ACHIEVE THE CORE

Proportional Relationships

7.RP.A Conceptual Understanding and Application Mini-Assessment by Student Achievement Partners

OVERVIEW

This mini-assessment is designed to illustrate the concepts in 7.RP.A, which sets an expectation for students to analyze proportional relationships and use them to solve real-world and mathematical problems. This mini-assessment is designed for teachers to use either in the classroom, for self-learning, or in professional development settings to:

- Evaluate students' understanding of 7.RP.A to prepare to teach this material or to check for student ability to demonstrate understanding and apply these concepts;
- Gain knowledge about assessing conceptual understanding at the depth expected at grade 7; and
- Illustrate CCSS-aligned assessment problems.

7.RP.A.
Analyze proportional relationships and use them to solve real-world and

MAKING THE SHIFTS

This mini-assessment attends to **focus** as it addresses proportional relationships, which are at the heart of the grade 7 standards and a key component of the major work of the grade.[1] It addresses **coherence** across grades as it builds on rate concepts from grade 6 and uses rational numbers to support learning of 7.NS.A. Cluster 7.RP.A and this mini-assessment target *conceptual understanding* and *application*, two of the three elements of **rigor**, through a variety of problems.

A CLOSER LOOK

Proportional relationships as described in cluster 7.RP.A are a critical link between the work with equivalent ratios in grade 6 and the work with equations in the form $y = mx + b$ in grade 8. In grade 7, students are looking at relationships between two quantities or variables. Equivalent ratios in grade 6 show examples of a relationship, such as 1 dog: 4 paws, 2 dogs: 8 paws, etc., whereas grade 7 students relate the number of dogs to the number of paws. Now there is a proportional relationship between two variables. The table to the right details how grade 6 focuses on the rows (examples of the relationship), while in grade 7, you look down the columns and see the multiplicative relationship between Dogs and Paws. For further reading on this topic, read pages 6–8 of the progression document, 6–7, Ratios and Proportional Relationships.

Dogs	Paws
1	4
2	8
5	20
6	24
9	36

Grade 6 (1 → 4)
Grade 6 (2 → 8)
Grade 7 (Dogs column)
Grade 7 (Paws column)

Standard 7.RP.A.2C gives the example "total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as $t = pn$. The constant of proportionality (or unit rate), p, expresses the relationship between the columns noted above. Students work with graphs, tables, and equations to understand the constant of proportionality from a variety of perspectives. These perspectives connect fundamentally with grade 7 work with expressions and equations (7.EE.B) where students both set up and solve real-world and mathematical problems which requires an understanding of the constant of proportionality. The following assessment should take 30-45 minutes, and students may use a calculator to facilitate some of these calculations, as rational number computation is not the focus of this mini-assessment.

[1] For more on the Major Work of the grade, see achievethecore.org/focus.

For a direct link, go to: http://achievethecore.org/page/1143/proportional-relationships-mini-assessment-detail-pg

Name:_____ Date:_____

1. The table shows the amounts of tomato sauce and cheese used to make the last 4 orders at Sara's Pizza.

Number of Pizzas	Tomato Sauce (ounces)	Cheese (ounces)
2	10	4.5
3	15	6.75
6	30	13.5
2	10	4.5

a. Decide whether the relationship between number of pizzas and amount of cheese is proportional. Explain your decision.

_____

_____

b. Some people make special requests such as "Extra Cheese" or "Less Cheese." Complete this table with possible values for the special orders shown.

Special order	Number of Pizzas	Tomato Sauce (ounces)	Cheese (ounces)
Extra Cheese	2	10	
Less Cheese	3		
Less Cheese	2		
Extra Cheese			5.5
Less Cheese			5.5

c. Sara's Pizza recorded weekly sales for regular cheese pizza from the past four weeks.

- Week 1: 417 pizzas sold
- Week 2: 399 pizzas sold
- Week 3: 405 pizzas sold
- Week 4: 410 pizzas sold

Estimate how much tomato sauce and cheese they should purchase for next week. Explain how you made your estimate and why it is reasonable.

2. This table has actual lengths from the Statue of Liberty.

Length	Actual Length (feet)	Replica Length (inches)
Ground to torch	305	9
Heel to head	111	
Length of hand	16.5	
Index finger	8	
Width of eye	2.5	
Length of nose	4.5	
Mouth	3	

An online company sells a 3-D replica that is 9 inches tall. Complete the table with the other lengths for the replica.

a. Write an equation to calculate the replica lengths using the actual lengths.

_____

b. Define your variables here:

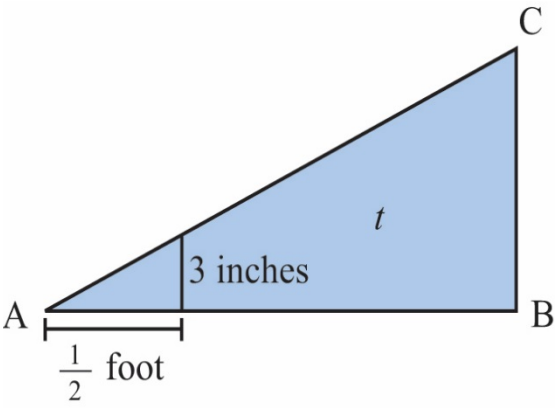
c. Write an equation to calculate the actual lengths using the replica lengths.

_____

d. Define your variables here:

e. Describe the relationship between the unit rates in your equations from parts a and c.

3. Mary is remodeling a room in her home. She needs to cut a piece of sheet rock in the shape of a right triangle to cover one wall. She measures ½ foot from the vertex of the sheet rock, as shown, and finds that the height is 3 inches.



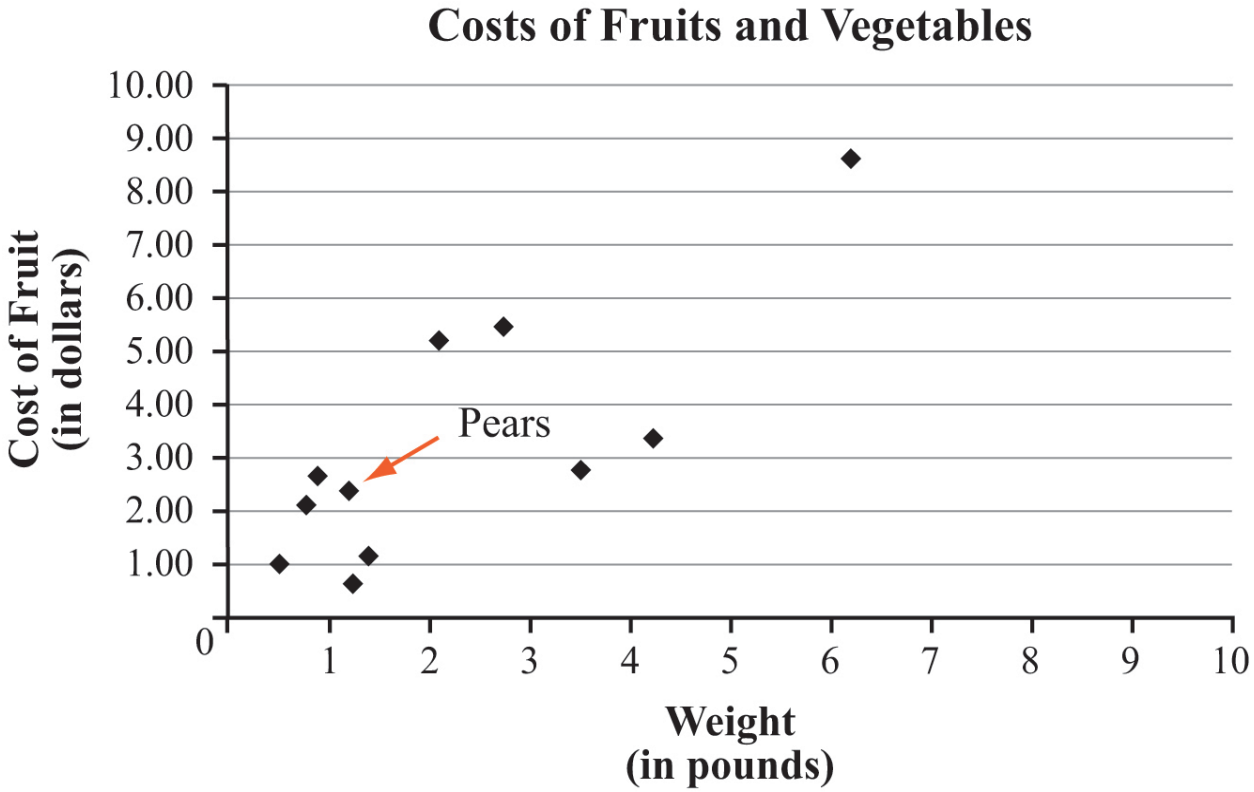
Mary wants to draw 4 points on the sheet rock to help her cut the correct shape. She makes one point 1/2 foot from the corner and 3 inches high.

a. Fill in this table to determine how high from the base each of the other points will be.

Distance from corner	Height from Base
½ foot	3 inches
1 foot	
2 feet	
5.5 feet	

b. The piece of sheet rock she is planning to cut her triangle from is 8 feet by 4 feet. If the length of side AB is 5.5 feet, will Mary be able to create the triangle she needs using just this one piece of sheet rock? Explain how you know using graphs, equations, and/or explanations.

4. The graph shows the weights and costs of the fruits and vegetables Tyrus bought at the store. For example, Tyrus bought 1.2 pounds of pears for $2.39.



a. Circle all points with a higher cost per pound than the pears. Explain why you circled those points.

_____

_____

b. Put an "**X**" on three points with the same cost per pound. Explain how you know.

_____

_____

c. Next week pears will cost two times as much per pound and Tyrus will buy the same amount. What will happen to the location of the point on the graph representing pears? Explain how you know.

_____

_____

Name:_____ Date:_____

1. The table shows the amounts of tomato sauce and cheese used to make the last 4 orders at Sara's Pizza.

Number of Pizzas	Tomato Sauce (ounces)	Cheese (ounces)
2	10	4.5
3	15	6.75
6	30	13.5
2	10	4.5

a. Decide whether the relationship between number of pizzas and amount of cheese is proportional. Explain your decision.

1 point for correct reasoning, for example:

- Yes, because the ratios are all equivalent in the Pizza and Cheese columns.
- This is a proportional relationship because I can relate *P* pizzas to *C* cheese with the equation $C = 2.25P$.
- I graphed Pizzas on the x-axis and Cheese on the y-axis and saw that the points were on a straight line that passed through the point (0, 0).
- I found a constant rate of 2.25 ounces of cheese per pizza.

b. Some people make special requests such as "Extra Cheese" or "Less Cheese." Complete this table with possible values for the special orders shown.

2 points for all correct, 1 point for 3-6 correct values.

Special order	Number of Pizzas	Tomato Sauce (ounces)	Cheese (ounces)
Extra Cheesy	2	10	Any value greater than 4.5
Less Cheese	3	15	Any value less than 6.75
Less Cheese	2	10	Any value less than 4.5
Extra Cheese	1 or 2 (extra cheesy pizzas could arguably have 5.5 oz)	5 or 10 (depending on number of pizzas)	5.5
Less Cheese	3 or 4 (less cheesy pizzas could arguably have 5.5 oz of cheese)	15 or 20 (depending on number of pizzas)	5.5

c. Sara's Pizza recorded weekly sales for regular cheese pizza from the past four weeks.

- Week 1: 417 pizzas sold
- Week 2: 399 pizzas sold
- Week 3: 405 pizzas sold
- Week 4: 410 pizzas sold

Estimate how much tomato sauce and cheese they should purchase for next week. Explain how you made your estimate and why it is reasonable.

2 points of correct reasoning. For example,

- They sell a little over 400 pizzas per week; 400 pizzas need 2,000 ounces of tomato sauce and 900 ounces of cheese, so I would order a little more: 2,200 ounces of tomato sauce and 1,100 ounces of cheese.
- I think they sell 410 pizzas per week, so they need about 2,050 ounces of tomato sauce and 923 ounces of cheese.
- They need to be prepared for a busy week like week 1, so they should buy (enough for 417 pizzas.)

1 point if the reasoning is partial or incomplete.
0 points if reasoning is insufficient, give 0 points.

2. This table has actual lengths from the Statue of Liberty.

2 points for all correct, 1 point for 3-6 correct values.

Length	Actual Length (feet)	Replica Length (inches)
Ground to torch	305	9
Heel to head	111	3.28
Length of hand	16.5	0.49
Index finger	8	0.24
Width of eye	2.5	0.07
Length of nose	4.5	0.13
Mouth	3	0.09

An online company sells a 3-D replica that is 9 inches tall. Complete the table with the other lengths for the replica.

a. Write an equation to calculate the replica lengths using the actual lengths.

Acceptable solutions include: $R = 0.03A$ and $R = \frac{A}{33.89}$

(Note: The equation in Part c is also acceptable)

b. Define your variables here:

1 point for correctly defining both variables to match the equation in Part a (e.g., R is the replica length in inches and A is the actual length in feet).

c. Write an equation to calculate the actual lengths using the replica lengths.

Acceptable solutions include: $A = (33.89)\ R$

(Note: An equation from Part a is also acceptable)

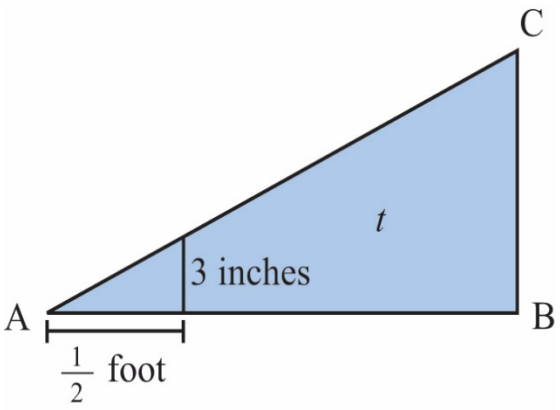
d. Define your variables here:

1 point for correctly defining both variables to match the equation in Part c or stating that they used the same variables.

e. Describe the relationship between the unit rates in your equation from parts a and c.

1 point for describing that the constant of proportionality in part a is the multiplicative inverse of the constant of proportionality in part c.

3. Mary is remodeling a room in her home. She needs to cut a piece of sheet rock in the shape of a right triangle to cover one wall. She measures ½ foot from the vertex of the sheet rock, as shown, and finds that the height is 3 inches.



Mary wants to draw 4 points on the sheet rock to help her cut the correct shape. She makes one point 1/2 foot from the corner and 3 inches high.

a. Fill in this table to determine how high from the base each of the other points will be.

2 points for all correct, 1 point for 1-2 values correct

Distance from corner	Height from Base
½ foot	3 inches
1 foot	6 inches
2 feet	12 inches
5.5 feet	33 inches

b. The piece of sheet rock she is planning to cut her triangle from is 8 feet by 4 feet. If the length of side AB is 5.5 feet, will Mary be able to create the triangle she needs using just this one piece of sheet rock? Explain how you know using graphs, equations, and/or explanations.

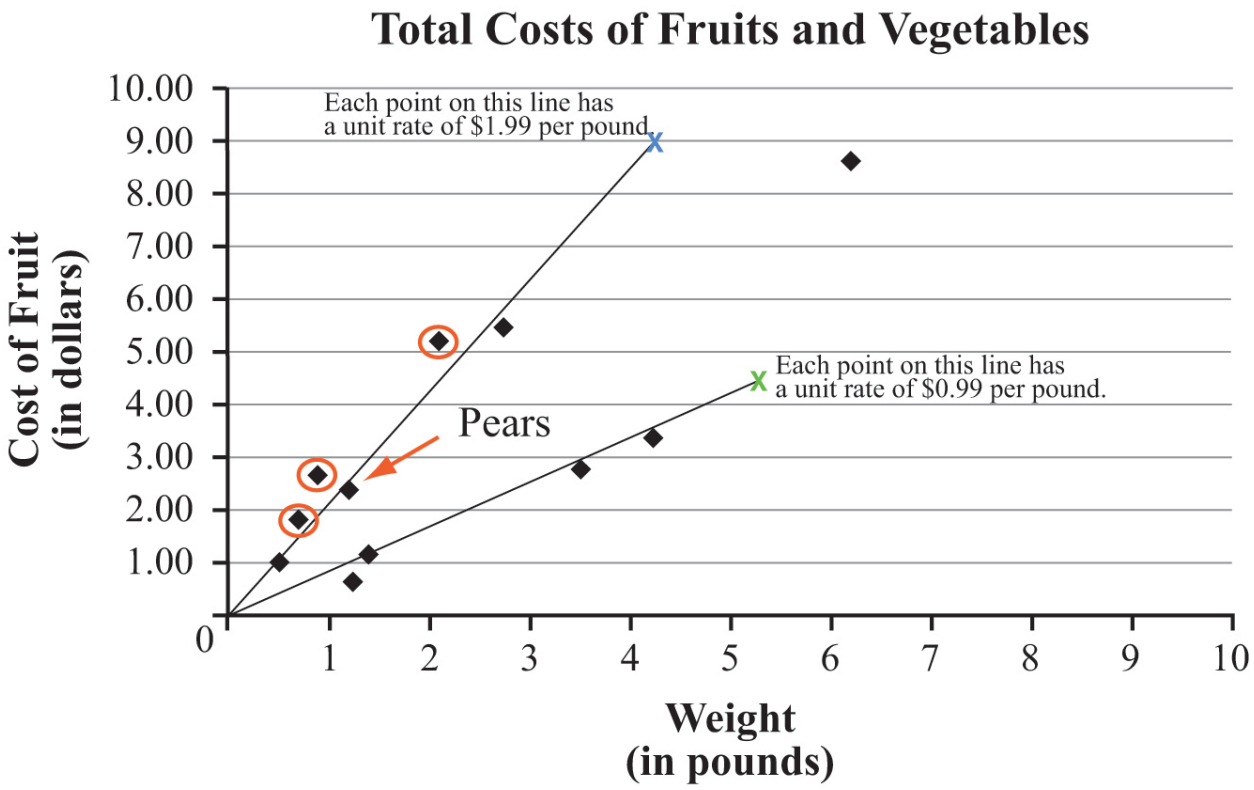
2 points for correct reasoning. For example,

- Students should state that Mary is able to create the triangle she needs.
- The distance from the corner and the height of the base are proportional, because as one quantity increases the other will also increase and the ratio of the quantities is the same for all values. Therefore 5.5 feet from the corner results in 2.75 feet or 66 inches from the corner results in 33 inches as a height from the base.

- The distance from the corner is double the height of the base in inches, or the height of the base is half the distance from the corner in inches, $k=h/d$ or $h=.5d$.

1 point if the reasoning is partial or incomplete
0 points if reasoning is insufficient

4. The graph shows the weights and costs of the fruits and vegetables Tyrus bought at the store. For example, Tyrus bought 1.2 pounds of pears for $2.39.



a. Circle all points with a higher cost per pound than the pears. Explain why you circled those points.

2 total points:

- 1 point for circling the points circled above
- 1 point for correct explanation. For example:
  - I drew a line through the origin and the point for Pears then circled everything above it.
  - I looked at the pear point and choose each point with a steeper unit rate.

b. Put an "**X**" on three points with the same cost per pound. Explain how you know.

2 total points:

- 1 point for putting X's on either set of three points with same unit rate noted above.
- 1 point for correct explanation. For example:
  - I drew a line through the origin and three points to find the same proportional relationship.
  - I used the graph to find three points with the same unit rate.

c. Next week pears will cost two times as much per pound and Tyrus will buy the same amount. What will happen to the location of the point on the graph representing pears? Explain how you know.

1 point for explaining that the point will have the same *x*-value (weight), but will have twice the *y*-value (e.g., "the point will be twice as high").