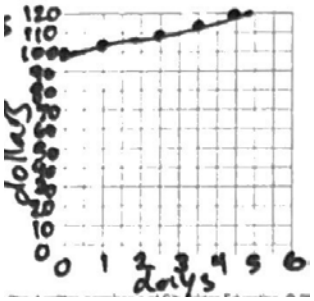


First I put x and y at the top of my table. That's days and dollars, which I'll write on top just to keep myself straight.

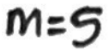


At the very beginning of my story, it would be 0 days, and it said Graham has $100. So I will write 0 and 100 as the first row. Then it says that "every day, he gets $5 from a neighbor." So if I go to the next day, that's day 1 and he would have $105. And I can keep going, right? The next day, day 2, would be another $5 so $110 altogether. Then 3 days is $115. 4 days is $120.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.



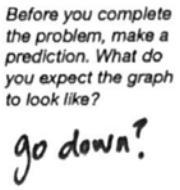
Now let's graph it. I will write days on the x-axis and dollars on the y-axis. For days, I can actually make it two lines is 1 then two lines is 2 then two lines is 3 and I keep going. For dollars, I will skip count by ten.Now I graph: (0,100) and then (1,105). I'm going to have to go halfway between to mark at 105. Then I'll do (2,110) and (3,115). I'll have to go halfway again for 115. Then I'll do (4,120). I draw a line to connect the dots, and look! It's exactly what we predicted. There is the y-intercept and it's a straight line. But also it is going up.



The rate or change or slope is 5 because the problem said he gets $5 per day. I'll write that as m = 5. We take for granted that this is a POSITIVE number because when numbers are positive, we just call them "numbers" and we leave off the positive sign. But next we'll look at an example with a negative slope and see that we can't leave that off.

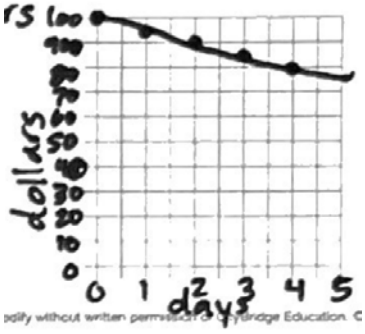
Let's Talk (Slide 4): This says, "Imagine the story on the previous slide was reversed." I am going to read it out loud while you read it silently in your head. *Read the story and make extra emphasis on the words 'he pays his neighbor.'"* This problem is not the same. Now, Graham is not getting paid. Graham is the one doing the paying. Let's think about this extra question here, "Before you complete the problem, make a prediction. What do you expect the graph to look like?" What do you think? What is your prediction? Possible Student Answers, Key Points:

- I expect it to be a straight line.
- I expect it to be diagonal.
- I expect it to go DOWN.
- I expect it to cross the y-axis.
- I expect it to go through points.



There are a lot of things we can think about like straight lines and y-intercepts. But the important thing we might guess here is that instead of the line going up, maybe it will go down. Because now Graham is losing money instead of gaining money. Let's make a table and graph and see.

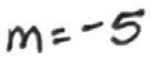
First I put x and y at the top of my table. That's days and dollars, which I'll write on top just to keep myself straight. At the very beginning of my story, it would be 0 days, and it said Graham has $100. So I will write 0 and 100 as the first row. Then it says that "every day, he pays his neighbor $5." So if I go to the next day, that's day 1 and he wouldn't have $105. He would have $5 less than $100, which is $95. And I can keep going, right? The next day, day 2, he would pay another $5 so that's $90 altogether. Then 3 days is $85. 4 days is $80. You get the idea.



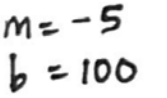
Now let's graph it. I will write days on the x-axis and dollars on the y-axis. For days, I can actually make it two lines is 1 then two lines is 2 then two lines is 3 and I keep going. For dollars, I will skipcount by ten again. Now I graph: (0,100). That's the same. But now I graph (1,95)! I'm going to have to go halfway between 90 and 100 to mark at 95. But the most important thing is that my point went LOWER than when we started. It went down. Next I'll do (2,90). Then (3,85). I'll have to go halfway again for 85. Then I'll do (4,80). I draw a line to connect the dots, and look! It's exactly what we predicted. There is the y-intercept and it's a straight line. But it's not going up. It's going down!

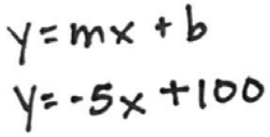
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

The rate or change or slope is not positive 5 like on the last slide. It's the opposite. It's NEGATIVE 5 because the problem said he loses $5 per day like it is getting subtracted. I am going to write m = -5 for this one. The big idea here is that you have to read the story and picture what is happening in your mind to be clear on whether your initial amount is increasing or decreasing because that will determine if your slope should be positive or negative.



Let's Think (Slide 5): We have one more representation to think about with GETS, Graph, Equation, Table and Story, right? This says, "Linear relationships with a negative slope follow the same rules as all linear relationships." That means they also have equations in the form y = mx + b. Let's work that out. We have a very similar problem but the underlined part is different. I am going to read it out loud and you should read silently in your head. *Read the problem.* This is the problem we just did with the negative slope. So, first, let's write that down: m = -5. Then we have the y-intercept which was Graham's money to start on day 0. Let's write that down: b = 100.





So, now we take the equation: y = mx + b and we just fill in the m and fill in the b. It would be y = -5x + 100.

And so, just as a side note, if we were to plug a value of x into this equation, such as x = 9, then it would be y = -5 times 9 plus 100. That is the same as y = -45 plus 100. And the negative number cancels 50 of the positive number, essentially subtracting. And we'd get y = 55. But the big idea here is that we really do the table and the graph and the equation the same way we always do. It's just that sometimes now the slope will be going down so it will be negative.

Let's Try It (Slide 6): Let's practice doing some problems with negative slopes together. I will walk you through each step.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

WARM WELCOME

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Today we will represent and interpret linear relationships with negative rates of change.

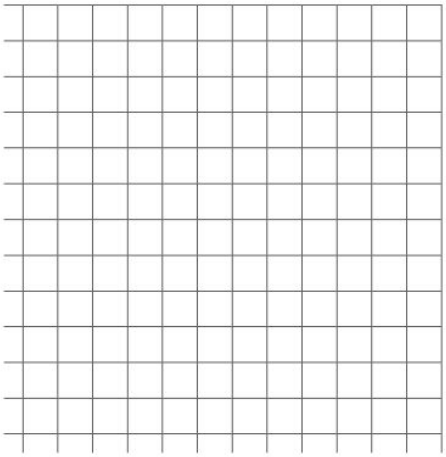
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Review:

We know that linear relationships look a certain way when graphed.

Graham has $100. Every day, he gets $5 from the neighbor for walking her dog. Make a table and graph of Graham's money. Let x stand for days walking the dog. Let y stand for dollars.

Before you complete the problem, make a prediction. What do you expect the graph to look like?



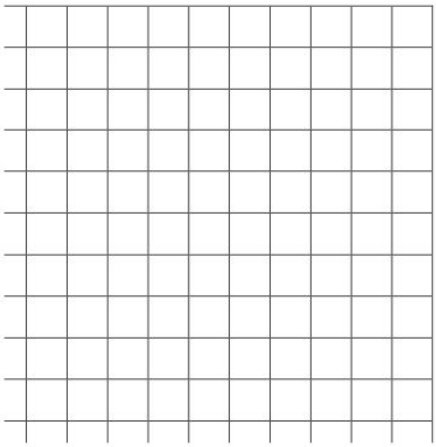
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk:

Imagine the story on the previous slide was reversed.

Graham has $100. Every day, he pays his neighbor $5 for walking his dog. Make a table and graph of Graham's money. Let x stand for days walking the dog. Let y stand for dollars.

Before you complete the problem, make a prediction. What do you expect the graph to look like?



CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

Linear relationships with a negative slope follow the same rules as all linear relationships.

Graham has $100. Every day, he pays his neighbor $5 for walking his dog. Write an equation that could be used to calculate Graham's money. Let x stand for days walking the dog. Let y stand for dollars.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Try It:

Let's work with negative slopes together!

Name: _____ G8 U3 Lesson 9 - Let's Try It

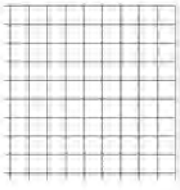
A lumberyard starts with a stockpile of 1,000 logs. It sells 100 logs per day. Let x represent the total number of days. Let y represent the total number of logs.

1. Draw a picture to represent the story starting with x = 0.

2. Label the columns with words.
3. Record the values you drew.

x	y

4. Extend the picture and record the values in the table.
5. Extend the picture and record the values. Keep going...
6. Use the labels from your table to label the axes on the graph.

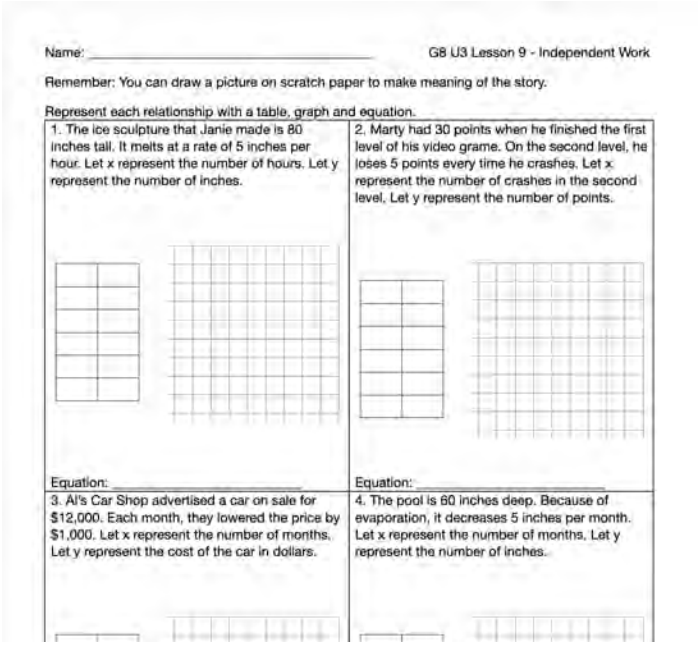


7. Fill in the numbers on each axis. You might have to skip count in order to reach the right number.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

On your Own:

Now it's time for you to do it on your own!



Name: _____ G8 U3 Lesson 9 - Independent Work

Remember: You can draw a picture on scratch paper to make meaning of the story.

Represent each relationship with a table, graph and equation.

1. The ice sculpture that Janie made is 80 inches tall. It melts at a rate of 5 inches per hour. Let x represent the number of hours. Let y represent the number of inches.

Equation: _____

2. Marty had 30 points when he finished the first level of his video game. On the second level, he loses 5 points every time he crashes. Let x represent the number of crashes in the second level. Let y represent the number of points.

Equation: _____

3. Al's Car Shop advertised a car on sale for $12,000. Each month, they lowered the price by $1,000. Let x represent the number of months. Let y represent the cost of the car in dollars.

4. The pool is 60 inches deep. Because of evaporation, it decreases 5 inches per month. Let x represent the number of months. Let y represent the number of inches.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Name: _____ G8 U3 Lesson 9 - Let's Try It

A lumberyard starts with a stockpile of 1,000 logs. It sells 100 logs per day. Let x represent the total number of days. Let y represent the total number of logs.

1. Draw a picture to represent the story starting with x = 0.

2. Label the columns with words.

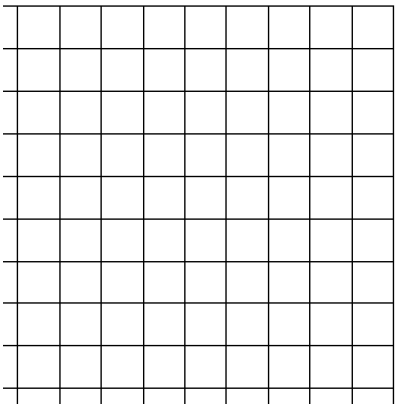
3. Record the values you drew.

x	**y**

4. Extend the picture and record the values in the table.

5. Extend the picture and record the values. Keep going…

6. Use the labels from your table to label the axes on the graph.



7. Fill in the numbers on each axis. You might have to skip count in order to reach the right number.

8. Use each row of the table as a set of coordinates.

9. What was the value of y when x was 0 (also known as the y-intercept)? _____ That is b.

10. What is the rate of change (also known as the slope)? _____ That is m.

11. Write an equation in y = mx + b form. _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

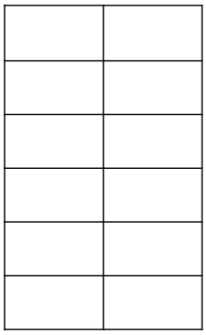
© 2023 CityBridge Education. All Rights Reserved.

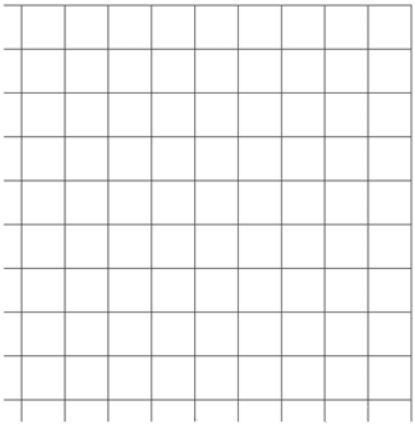
Name: _____ G8 U3 Lesson 9 - Independent Work

Remember: You can draw a picture on scratch paper to make meaning of the story.

Represent each relationship with a table, graph and equation.

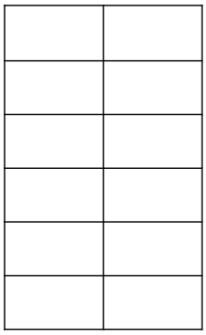
1. The ice sculpture that Janie made is 80 inches tall. It melts at a rate of 5 inches per hour. Let x represent the number of hours. Let y represent the number of inches.

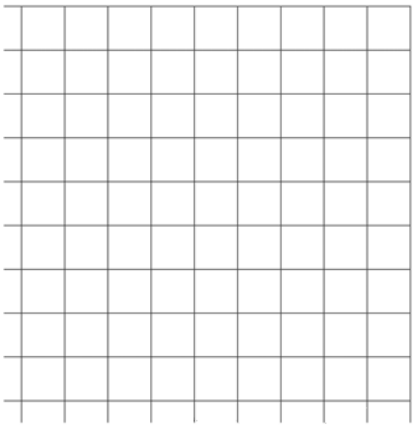




Equation: _____

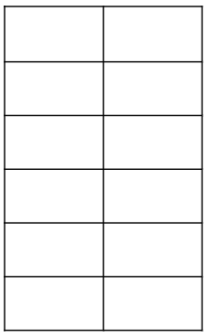
2. Marty had 30 points when he finished the first level of his video grame. On the second level, he loses 5 points every time he crashes. Let x represent the number of crashes in the second level. Let y represent the number of points.

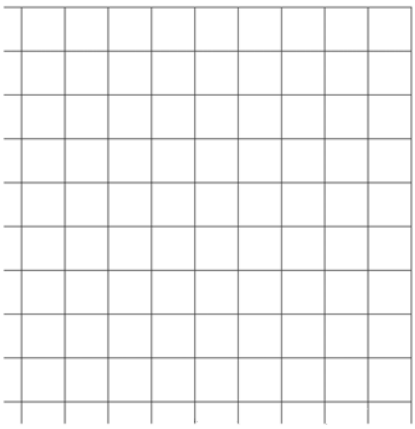




Equation: _____

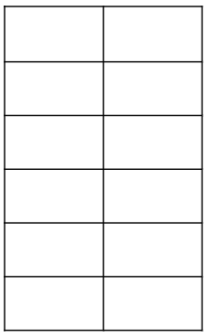
3. Al's Car Shop advertised a car on sale for $12,000. Each month, they lowered the price by $1,000. Let x represent the number of months. Let y represent the number of inches.

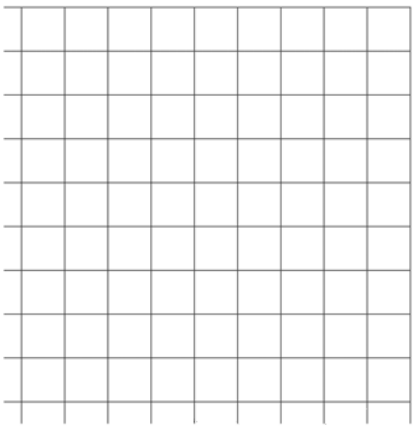




Equation: _____

4. The pool is 60 inches deep. Because of evaporation, it decreases 5 inches per month. Let x represent the number of months. Let y represent the number of inches.





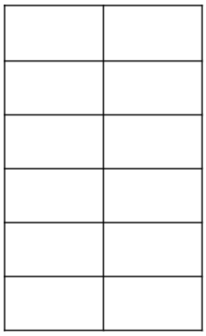
Equation: _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

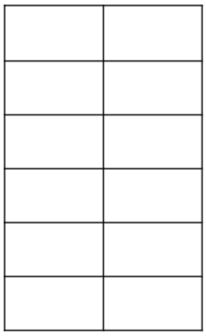
Represent each relationship with a table, graph and equation.

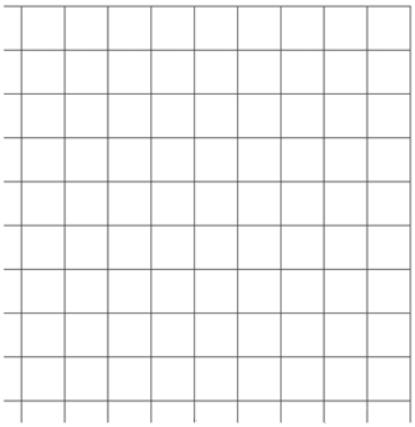
5. Sam used 100 Legos for each house he built. He started with a tub of 800 Legos. Let x represent the number of houses Sam built. Let y represent the number of Legos Sam had left.



Equation: _____

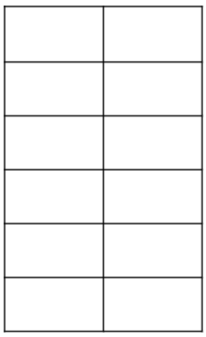
6. Marvin bought 40 pounds of kitty litter. He uses 5 pounds per week. Let x represent the number of weeks. Let y represent the number of pounds of kitty litter.

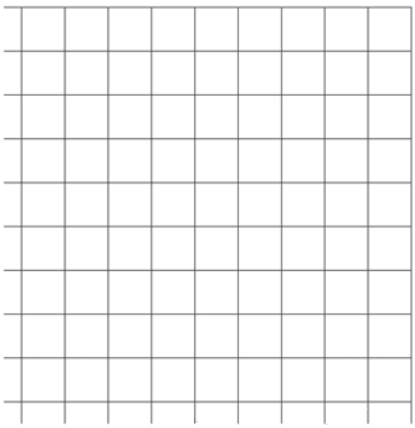




Equation: _____

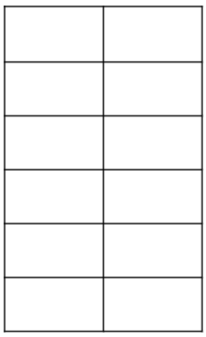
7. The principal at Sunny Elementary has 100 stickers in her office. She gives 10 stickers to every child sent to her office for something good. Let x represent the number of students who come to the office for something good. Let y represent the number of stickers the principal has left.

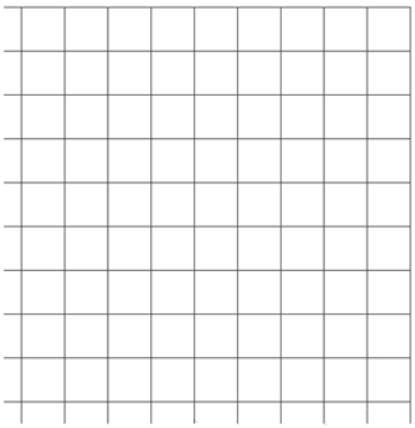




Equation: _____

8. Lisa saved enough money to spent $50 on each day of her trip to Spain. Lisa saved $250 for the trip. Let x represent the number of days. Let y represent the number of dollars Lisa has.





Equation: _____

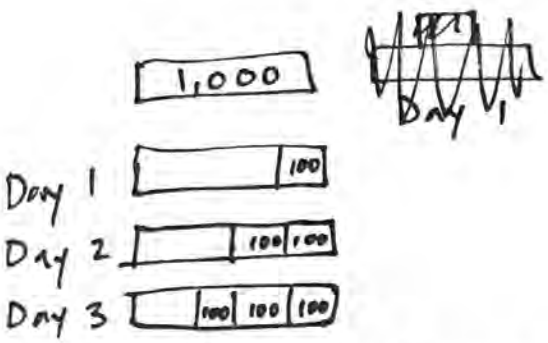
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

A lumberyard starts with a stockpile of 1,000 logs. It sells 100 logs per day. Let x represent the total number of days. Let y represent the total number of logs.

1. Draw a picture to represent the story starting with x = 0.



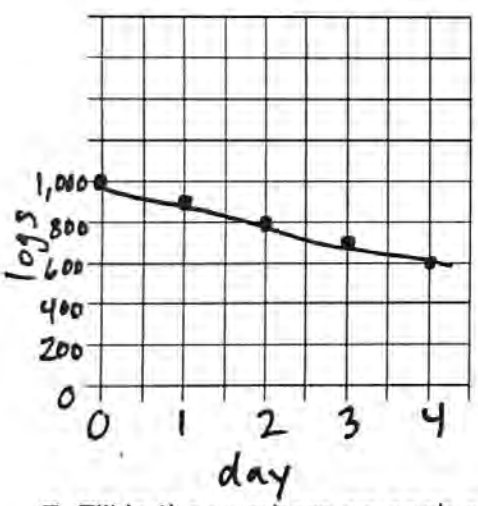
2. Label the columns with words.
3. Record the values you drew.

day	logs
x	y
0	1000
1	900
2	800
3	700

4. Extend the picture and record the values in the table.

5. Extend the picture and record the values. Keep going...

6. Use the labels from your table to label the axes on the graph.



7. Fill in the numbers on each axis. You might have to skip count in order to reach the right number.

8. Use each row of the table as a set of coordinates.

9. What was the value of y when x was 0 (also known as the y-intercept)? 1,000 That is b.

10. What is the rate of change (also known as the slope)? -100 That is m.

11. Write an equation in y = mx + b form. y = -100x + 1000

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

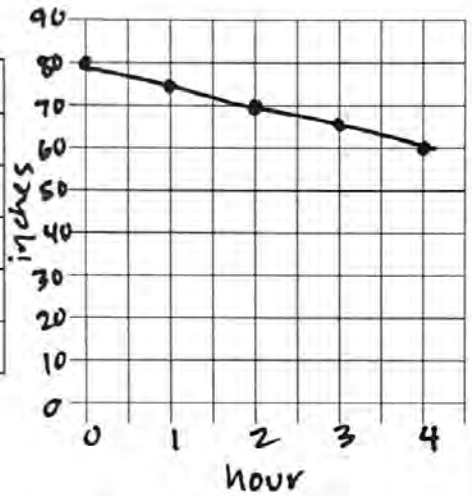
G8 U3 Lesson 9 - Independent Work

Remember: You can draw a picture on scratch paper to make meaning of the story.

Represent each relationship with a table, graph and equation.

1. The ice sculpture that Janie made is 80 inches tall. It melts at a rate of 5 inches per hour. Let x represent the number of hours. Let y represent the number of inches.

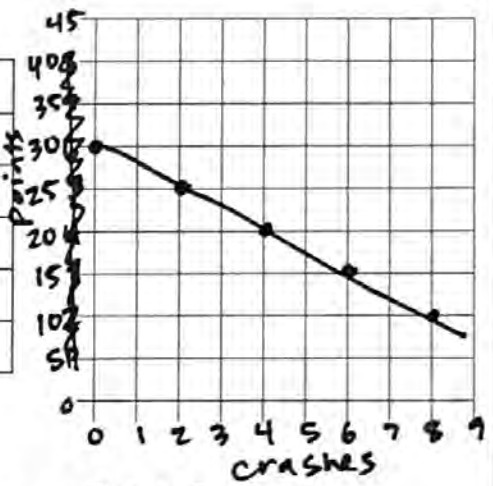
x	y
0	80
1	75
2	70
3	65
4	60



Equation: $y = -5x + 80$

2. Marty had 30 points when he finished the first level of his video grame. On the second level, he loses 5 points every time he crashes. Let x represent the number of crashes in the second level. Let y represent the number of points.

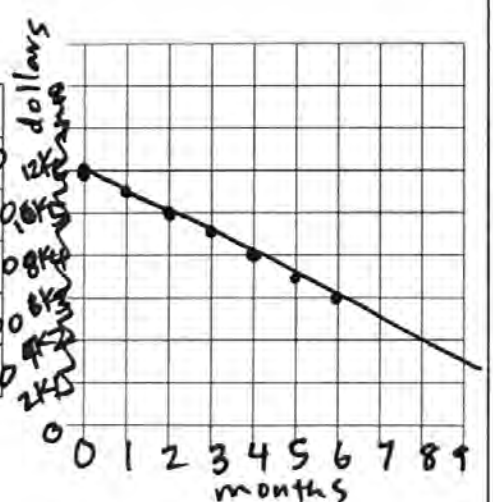
x	y
0	30
1	25
2	20
3	15
4	10



Equation: $y = -5x + 30$

3. Al's Car Shop advertised a car on sale for $12,000. Each month, they lowered the price by $1,000. Let x represent the number of months. Let y represent the cost of the car in dollars.

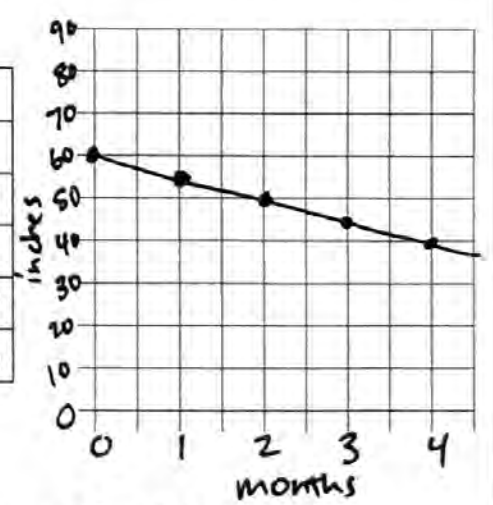
x	y
0	12000
1	11,000
2	10,000
3	9,000
4	8,000



Equation: $y = -1{,}000x + 12{,}000$

4. The pool is 60 inches deep. Because of evaporation, it decreases 5 inches per month. Let x represent the number of months. Let y represent the number of inches.

x	y
0	60
1	55
2	50
3	45
4	40



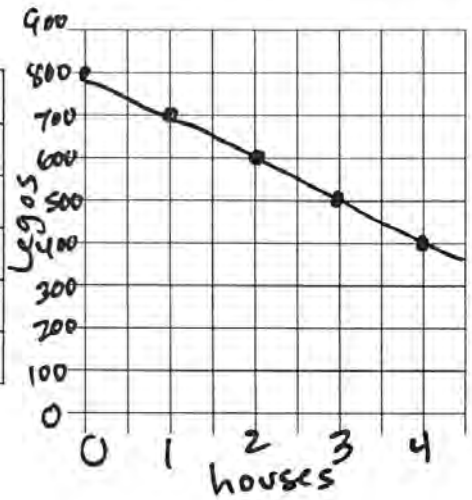
Equation: $y = -5x + 60$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Represent each relationship with a table, graph and equation.

5. Sam used 100 Legos for each house he built. He started with a tub of 800 Legos. Let x represent the number of houses Sam built. Let y represent the number of Legos Sam had left.

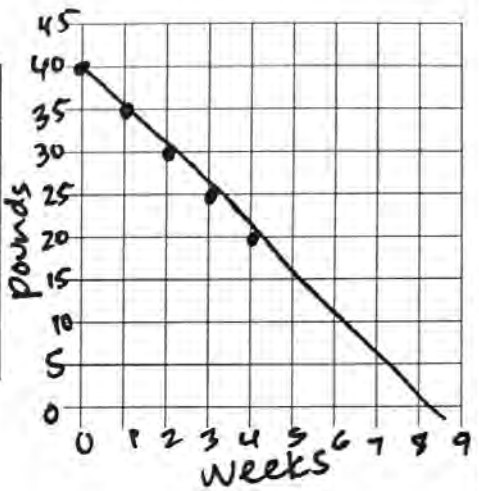
x	y
0	800
1	700
2	600
3	500
4	400



Equation: $y = -100x + 800$

6. Marvin bought 40 pounds of kitty litter. He uses 5 pounds per week. Let x represent the number of weeks. Let y represent the number of pounds of kitty litter.

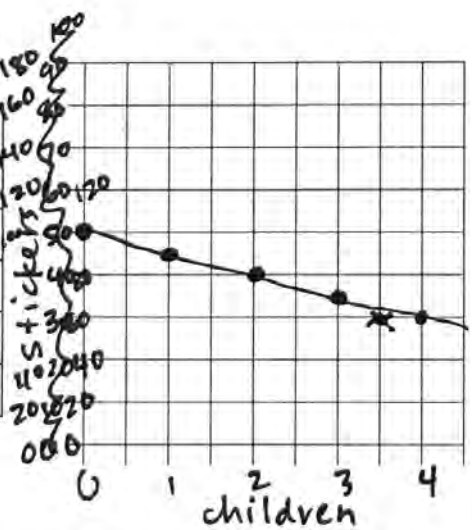
x	y
0	40
1	35
2	30
3	25
4	20



Equation: $y = -5x + 40$

7. The principal at Sunny Elementary has 100 stickers in her office. She gives 10 stickers to every child sent to her office for something good. Let x represent the number of students who come to the office for something good. Let y represent the number of stickers the principal has left.

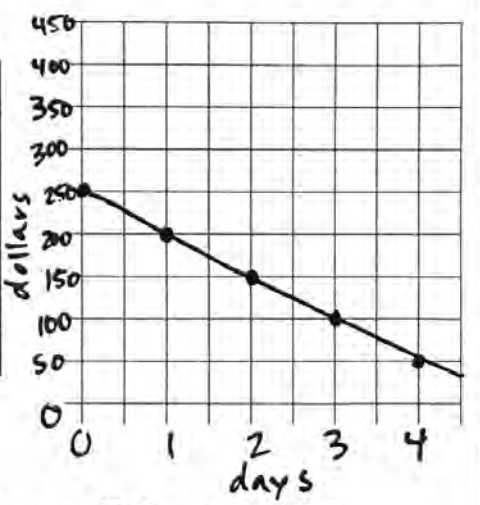
x	y
0	100
1	90
2	80
3	70
4	60



Equation: $y = -10x + 100$

8. Lisa saved enough money to spent $50 on each day of her trip to Spain. Lisa saved $250 for the trip. Let x represent the number of days. Let y represent the number of dollars Lisa has.

x	y
0	250
1	200
2	150
3	100
4	50



Equation: $y = -50x + 250$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

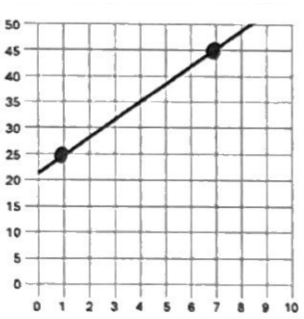
G8 U3 Lesson 10
Write an equation and find the x-intercept for linear relationships with negative rates of change.

G8 U3 Lesson 10 - Today we will write an equation and find the x-intercept for linear relationships with negative rates of change.

Warm Welcome (Slide 1): Tutor choice

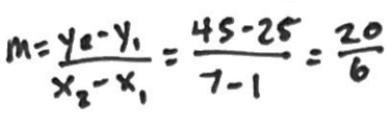
Frame the Learning/Connect to Prior Learning (Slide 2): In today's lesson, we will write an equation and find the x-intercept for linear relationships with negative rates of change. We are going to use everything we've already learned so I know you are going to do a great job!

Let's Review (Slide 3): We know how to write an equation when the slope of a graph is positive. Sometimes it's easier than others. If I can see the y-intercept clearly, it will be easier. If I can see the rise over run clearly, it will be easier. This says, "Write an equation for the line." And when I look, I see it's not one of the easy ones. I'm going to need to do some work. What work do I need to do? Possible Student Answers, Key Points:

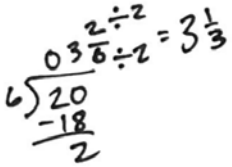


- Find the slope.
- Find the y-intercept.
- Mark two points.
- Do y_2-y_1 over x_2-x_1
- Write it in y=mx+b form.

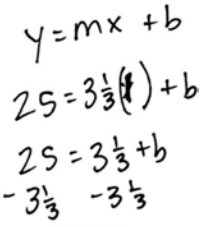
There are a few pieces we need to find here and the order really matters. If I look at my graph and I can't see the y-intercept then I have to do some other math before I can do that math so let's make a review. First, I use two points to find m. Then I use one point to find b. Let's start with m. I am going to choose this point and this point. *Mark a point at (1,25) and (7,45).*



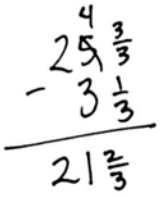
Now I plug those values into y_2-y_1 over x_2-x_1. That's 45 minus 25 over 7 minus 1, which is 20 over 6.



I divide this over to the side of my paper, and it is 3 and 2 sixths. I simplify 2 sixths and get 3 and 1 third.



Next I am going to find b using y = mx + b. I have to fill in all the other values to solve for b. I need 1 point for this. It doesn't matter which one. I'll use (1,25). So y is 25, which equals 3 and 1 third times 1 plus b. 3 and 1 third times 1 is 3 and 1 third. So this is really 25 equals 3 and 1 third plus b. To get b on its own, I have to subtract 3 and 1 third from both sides.



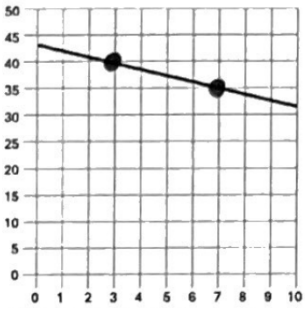
Now, this is a little tricky. Normally I could subtract this in my head. But I am subtracting a fraction. So let me write this to the side. I notice that I don't have any thirds to subtract from. I have to regroup from the 25 and write it as one less so I can get 3 thirds. It becomes 24 and 3 thirds.

Now I can subtract that 1 third. I get 2 thirds. I can subtract that 3. I get 21. I get 21 and 2 thirds as my final answer.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

$y = 3\frac{1}{3}x + 21\frac{2}{3}$

Let's review. I did step one, which was to use two points to find m. *Point to the work for step one.* Then I did step two, which was to use one point to find b. *Point to the work for step two.* Now I can write my final equation: y = 3 and 1 third x plus 21 and 2 thirds. There are two big steps there with a lot of itty bitty steps to do the number crunching. But we did it!



Let's Talk (Slide 4): Linear relationships with a negative slope follow the same rule as all linear relationships. That means we're going to do the exact same steps we just did even though this line is going down instead of up. It is literally the exact same. There is one tricky part that we have to look out for that could trip you up, and I'll show you where there is. Let's start by writing out our steps again. First, I use two points to find m. Then I use one point to find b. Let's start with m. I am going to choose this point and this point. *Mark a point at (3,40) and (7,35).*

Now I plug those values into y_2-y_1 over x_2-x_1. So far, this is exactly like what we've done before. Now here is the tricky part. This is where you really need to pay attention. It is tempting to put 40-35 because we are used to subtracting from the bigger number. But (3,40) is x_1 and y_1. It is the first point. We want to start with y_2. That's the second point. So we need to write 35 minus 40 NOT 40 minus 35. That's 35 minus 40 over 7 minus 3. This is important because this is how we end up getting that negative answer. 35 minus 40 is NEGATIVE 5 because I don't have enough. I have to think of it as being able to subtract 35 and still having 5 left to subtract. That's negative 5. I get -5 over 4.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{35 - 40}{7 - 3} = \frac{-5}{4}$$

$$4\overline{)5} \quad 1\frac{1}{4}$$
$$-4$$
$$1$$

I divide this over to the side of my paper, and it is NEGATIVE 1 and 1 fourth. M is negative which makes sense because m is the slope and I can see that this slope is going down; it's negative.

$y = mx + b$

$40 = -1\frac{1}{4}(3) + b$

$40 = -3\frac{3}{4} + b$

$+3\frac{3}{4} \quad +3\frac{3}{4}$

$43\frac{3}{4} = b$

Next I am going to find b using y = mx + b. I have to fill in all the other values to solve for b. I need 1 point for this. It doesn't matter which one. I'll use (3,40). So y is 40, which equals NEGATIVE 1 and 1 fourth times 3 plus b.I have to multiply each part of my mixed number so 1 and 1 fourth times 3 is 1 times 3, which is 3, and 1 fourth times 3, which is 3 fourths. But this was negative! So this is really 40 equals NEGATIVE 3 and 3 fourths plus b. To get b on its own, I have to ADD 3 and 3 fourths to both sides. I'm not subtracting this time because I'm doing the opposite. That means adding this time. Now I have 43 and 3 fourths equals b.

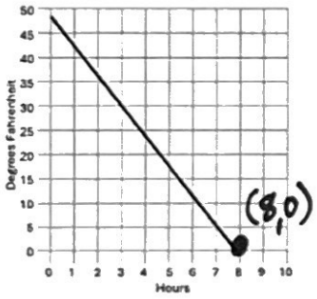
$y = -1\frac{1}{4}x + 43\frac{3}{4}$

Let's review. I did step one, which was to use two points to find m. *Point to the work for step one.* Then I did step two, which was to use one point to find b. *Point to the work for step two.* Now I can write my final equation: y = NEGATIVE 1 and 1 fourth x plus 43 and 3 fourths. I still did the same two big steps there with a lot of itty bitty steps to crunch the numbers. Great job!

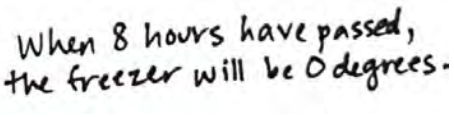
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think (Slide 5): There's one more big idea that we need to learn for linear relationships with negative slopes. This says, "With negative slopes, sometimes our graphs will have x-intercepts." Whoa! This says x-intercepts not y-intercepts. We know that y-intercepts are where the line crosses the y-axis and x = 0. So what do you think x-intercepts are? Possible Student Answers, Key Points:

- X-intercepts are where the line crosses the x-axis.
- X-intercepts are where y = 0.



X-intercepts are where the line crosses the x-axis so they are where y = 0. I am going to mark a point at the x-intercept on this graph. You can see that it is all the way down here, y isn't there at all. The y is zero. *Put a point at (8,0).* I can see that it is super close to 8. I'm not sure that it is exactly 8 but it is pretty close. Let's think about what this means. I am going to write the coordinates so we can add words and use "when" and "then" in our sentences. It is (8,0).



I can write, "When 8 hours have passed, the freezer will be 0 degrees." It will be frozen! This is helpful. If the y-intercept helps us understand when the graph starts. Then it's kind of like the x-intercept helps us understand when the graph stops.

Let's Try It (Slide 6): Let's write equations for graphs with negative slopes together. I will walk you through each step.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

WARM WELCOME

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

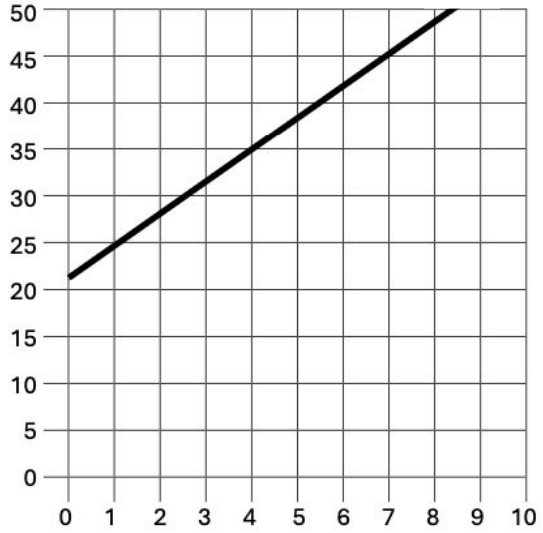
Today we will write an equation and find the x-intercept for linear relationships with negative rates of change.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Review:

We know how to write an equation when the slope of a graph is positive.

Write an equation for the line.

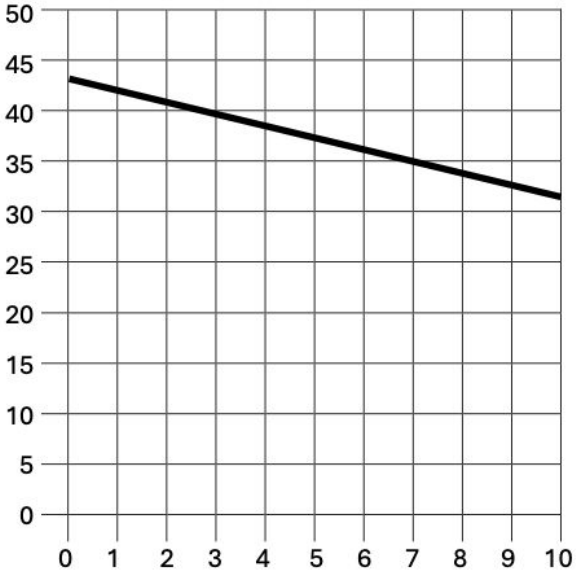


CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk:

Linear relationships with a negative slope follow the same rule as all linear relationships.

Write an equation for the line.

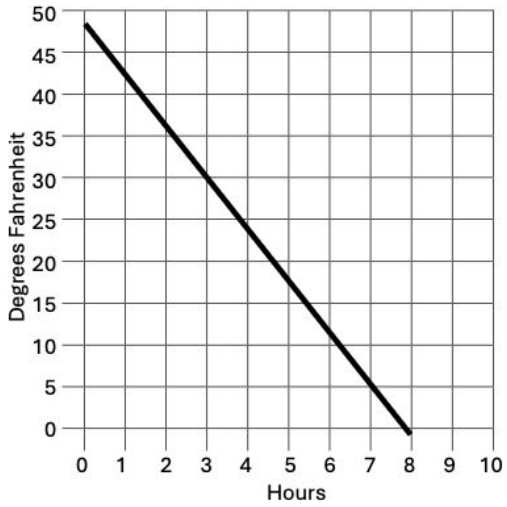


CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Think:

With negative slopes, sometimes our graphs will have x-intercepts.

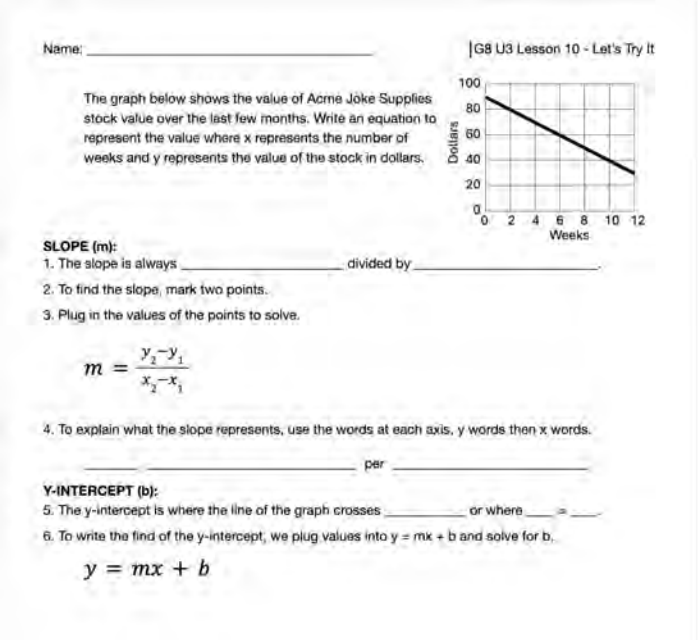
Chef Harvey graphed the temperature each minute after he fixed his freezer. Find the x-intercept and explain what it represents in the context of the story.



CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Try It:

Let's find y-intercepts and equations for graphs together!



Name: _____ | G8 U3 Lesson 10 - Let's Try It

The graph below shows the value of Acme Joke Supplies stock value over the last few months. Write an equation to represent the value where x represents the number of weeks and y represents the value of the stock in dollars.

SLOPE (m):

1. The slope is always _____ divided by _____.
2. To find the slope, mark two points.
3. Plug in the values of the points to solve.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

4. To explain what the slope represents, use the words at each axis, y words then x words.

_____ _____ per _____

Y-INTERCEPT (b):

5. The y-intercept is where the line of the graph crosses _____ or where ____ = ____.
6. To write the find of the y-intercept, we plug values into y = mx + b and solve for b.

$$y = mx + b$$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

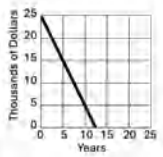
On your Own:

Now it's time for you to do it on your own!

Name: _____ G8 U3 Lesson 10 - Independent Work

Answer each question. Show your work.

The graph below shows the value of a new car after it is purchased.

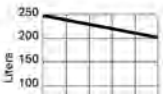


1. Write an equation for the graph.

2. Find the x-intercept.

3. Explain what the y-intercept, the slope and the x-intercept of the graph show us in words.

A water tank starts full but it has a leak that is shown in the graph below.

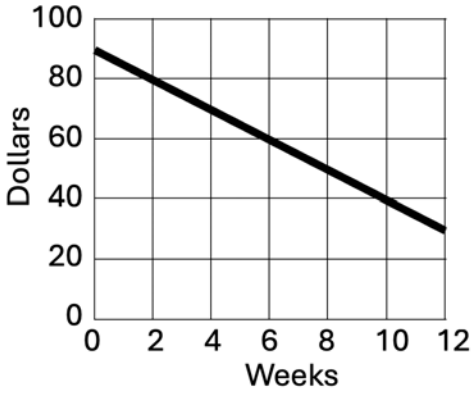


4. Write an equation for the graph.

5. Find the x-intercept.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

The graph below shows the value of Acme Joke Supplies stock value over the last few months. Write an equation to represent the value where x represents the number of weeks and y represents the value of the stock in dollars.



SLOPE (m):

1. The slope is always _____ divided by _____.

2. To find the slope, mark two points.

3. Plug in the values of the points to solve.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

4. To explain what the slope represents, use the words at each axis, y words then x words.

_____ _____ per _____

Y-INTERCEPT (b):

5. The y-intercept is where the line of the graph crosses _____ or where ____ = ____.

6. To write the find of the y-intercept, we plug values into y = mx + b and solve for b.

$$y = mx + b$$

7. To explain what the y-intercept represents, put your answer to #6 into a complete sentence.

_____

_____

8. Use the answers you found to write an equation in y = mx + b form. _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

X-INTERCEPT:

9. The x-intercept is where the line of the graph crosses _____ or where ____ = ____.

10. To write the find of the x-intercept, we plug y = 0 into the equation we made and solve for x.

$$y = mx + b$$

11. To explain what the x-intercept represents, put your answer to #10 into a complete sentence.

_____

_____

12. Explain what the y-intercept, the slope and the x-intercept of the graph show us in words. Put all the ideas from #4, #7 and #11 into one answer.

_____

_____

_____

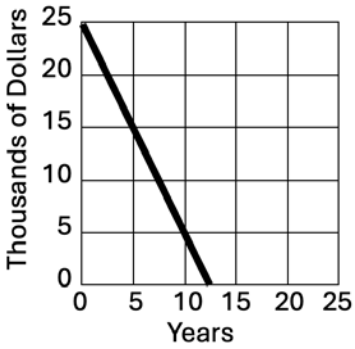
_____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: _____ G8 U3 Lesson 10 - Independent Work

Answer each question. Show your work.

The graph below shows the value of a new car after it is purchased.

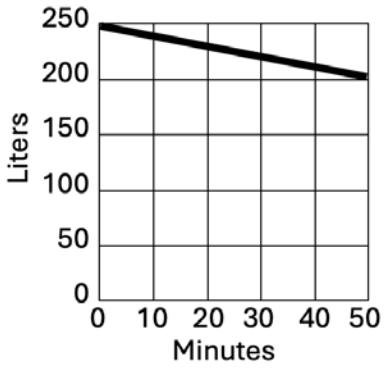


1. Write an equation for the graph.

2. Find the x-intercept.

3. Explain what the y-intercept, the slope and the x-intercept of the graph show us in words.

A water tank starts full but it has a leak that is shown in the graph below.



4. Write an equation for the graph.

5. Find the x-intercept.

6. Explain what the y-intercept, the slope and the x-intercept of the graph show us in words.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

Solve.

Sara used the table below to keep track of her money over the summer weeks. Let x equal the number of weeks and y equal the number of dollars.

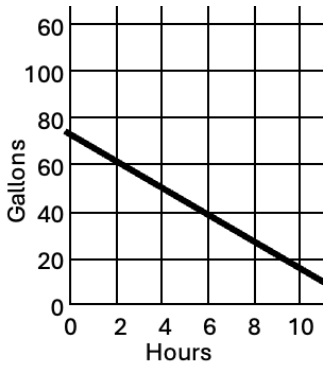
x	*y*
2	9
4	6
6	3
8	0

7. Write an equation for the table.

8. Find the x-intercept.

9. Explain what the y-intercept, the slope and the x-intercept of the table show us in words.

The amount of gas in Nolan's car during his trip to Florida is shown below.



10. Write an equation for the graph.

11. Find the x-intercept.

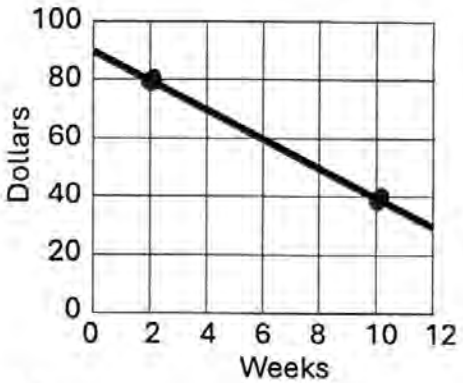
12. Explain what the y-intercept, the slope and the x-intercept of the table show us in words.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

The graph below shows the value of Acme Joke Supplies stock value over the last few months. Write an equation to represent the value where x represents the number of weeks and y represents the value of the stock in dollars.



SLOPE (m):

1. The slope is always $y_2 - y_1$ divided by $x_2 - x_1$.
2. To find the slope, mark two points.
3. Plug in the values of the points to solve.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \qquad \frac{40 - 80}{10 - 2} = \frac{-40}{8} = -5$$

4. To explain what the slope represents, use the words at each axis, y words then x words.

-5 dollars per week

Y-INTERCEPT (b):

5. The y-intercept is where the line of the graph crosses y-axis or where x = 0.
6. To write the find of the y-intercept, we plug values into y = mx + b and solve for b.

$$y = mx + b$$
$$80 = -5(2) + b$$
$$80 = -10 + b$$
$$+10 \quad +10$$
$$\boxed{90 = b}$$

7. To explain what the y-intercept represents, put your answer to #6 into a complete sentence.

When 0 weeks have passed, the value is $90.

8. Use the answers you found to write an equation in y = mx + b form. $y = -5x + 90$

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

X-INTERCEPT:

9. The x-intercept is where the line of the graph crosses x-axis or where y = 0.

10. To write the find of the x-intercept, we plug y = 0 into the equation we made and solve for x.

$$y = mx + b$$

$$0 = -5(x) + 90$$

$$-90 \qquad -90$$

$$\frac{-90}{-5} = \frac{-5x}{-5}$$

$$18 = x$$

11. To explain what the x-intercept represents, put your answer to #10 into a complete sentence.

When 18 weeks have passed, the stock will be worth $0.

12. Explain what the y-intercept, the slope and the x-intercept of the graph show us in words. Put all the ideas from #4, #7 and #11 into one answer.

The stock will start with a value of $90. It will decrease $5 per week. Then after 18 weeks, it will be worth $0.

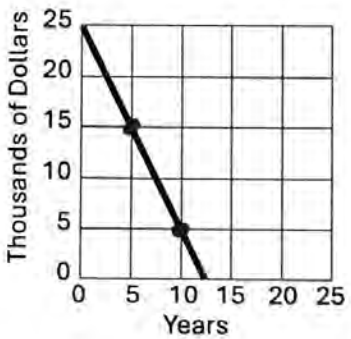
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

G8 U3 Lesson 10 - Independent Work

Answer each question. Show your work.

The graph below shows the value of a new car after it is purchased.



1. Write an equation for the graph.

$m = \frac{5-15}{10-5} = \frac{-10}{5} = -2$

$y = mx + b$

$15 = -2(5) + b$

$15 = -10 + b$

$+10 \quad +10$

$25 = b$

$y = -2x + 25$

2. Find the x-intercept.

$y = -2x + 25$

$0 = -2x + 25$

$-25 \quad -25$

$\frac{-25}{-2} = \frac{-2x}{-2}$

$12\frac{1}{2}$

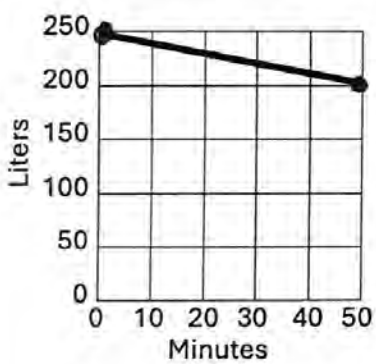
$2\overline{)25}$, -2, 05, -4, 1

$x = 12\frac{1}{2}$

3. Explain what the y-intercept, the slope and the x-intercept of the graph show us in words.

The car starts at a value of 25 thousand dollars. Its value decreases 2 thousand per years. After $12\frac{1}{2}$ years, it will be worth 0 dollars.

A water tank starts full but it has a leak that is shown in the graph below.



4. Write an equation for the graph.

$m = \frac{200-250}{50-0} = \frac{-50}{50} = -1$

$y = mx + b$

$250 = -1(0) + b$

$250 = b$

$y = -1x + 250$

5. Find the x-intercept.

$y = -1x + 250$

$0 = -1x + 250$

$-250 \quad -250$

$\frac{-250}{-1} = \frac{-1x}{-1}$

$x = 250$

6. Explain what the y-intercept, the slope and the x-intercept of the graph show us in words.

The tank holds 250 Liters. It leaks out 1 Liter per minute. After 250 minutes, it will have 0 Liters.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Solve.

Sara used the table below to keep track of her money over the summer weeks. Let x equal the number of weeks and y equal the number of dollars.

x	y
2	9
4	6
6	3
8	0

7. Write an equation for the table.

$m = \frac{6-9}{4-2} = \frac{-3}{2} = -1\frac{1}{2}$

$y = mx + b$

$9 = -\frac{3}{2}(2) + b$

$9 = -3 + b$ $\boxed{12 = b}$

$+3 \quad +3$

$y = -1\frac{1}{2}x + 12$

8. Find the x-intercept.

$y = -1\frac{1}{2}x + 12$

$0 = -1\frac{1}{2}x + 12$

$-12 \quad -12$

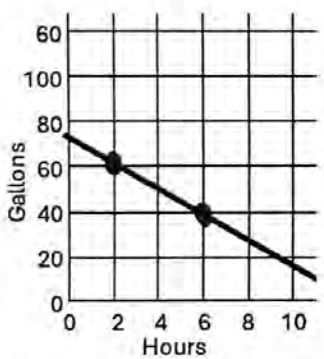
$-12 = -\frac{3}{2}x$ $\cdot\frac{2}{-3}$ $\quad \frac{24}{3} = x$ $\boxed{8 = x}$

$\cdot\frac{2}{3}$

9. Explain what the y-intercept, the slope and the x-intercept of the table show us in words.

Sara started with \$12. Each week she lost \$$1\frac{1}{2}$ dollars. After 8 weeks, she had \$0.

The amount of gas in Nolan's car during his trip to Florida is shown below.



10. Write an equation for the graph.

$m = \frac{40-60}{6-2} = \frac{-20}{4} = -5$

$y = mx + b$

$60 = -5(2) + b$

$60 = -10 + b$ $\boxed{70 = b}$

$+10 \quad +10$

$y = -5x + 70$

11. Find the x-intercept.

$y = -5x + 70$

$0 = -5x + 70$

$-70 \quad -70$

$\frac{-70}{-5} = \frac{-5x}{-5}$

$5\overline{)70}$ = 14, $-5\downarrow$, 20 $\boxed{x = +14}$

12. Explain what the y-intercept, the slope and the x-intercept of the table show us in words.

The car started with 70 gallons. It uses 5 gallons per hour. At 14 hours, it will have 0 gallons.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

G8 U3 Lesson 11
Write equations for horizontal and vertical lines.

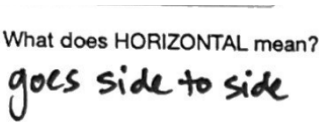
G8 U3 Lesson 11 - Today we will write equations for horizontal and vertical lines.

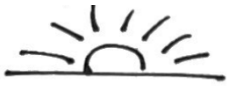
Warm Welcome (Slide 1): Tutor choice

Frame the Learning/Connect to Prior Learning (Slide 2): In today's lesson, we will write equations for horizontal and vertical lines. We are going to use the ideas we've built over the whole unit to notice a pattern, and then you will able to easily use graphs, equations and tables for these sorts of lines.

Let's Review (Slide 3): This says, "Diagonal straight lines show linear relationships. Horizontal and vertical lines do not show linear relationships." We have been working on linear relationships shown by diagonal straight lines. But today we're going to talk about these other kind of lines. What does HORIZONTAL mean? Possible Student Answers, Key Points:

- It means going side to side.
- It is a line that goes across.



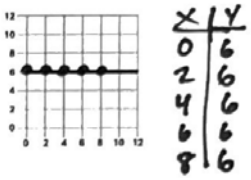


A horizontal line goes side to side. We can remember it by thinking of the "horizon." That's the line of the earth when we look far away. It goes side to side.

What does VERTICAL mean? Possible Student Answers, Key Points:

- It means going up and down.

A vertical line goes up and down. One trick that people have used to remember is thinking of the v as pointing down. There used to be a wresting move called the "vertical supplex" which involved lifting someone vertically. These are the lines that we are going to represent today.



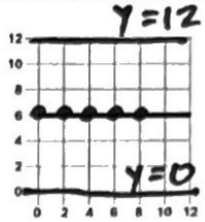
x	y
0	6
2	6
4	6
6	6
8	6

Let's Talk (Slide 4): A table helps us see how to write an equation for horizontal or vertical lines. This says, "Make a table for each graph. Then write an equation." I will draw a table and write the labels x and y. I am going to mark some points along the line. Let's fill them in. I see (0,6) and (2,6) and (4,6) and (6,6) and (8,6) and we can see how it will keep going.

What do you notice about this table? Possible Student Answers, Key Points:

- The right column is always 6.
- There is the same number for y every time.

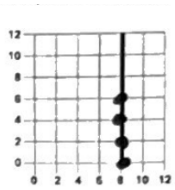
Every single number in this column is a 6. That means y is always a 6. Think to yourself how you might write an equation if y is always 6. *Give the kids 15 seconds of think time without letting anyone call out.* It is almost too easy. If y is always 6 then we write y = 6. This means that x can be anything but y is always 6 which is exactly what we saw in the table.

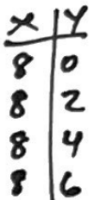


And guess what? If I drew other horizontal lines, they would always be y equals something. Here I am drawing a line of (0,12), (2,12), (4,12) and y = 12. Or here I am drawing a line of (0,0), (2,0), (4,0) and y = 0. You can memorize that horizontal lines will always be y equals something. But you can also always make a table to remind yourself.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

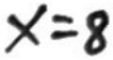
You can probably guess what the equation for a vertical line might always be. But let's use that table first. I am going to draw the table with x and y. Then I will mark some points on the line. I will record (8,0) then (8,2) then (8,4) then (8,6) and this would keep going all the way to 8 and infinity! What do you notice about this table? Possible Student Answers, Key Points:





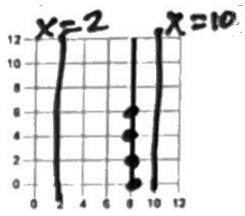
- The left column is always 8.
- There is the same number for every time.

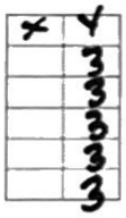
Every single number in this column is a 8. That means x is always a 8.



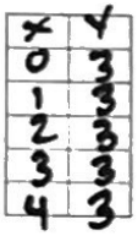
Think to yourself how you might write an equation if x is always 8. *Give the kids 5 seconds of think time without letting anyone call out.* It is almost too easy. If x is always 8 then we write x = 8. This means that y can be anything but x is always 8 which is exactly what we saw in the table.

And once again, if I draw similar lines, they would always be x equals something. Here I am drawing a line of (2,0), (2,2), (2,4) and x = 2. Or here I am drawing a line of (10,0), (10,2), (10,4) and x = 10. You can memorize that vertical lines will always be x equals something. But you can also always make a table to remind yourself. One thing to notice is that the "x equals" lines don't go the same way as the x-axis. They intersect the x axis right at the number it equals. The "y equals" lines also don't go the same way as the y-axis. Instead, they intersect the y axis right at the number it equals. That's just another way to help you remember which equation goes which way. But you can always make a table.

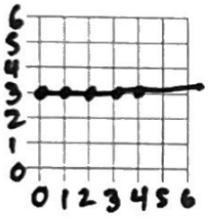




Let's Think (Slide 5): We can also draw a graph from a table or equation. Now, we just talked about ways of memorizing which ways the lines go depending on whether they are "x equals" or "y equals" but it is easy to forget that they go the other way as their axis. So, I like to just do a quick table and then it becomes super obvious. This says, "Make a table and graph for y = 3." I put x and y at the top of the table, and since it says that y = 3 I am just going to put a 3 all the way down the y column.

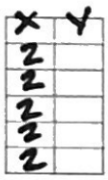


It doesn't matter what x equals. X could be 0 or x could be 1 or x could be 2 or 3 or 4.



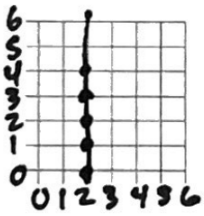
I am going to quickly put numbers on these axes. When I graph (0,3), (1,3), (2,3), (3,3) it becomes obvious that I am getting a horizontal line.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.



Let's do this next one, x = 2. I put x and y at the top of the table, and since it says that x = 2 I am just going to put a 3 all the way down the x column.

It doesn't matter what y equals. Y could be 0 or y could be 1 or y could be 2 or 3 or 4.



I am going to quickly put numbers on these axes. When I graph (2,0), (2,1), (2,2), (2,3) it becomes obvious that I am getting a vertical line. The big idea here is the same one as the whole units. We learned the acronym GETS because a graph, equation, table and story can all be equivalent ways to see the same relationship. For these special lines, it is especially useful to do a quick table to make sure you see the trend.

Let's Try It (Slide 6): Let's represent more horizontal and vertical lines together. I will walk you through each step.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

WARM WELCOME

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Today we will write equations for horizontal and vertical lines.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Review:

Diagonal straight lines show linear relationships. Horizontal and vertical lines do not show linear relationships.

What does HORIZONTAL mean?

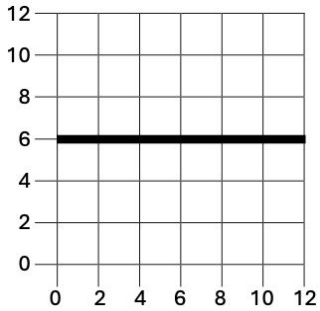
What does VERTICAL mean?

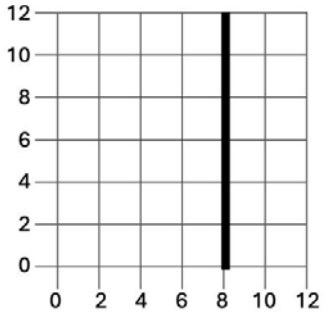
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Talk:

A table helps us see how to write an equation for horizontal or vertical lines.

Make a table for each graph. Then write an equation.



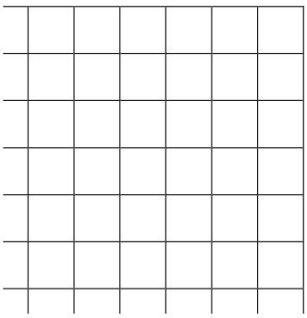


CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

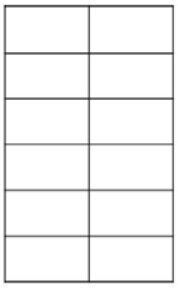
Let's Think:

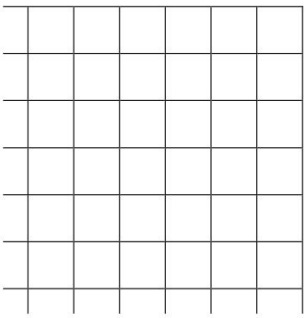
We can also draw a graph from a table or equation.

Make a table and graph for y = 3.



Make a table and graph for x = 2.

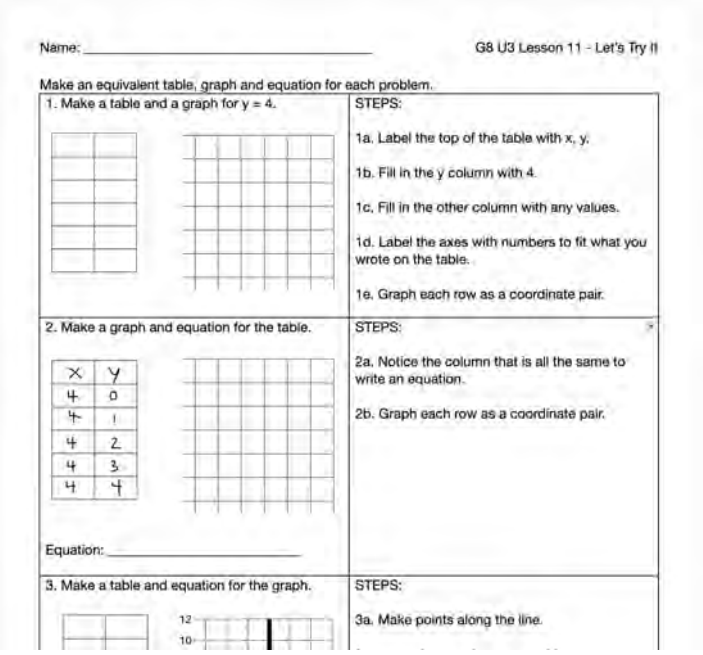




CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Let's Try It:

Let's find y-intercepts and equations for graphs together!



Name: _____ G8 U3 Lesson 11 - Let's Try It

Make an equivalent table, graph and equation for each problem.

1. Make a table and a graph for y = 4.

STEPS:

1a. Label the top of the table with x, y.

1b. Fill in the y column with 4.

1c. Fill in the other column with any values.

1d. Label the axes with numbers to fit what you wrote on the table.

1e. Graph each row as a coordinate pair.

2. Make a graph and equation for the table.

x	y
4	0
4	1
4	2
4	3
4	4

Equation: _____

STEPS:

2a. Notice the column that is all the same to write an equation.

2b. Graph each row as a coordinate pair.

3. Make a table and equation for the graph.

12

10

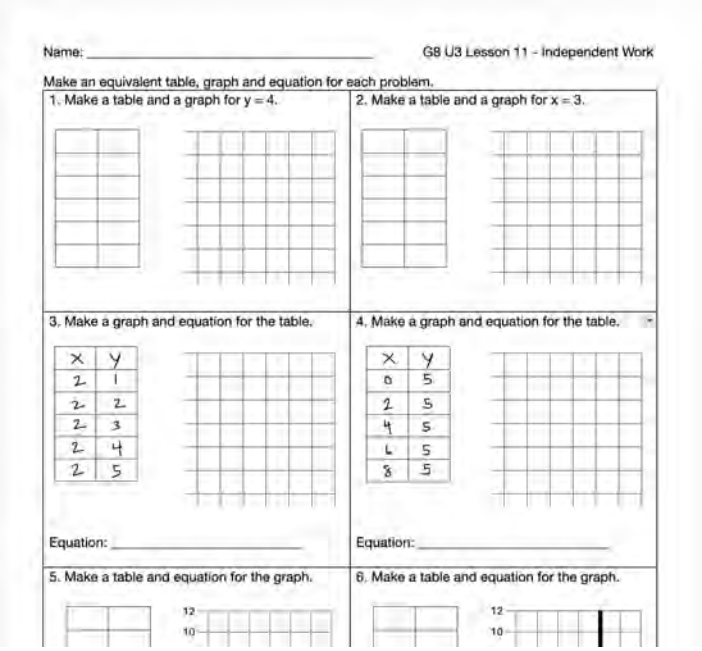
STEPS:

3a. Make points along the line.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

On your Own:

Now it's time for you to do it on your own!



Name: _____ G8 U3 Lesson 11 - Independent Work

Make an equivalent table, graph and equation for each problem.

1. Make a table and a graph for $y = 4$.

2. Make a table and a graph for $x = 3$.

3. Make a graph and equation for the table.

x	y
2	1
2	2
2	3
2	4
2	5

Equation: _____

4. Make a graph and equation for the table.

x	y
0	5
2	5
4	5
6	5
8	5

Equation: _____

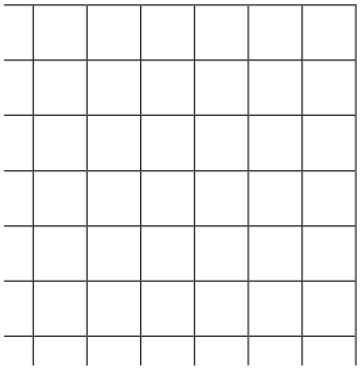
5. Make a table and equation for the graph.

6. Make a table and equation for the graph.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education. © 2023 CityBridge Education. All Rights Reserved.

Make an equivalent table, graph and equation for each problem.

1. Make a table and a graph for y = 4.



STEPS:

1a. Label the top of the table with x, y.

1b. Fill in the y column with 4.

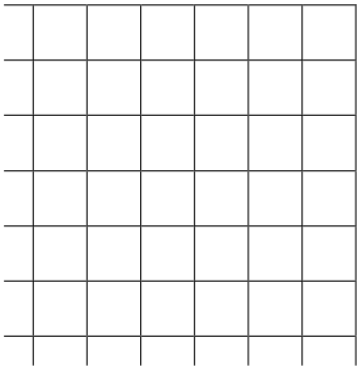
1c. Fill in the other column with any values.

1d. Label the axes with numbers to fit what you wrote on the table.

1e. Graph each row as a coordinate pair.

2. Make a graph and equation for the table.

x	y
4	0
4	1
4	2
4	3
4	4



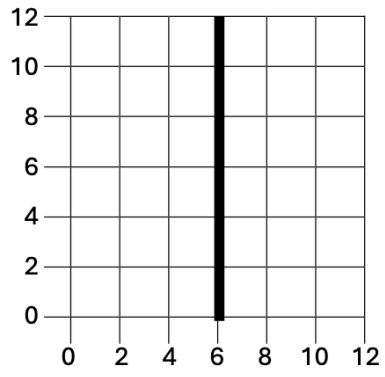
Equation: _____

STEPS:

2a. Notice the column that is all the same to write an equation.

2b. Graph each row as a coordinate pair.

3. Make a table and equation for the graph.



Equation: _____

STEPS:

3a. Make points along the line.

3b. Label the top of the table with x, y.

3c. Use the points you marked to fill in the table.

3d. Notice the column that is all the same to write an equation.

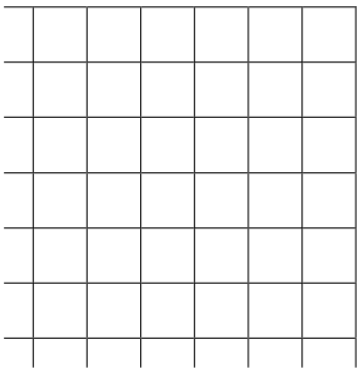
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

© 2023 CityBridge Education. All Rights Reserved.

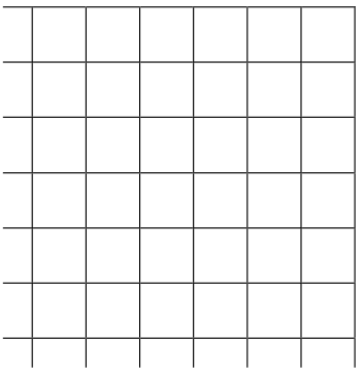
Name: _____ G8 U3 Lesson 11 - Independent Work

Make an equivalent table, graph and equation for each problem.

1. Make a table and a graph for y = 4.

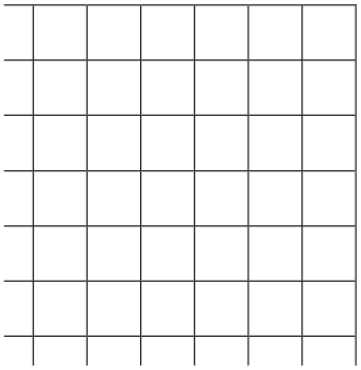


2. Make a table and a graph for x = 3.



3. Make a graph and equation for the table.

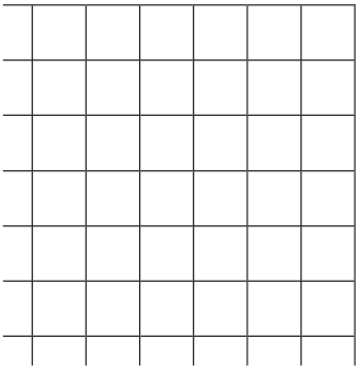
x	y
2	1
2	2
2	3
2	4
2	5



Equation: _____

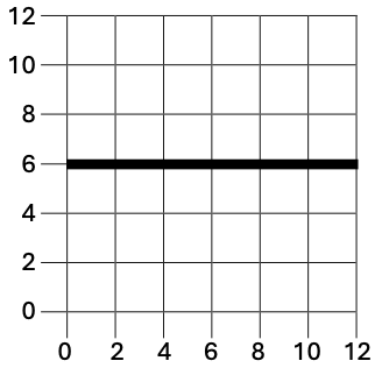
4. Make a graph and equation for the table.

x	y
0	5
2	5
4	5
6	5
8	5



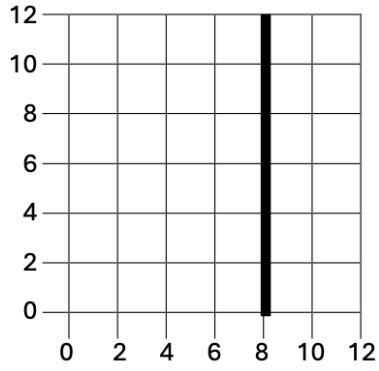
Equation: _____

5. Make a table and equation for the graph.



Equation: _____

6. Make a table and equation for the graph.

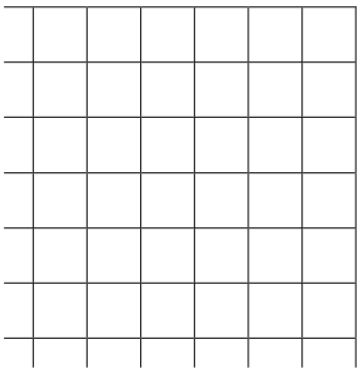


Equation: _____

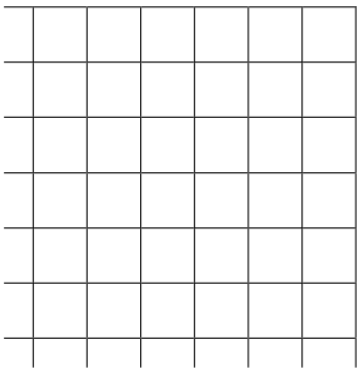
CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Make an equivalent table, graph and equation for each problem.

7. Make a table and a graph for y = 3.

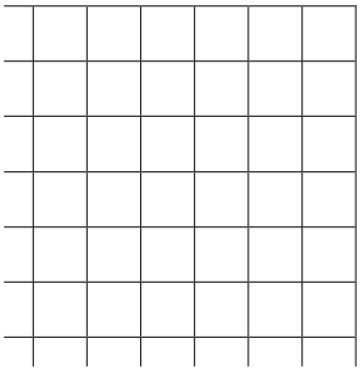


8. Make a table and a graph for x = y.



9. Make a graph and equation for the table.

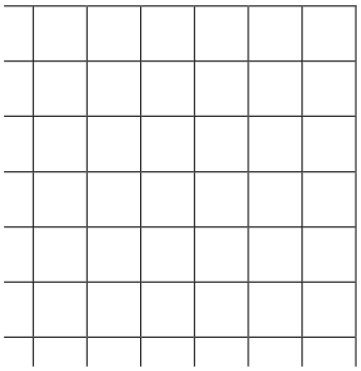
x	y
2	4
3	4
4	4
5	4
6	4



Equation: _____

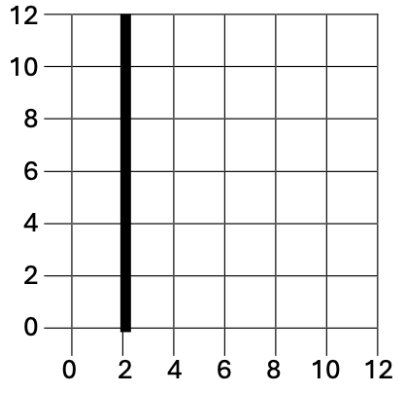
10. Make a graph and equation for the table.

x	y
1	0
1	1
1	2
1	3
1	4



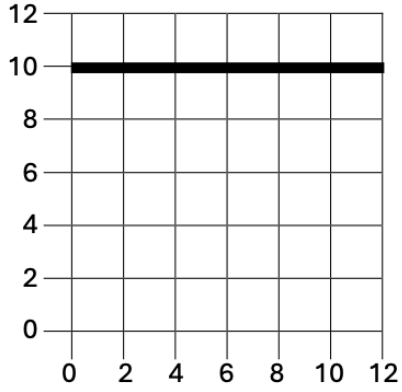
Equation: _____

11. Make a table and equation for the graph.



Equation: _____

12. Make a table and equation for the graph.



Equation: _____

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.

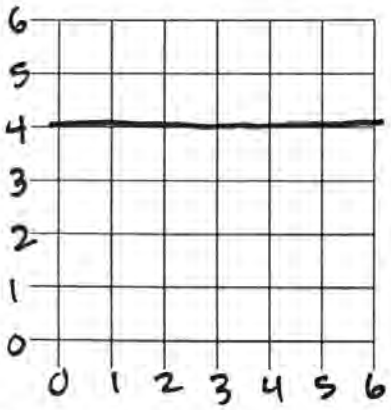
© 2023 CityBridge Education. All Rights Reserved.

Name: ANSWER KEY

Make an equivalent table, graph and equation for each problem.

1. Make a table and a graph for y = 4.

x	y
0	4
1	4
2	4
3	4
4	4



STEPS:

1a. Label the top of the table with x, y.

1b. Fill in the y column with 4.

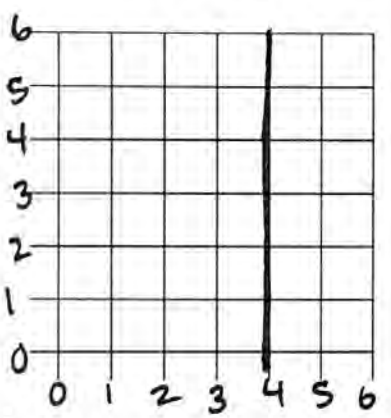
1c. Fill in the other column with any values.

1d. Label the axes with numbers to fit what you wrote on the table.

1e. Graph each row as a coordinate pair.

2. Make a graph and equation for the table.

x	y
4	0
4	1
4	2
4	3
4	4



Equation: x = 4

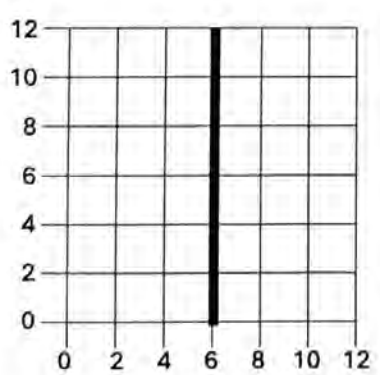
STEPS:

2a. Notice the column that is all the same to write an equation.

2b. Graph each row as a coordinate pair.

3. Make a table and equation for the graph.

x	y
6	0
6	2
6	4
6	6
6	8



Equation: x = 6

STEPS:

3a. Make points along the line.

3b. Label the top of the table with x, y.

3c. Use the points you marked to fill in the table.

3d. Notice the column that is all the same to write an equation.

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

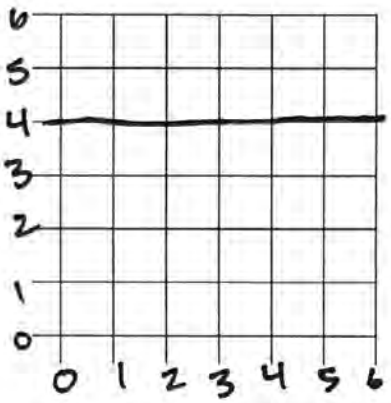
Name: ANSWER KEY

G8 U3 Lesson 11 - Independent Work

Make an equivalent table, graph and equation for each problem.

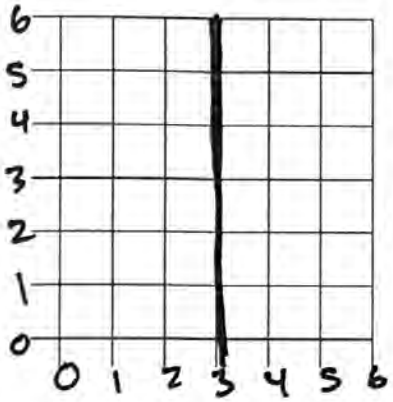
1. Make a table and a graph for y = 4.

x	y
0	4
1	4
2	4
3	4
4	4



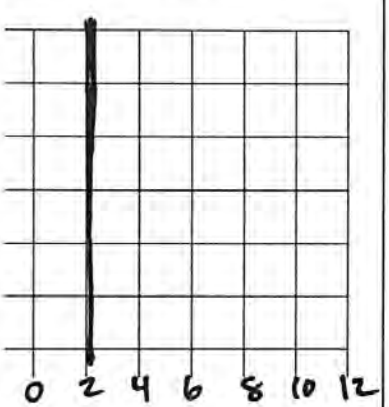
2. Make a table and a graph for x = 3.

x	y
3	0
3	1
3	2
3	3
3	4



3. Make a graph and equation for the table.

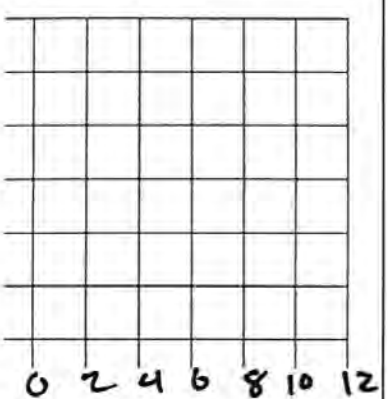
x	y
2	1
2	2
2	3
2	4
2	5



Equation: x = 2

4. Make a graph and equation for the table.

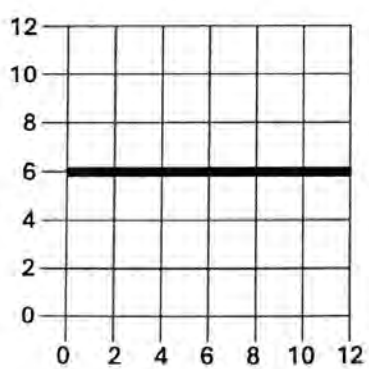
x	y
0	5
2	5
4	5
6	5
8	5



Equation: y = 5

5. Make a table and equation for the graph.

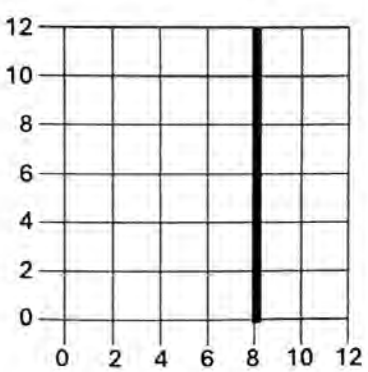
x	y
0	6
2	6
4	6
6	6
8	6



Equation: y = 6

6. Make a table and equation for the graph.

x	y
8	0
8	2
8	4
8	6
8	8



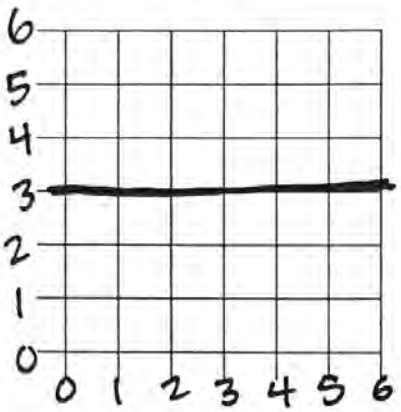
Equation: x = 8

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.

Make an equivalent table, graph and equation for each problem.

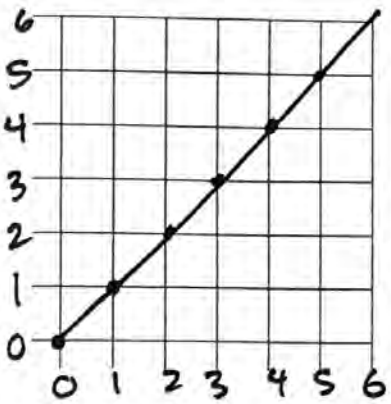
7. Make a table and a graph for y = 3.

x	y
0	3
1	3
2	3
3	3
4	3



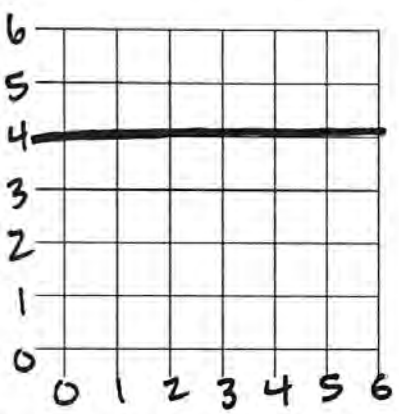
8. Make a table and a graph for x = y.

x	y
0	0
1	1
2	2
3	3
4	4



9. Make a graph and equation for the table.

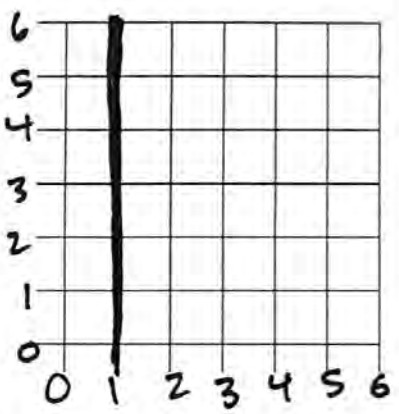
x	y
2	4
3	4
4	4
5	4
6	4



Equation: y = 4

10. Make a graph and equation for the table.

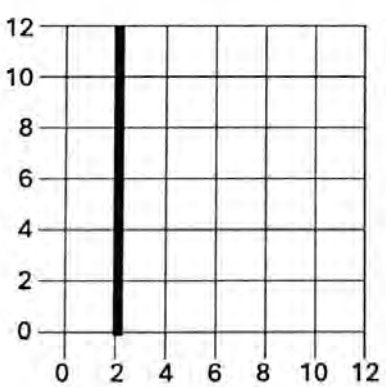
x	y
1	0
1	1
1	2
1	3
1	4



Equation: x = 1

11. Make a table and equation for the graph.

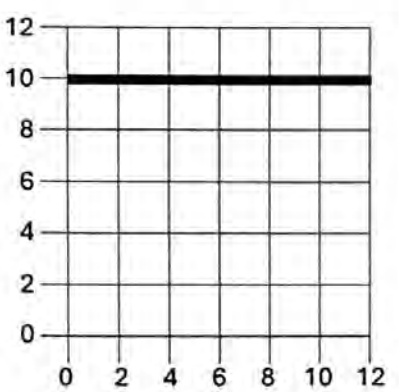
x	y
2	0
2	2
2	4
2	6
2	8



Equation: x = 2

12. Make a table and equation for the graph.

x	y
0	10
2	10
4	10
6	10
8	10



Equation: y = 10

CONFIDENTIAL INFORMATION. Do not reproduce, distribute, or modify without written permission of CityBridge Education.
© 2023 CityBridge Education. All Rights Reserved.