5 mins

Unit 2, Lesson 13: Two Graphs for Each Relationship

13.1 True or False: Fractions & Decimals

IDEAS TO CONSIDER:

1/ Multiplicative relationships between factors. Multiplying one factor by 2 & dividing by 2 on the left side of the equation results in the two factors on the right hand side

$$\frac{3}{2} \cdot 16 = 3 \cdot 8$$

True

Q. Could you rely on the same reasoning for other problems?

2/ In this case, factors on the left hand side are adjusted in the same manner as in #1. However, operation is division, so one side is 4 times the value of the other.

$$\frac{3}{4} \div \frac{1}{2} = \frac{6}{4} \text{ and } \frac{6}{4} \div \frac{1}{4} = 6$$

False

Q. How could the problem be changed to be true?

3/ This equation applies the same reasoning as #1 except the factors are adjusted by multiplying and dividing by 4.

$$(2.8) \cdot (13) = (0.7) \cdot (52)$$

True

BARTLETT

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13.2: Tables, Graphs, and Equations

20 mins.

m.openup.org/1/7-2-13-2

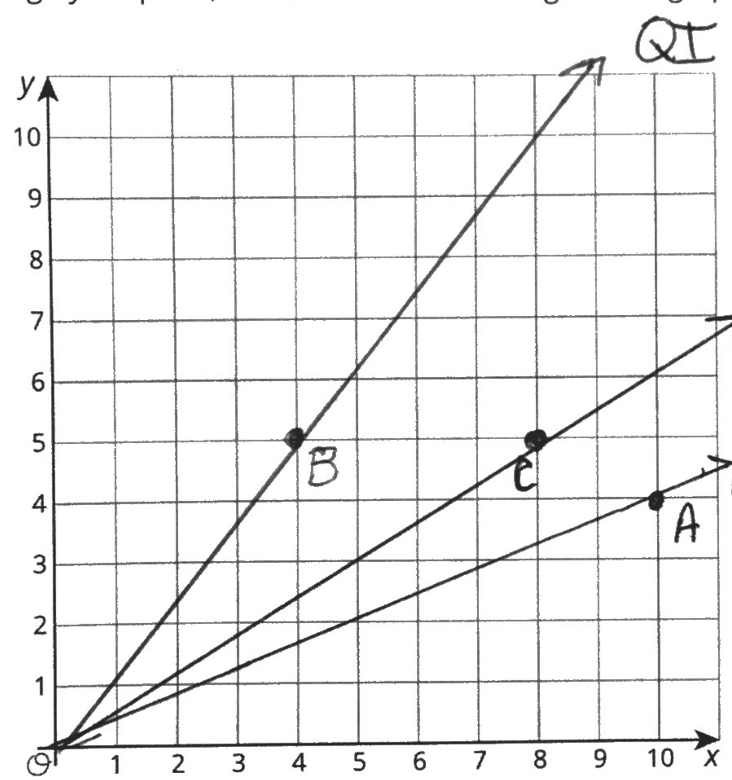
Your teacher will assign you *one* of these three points:

$$A = (10,4),\ B = (4,5),\ C = (8,5).$$

Each student gets a different letter

1. On the graph, plot and label *only* your assigned point.

2. Use a ruler to line up your point with the origin, $(0,0)$. Draw a line that starts at the origin, goes through your point, and continues to the edge of the graph.



x	y (A)	y (B)	y (C)	$\frac{y}{x}$
0	0	0	0	NA A B C
1	$\frac{2}{5}$	$\frac{5}{4}$	$\frac{5}{8}$	A: $\frac{2}{5}$ B: $\frac{5}{4}$ C: $\frac{5}{8}$
2	$\frac{4}{5}$	$\frac{10}{4}$	$\frac{10}{8}$	
3	$\frac{6}{5}$	$\frac{15}{4}$	$\frac{15}{8}$	
4	$\frac{8}{5}$	5	$\frac{20}{8}$	
5	2	$\frac{25}{4}$	$\frac{25}{8}$	
6	$\frac{12}{5}$	$\frac{30}{4}$	$\frac{30}{8}$	
7	$\frac{14}{5}$	$\frac{35}{4}$	$\frac{35}{8}$	
8	$\frac{16}{5}$	10	5	
9	$\frac{18}{5}$	$\frac{45}{4}$	$\frac{45}{8}$	
10	4	$\frac{50}{4}$	$\frac{50}{8}$	

3. Complete the table with the coordinates of points on your graph. Use a fraction to represent any value that is not a whole number.

Not a mixed number, but improper fraction.

4. Write an equation that represents the relationship between x and y defined by your point.

A: $y = \frac{2}{5}x$ B: $y = \frac{5}{4}x$ C: $y = \frac{5}{8}x$

$\frac{5}{2}y = x$ $\frac{4}{5}y = x$ $\frac{8}{5}y = x$

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5. Compare your graph and table with the rest of your group. What is the same and what is different about: y values as fractions, same denominator

   a. your tables?

   In each one, $\frac{y}{x}$ is always equal

   b. your equations?

   all include y and x; all include a different number, but each corresponds to a value

   c. your graphs?

   all go through origin, different slopes

6. What is the y-coordinate of your graph when the x-coordinate is 1? Plot and label this point on your graph. Where do you see this value in the table? Where do you see this value in your equation?

A: $\frac{2}{5}$ or 0.4 B: $\frac{5}{4}$ or 1.25 C: $\frac{5}{8}$ or 0.625

7. Describe any connections you see between the table, characteristics of the graph, and the equation.

Attention to (1, k) in graph, table, & equation

$y = kx$

Are you ready for more? HONORS

The graph of an equation of the form $y = kx$, where k is a positive number, is a line through $(0, 0)$ and the point $(1, k)$.

1. Name at least one line through $(0, 0)$ that cannot be represented by an equation like this.

   x & y-axes. Any line through (0,0) and (1, k), where k is negative

2. If you could draw the graphs of *all* of the equations of this form in the same coordinate plane, what would it look like?

   It would look completely shaded in QI and QIII

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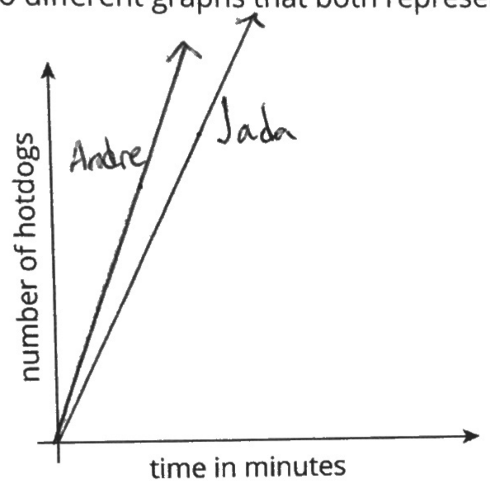
OPTIONAL 10 mins

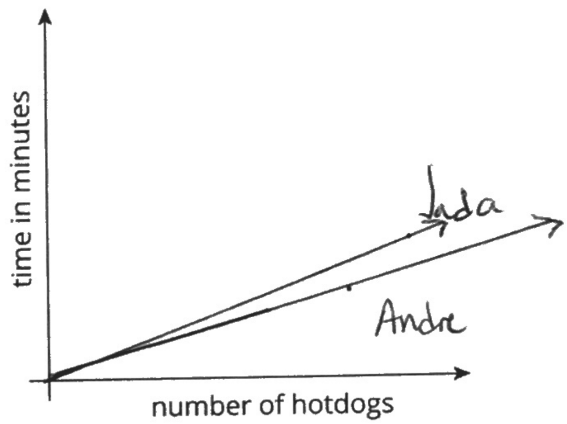
13.3: Hot Dog Eating Contest

m.openup.org/1/7-2-13-3

Andre and Jada were in a hot dog eating contest. Andre ate 10 hot dogs in 3 minutes. Jada ate 12 hot dogs in 5 minutes.

Here are two different graphs that both represent this situation.





1. On the first graph, which point shows Andre's consumption and which shows Jada's consumption? Label them.

2. Draw two lines: one through the origin and Andre's point, and one through the origin and Jada's point.

3. Write an equation for each line. Use t to represent time in minutes and h to represent number of hot dogs.

   a. Andre: $h = \frac{10}{3}t$

   b. Jada: $h = \frac{12}{5}t$ or $h = 2.4t$

4. For each equation, what does the constant of proportionality tell you?

   Andre eats 10/3 hot dogs per min. Jada eats 12/5 hot dogs per min.

5. Repeat the previous steps for the second graph.

   a. Andre: $t = \frac{3}{10}h$ or $0.3h = t$

   b. Jada: $t = 5/12\,h$

18 secs.
Andre takes 3/10 of a min. per hot dog.

25 secs.
Jada takes 5/12 of a min per hot dog

NAME Star any words that are unknown DATE PERIOD

14.2: One Scenario, Four Representations 20 mins

1. Select two things from different lists. Make up a situation where there is a *proportional relationship* between quantities that involve these things. 2 categories, one thing from each

creatures	length	time	volume
○ starfish	○ centimeters	○ nanoseconds	○ milliliters
○ centipedes	○ cubits	○ minutes	○ gallons
○ earthworms	○ kilometers	○ years	○ bushels
○ dinosaurs	○ parsecs	○ millennia	○ cubic miles

body parts	area	weight	substance
○ legs	○ square microns	○ nanograms	○ helium
○ eyes	○ acres	○ ounces	○ oobleck
○ neurons	○ hides	○ deben	○ pitch
○ digits	○ square light-years	○ metric tonnes	○ glue

2. Select two other things from the lists, and make up a situation where there is a relationship between quantities that involve these things, but the relationship is *not* proportional.

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3. Your teacher will give you two copies of the "One Scenario, Four Representations" sheet. For each of your situations, describe the relationships in detail. If you get stuck, consider asking your teacher for a copy of the sample response.

   a. Write one or more sentences describing the relationship between the things you chose.

   b. Make a table with titles in each column and at least 6 pairs of numbers relating the two things.

   c. Graph the situation and label the axes.

   d. Write an equation showing the relationship and explain in your own words what each number and letter in your equation means.

   e. Explain how you know whether each relationship is proportional or not proportional. Give as many reasons as you can.

(See attached on next page)

14.3: Make a Poster EXTRA CREDIT OPTIONAL 15 mins

Create a visual display of your two situations that includes all the information from the previous activity.

ckline Master for Classroom Activity 7.2.14.2: One Scenario, Four Representations

SAMPLE RESPONSE:

The two quantities are: d yards (distance traveled in race) and t minutes (time elapsed in race)

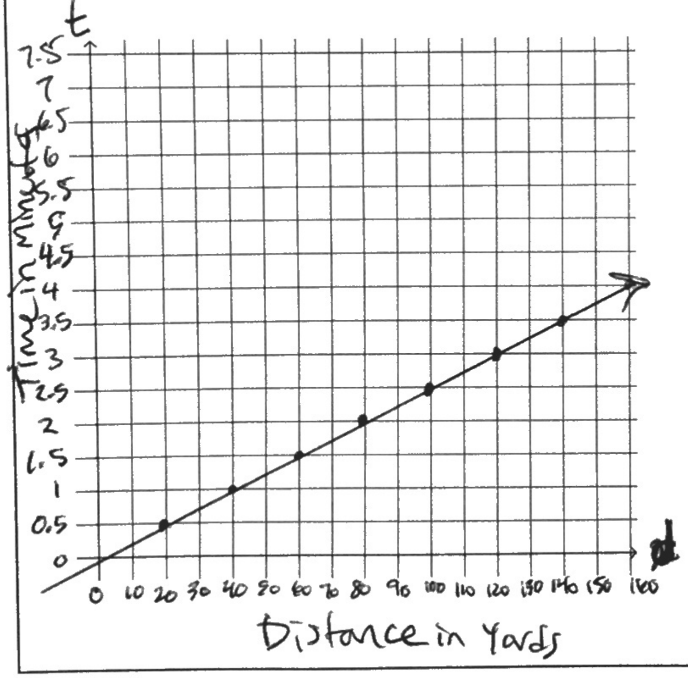
Verbal Description: One or more complete sentences describing the relationship

Mr. Bartlett & Ms. Sanfilippo are teammates in a 100-yd three-legged race. Their friend Ms. Pineda is timing them. Ms. Pineda notices that they pass the 20-yd marker at 1/2 minute, the 40-yd marker at 1 min., and the 60-yd at 1.5 mins.

Table of Values:

d	t
20	1/2
40	1
60	1.5
80	2
100	2.5
1	1/40
120	3

Graph: Label each axis!



Equation: $\boxed{t = \frac{1}{40}d}$ or $40t = d$

Explain in words what each letter and number in your equation means:

t represents the time in minutes that has elapsed in the race. d represents the distance in yards they have traveled, and 1/40 is the constant of proportionality. It takes them 1/40 of a minute to go 1 yard.

Explain how you know the relationship is or is not proportional. Give as many reasons as you can:

- Each value of d in the table can be multiplied by 1/40 to get the corresponding t-value.
- The graph is part of a line that goes through the origin & QI.
- The equation can be written in the form d = kt

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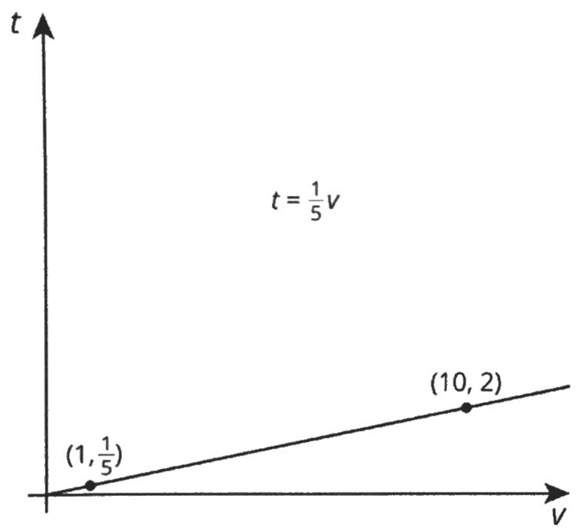
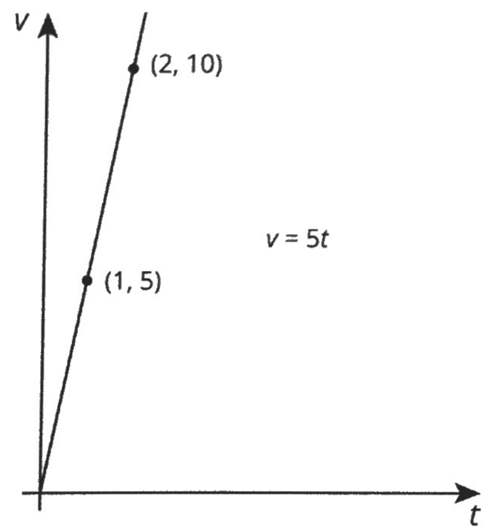
Lesson 13 Summary

Imagine that a faucet is leaking at a constant rate and that every 2 minutes, 10 milliliters of water leaks from the faucet. There is a proportional relationship between the volume of water and elapsed time.

- We could say that the elapsed time is proportional to the volume of water. The corresponding constant of proportionality tells us that the faucet is leaking at a rate of $\frac{1}{5}$ of a minute per milliliter.
- We could say that the volume of water is proportional to the elapsed time. The corresponding constant of proportionality tells us that the faucet is leaking at a rate of 5 milliliters per minute.

Let's use v to represent volume in milliliters and t to represent time in minutes. Here are graphs and equations that represent both ways of thinking about this relationship:





Even though the relationship between time and volume is the same, we are making a different choice in each case about which variable to view as the independent variable. The graph on the left has v as the independent variable, and the graph on the right has t as the independent variable.

- When we have two quantities x and y in a proportional relationship, we have two choices for writing an equation, making a table, or drawing a graph to represent the relationship.
- Either way it is presented, it will display the same information

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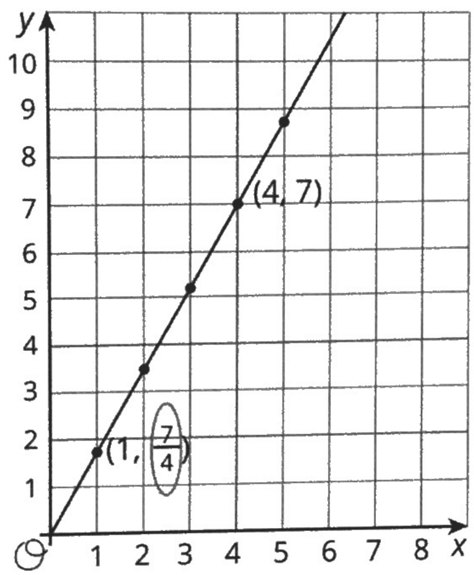
Lesson 14 Summary

The constant of proportionality for a proportional relationship can often be easily identified in a graph, a table, and an equation that represents it. Here is an example of all three representations for the same relationship. The constant of proportionality is circled:



$$y = \frac{7}{4}x$$

x	y
0	0
1	$\frac{7}{4}$
2	$\frac{7}{2}$
3	$\frac{21}{4}$
4	7

On the other hand, some relationships are not proportional. If the graph of a relationship is not a straight line through the origin, if the equation cannot be expressed in the form $y = kx$, or if the table does not have a constant of proportionality that you can multiply by any number in the first column to get the associated number in the second column, then the relationship between the quantities is not a proportional relationship.