Illustrative Mathematics 7

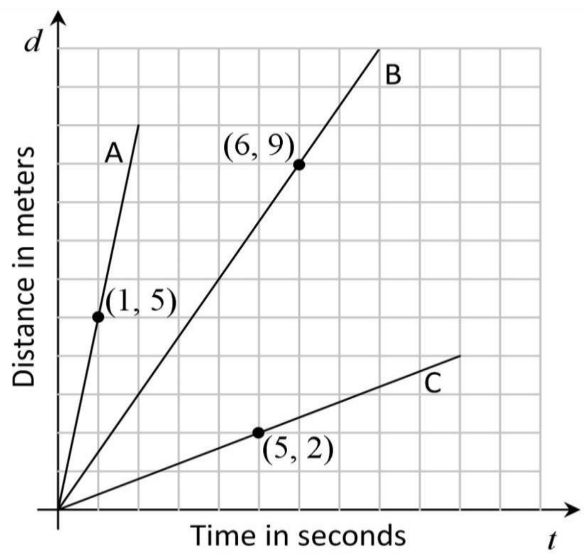
7.RP **Robot Races**
Alignment 1: 7.RP.A.2

Carli's class built some solar-powered robots. They raced the robots in the parking lot of the school. The graphs below are
all line segments that show the distance , in meters, that each of three robots traveled after seconds.

a. Each graph has a point labeled. What does the point tell you about how far that robot has traveled?

b. Carli said that the ratio between the number of seconds each robot travels and the number of meters it has traveled is constant. Is she correct? Explain.

c. How fast is each robot traveling? How did you compute this from the graph?



Solution: Answers
a. The point (1, 5) tells that robot A traveled 5 meters in 1 second.
The point (6, 9) tells that robot B traveled 9 meters in 6 seconds.
The point (5, 2) tells that robot C traveled 2 meters in 5 seconds.

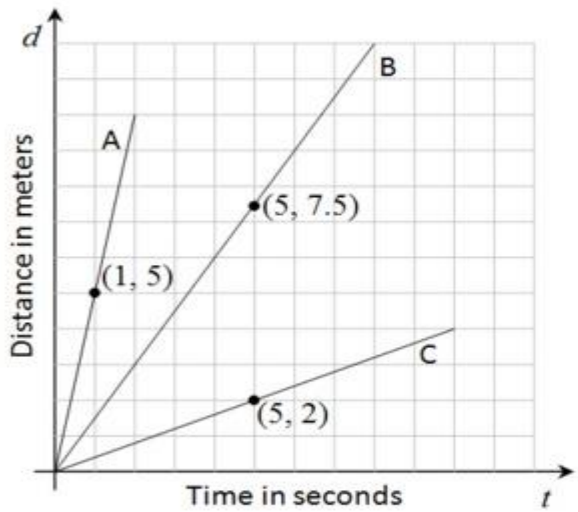
b. Carli is correct. Whenever the ratio between two quantities is constant, the graph of the relationship between them is a straight line through (0,0). We can also say that for each robot, the relationship between the time and distance is a proportional relationship.

c. The speed can be seen as the d-coordinate of the graph when t=1. This is the robot's unit rate:
Robot A traveled 5 meters per second, as shown by the point (1, 5) on its graph.
Robot B traveled 1.5 meters per second, as shown by the point (1, 1.5) on its graph.
Robot C traveled 0.4 meters per second, as shown by the point (1, 0.4) on its graph.

The speed of each robot can also be seen in the steepness of its graph, which is quantified as slope. But that perspective is not expected until grade 8.

7.RP **Robot Races, Assessment Variation**
Alignment 1: 7.RP.A.2

The students in Carli's class built some solar-powered robots which they raced in the cafeteria of the school. After the race, Carli drew the graphs shown below to represent the distance, in meters, that each of three robots A, B, and C traveled after *t* seconds.



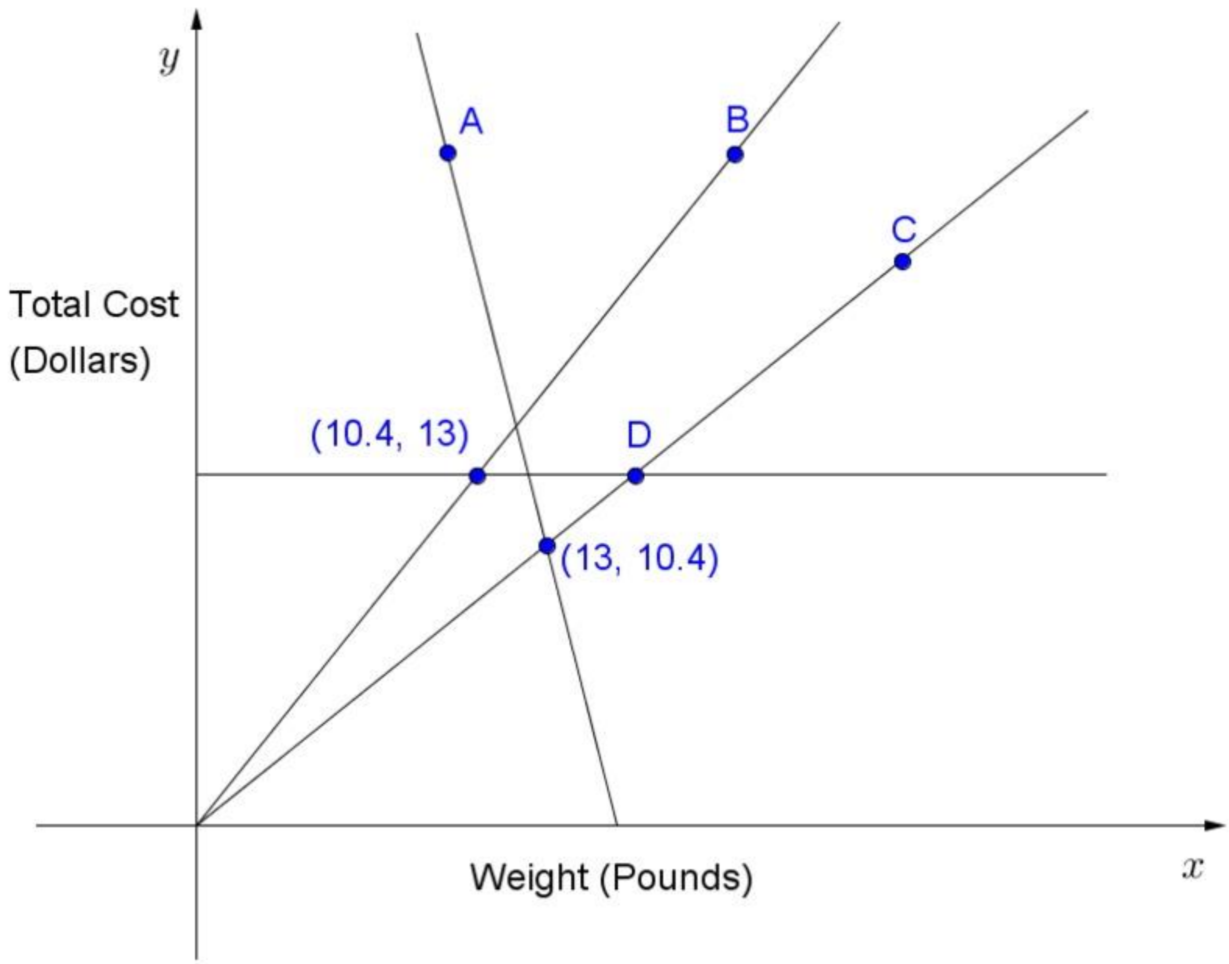
Which of the following statements about Robot B are true? (Select all that apply.)

i. Robot B traveled in a different direction than the other two robots.
ii. Robot B traveled 5 meters in 7.5 seconds.
iii. Robot B traveled 7.5 meters in 5 seconds.
iv. Robot B traveled meters per second.
v. Robot B traveled meters per second.
vi. None of these are true.

Commentary
7.RP.2 Robot Races asks students to "explain what a point (x,y) on the graph of a proportional relationship means in terms of the situation" and to "compute unit rates associated with ratios of fractions." Students also need to compare the speeds of the robots.

7.RP **Buying Bananas, Assessment Version**
Alignment 1: 7.RP.A.2

Carlos bought pounds of bananas for $5.20.
a. What is the price per pound of the bananas that Carlos bought?[_____]
b. What quantity of bananas would one dollar buy?[_____] pounds
c. Which of the points in the coordinate plane shown below correspond to a quantity of bananas that cost the same price per pound as the bananas Carlos bought? (Select all that apply.)



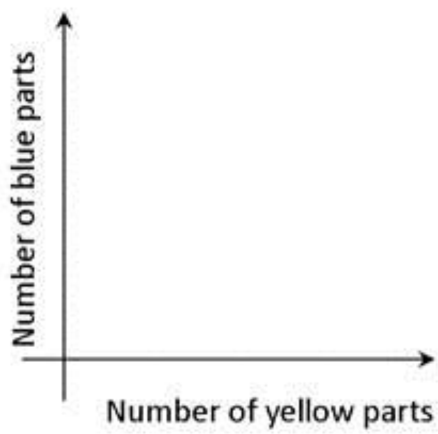
i. A
ii. B
iii. C
iv. D
v. (10.4, 13)
vi. (13, 10.4)
vii. There is not enough information to determine this.

Illustrative Mathematics
7.RP **Art Class, Variation 1**

The students in Ms. Baca's art class were mixing yellow and blue paint. She told them that two mixtures will be the same shade of green if the blue and yellow paint are in the same ratio. The table below shows the different mixtures of paint that the students made.

	A	B	C	D	E
Yellow	1	2	3	4	6
Blue	2	3	6	6	9

a. How many different shades of paint did the students make?
b. Some of the shades of paint were bluer than others. Which mixture(s) were the bluest? Show work or explain how you know.
c. Carefully plot a point for each mixture on a coordinate plane like the one that is shown in the figure. (Graph paper might help.)
d. Draw a line connecting each point to (0, 0). What do the mixtures that are the same shade of green have in common?



Commentary
Giving the amount of paint in "parts" instead of a specific standardized unit like cups might be confusing to students who do not understand what this means. Because this is standard language in ratio problems, students need to be exposed to it, but teachers might need to explain the meaning if their students are encountering it for the first time.

7.RP **Art Class, Variation 2**

Alignment 1: 7.RP.A.2

	A	B	C	D	E	F
Yellow	1	2	3	4	5	6
Blue	2	3	6	6	8	9

a. How many different shades of paint did the students make?
b. Write an equation that relates, the number of parts of yellow paint, and , the number of parts of blue paint for each of the different shades of paint the students made.

7.RP **Art Class, Assessment Variation**

Alignment 1: 7.RP.A.2

a. How many different shades of paint did the students make?

b. Which mixture(s) make the same shade as mixture A?

c. How many cups of yellow paint would a student add to one cup of blue paint to make a mixture that is the same shade as mixture A?

d. Let represent the number of cups of blue paint and represent the number of cups of yellow paint in a paint mixture. Write an equation that shows the relationship between the number of cups of yellow paint, *y*, and the number of cups of blue paint, *b*, in mixture E.

7.RP.2 Art Class requires students to decide whether two quantities are in a proportional relationship by testing for equivalent ratios in a table, to find a unit rate for a ratio defined by non-whole numbers, and to represent a proportional relationship with an equation. Part (a) essentially asks students to partition a set of ratios displayed in a table into two sets of equivalent ratios. Part (b) asks students to identify all the ratios in the table that are equivalent to a given ratio. These two parts work together: the first question asks students to make a judgment about how many different proportional relationships are represented in the table, and the second asks students to specifically identify all of the ratios that go with one of those relationships. This task shows a shift in the standards that expand upon common approaches to "proportional reasoning" because it requires students to understand different aspects of proportional relationships, not just their ability to set up and solve a proportion.

Solution:

1. The students made **2** different shades of paint.
2. Mixtures **D** and **E** make the same shade as mixture A.
3. A student should add **2/3** cup of yellow paint to 1 cup of blue paint to make the same shade as mixture A.
4. Either of these equations would be correct:
5. $b=(3/2)y$ (or $(3/2)y=b$ if this is a fill-in-the-blank)
    - $y=(2/3)b$ (or $(2/3)b=y$ if this is a fill-in-the-blank)