Sleep Survey (ECR)

Overview

Students will work with rational numbers including decimals, fractions, and percentages to answer questions about a survey conducted by students.

Standards

Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

7.EE.B.3 Solve multistep real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50 an hour. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation*.

Prior to the Task

Students must be able to convert fractions to decimals, decimals to fractions, percentages to decimals, decimals to percentages, fractions to percentages, and percentages to fractions. Students need to be able to round to the nearest whole number.

Grade-Level Standard	The Following Standards Will Prepare Them:	Items to Check for Task Readiness:	Sample Remediation Items:
7.EE.B.3	• 7.NS.A.3	1. What is the decimal equivalent of 45%? a. 0.45 2. Write 25% as a fraction in its simplest form. a. ¼ 3. Write a percentage for 35/100. a. 35% 4. Write 4% as a decimal. a. 0.04 5. What is 12% of 73? a. 8.76 6. http://www.illustrativemathematics.org/illustrations/108 7. http://www.illustrativemathematics.org/illustrations/478 8. http://www.illustrativemathematics.org/illustrations/1588	• http://www.illustrativemathematics.org/illustrations/298 • http://learnzillion.com/lessonsets/680-solve-complex-problems-with-positive-and-negative-rational-numbers-in-all-forms-converting-between-forms-and-assessing-the-reasonableness-of-answers • http://learnzillion.com/lessonsets/135-solve-multistep-reallife-and-mathematical-problems-with-positive-and-negative-rational-numbers-in-any-form

Real-World Preparation: The following questions will prepare students for some of the real-world components of this task:

What is a survey? It is a question, or set of questions, that is asked of a large group to find out how the group feels about a topic.

What does the term *interview* mean with regard to a survey? When someone is interviewed for a survey, he or she is asked questions for which responses are noted.

After the Task

Students may have difficulty with question 3. When multiplying, they will get fractions of students. They will have to realize that this number must be rounded to the nearest whole number to represent an accurate number of students.

Student Extended Constructed Response Task

Mr. Browning asked students in his science class to survey their schoolmates to find out how many hours of sleep students at their school get each night. To keep his class from asking the same students more than once, each group was given a certain grade to interview. The following chart displays the results of the survey.

Grade	Fewer Than 8 Hours	8 Hours	More Than 8 Hours
6th	23%	26%	51%
7th	3/10	¼	9/20
8th	0.28	0.2	0.52

1. Which grade has the largest ratio of students getting more than 8 hours of sleep? What is the difference between the two groups with the largest ratios? Show all of your work.

2. Which grade has the largest ratio of students getting fewer than 8 hours of sleep? What is the difference between the two groups with the largest ratios? Show all of your work.

3. If there are 70 sixth graders, 68 seventh graders, and 76 eighth graders, complete the table below to show approximately how many students are in each category by grade.

Grade	Fewer Than 8 Hours	8 Hours	More Than 8 Hours
6th			
7th			
8th			

4. Find the percentage of **the total number** of students surveyed across all three grades for each category: Fewer Than 8 Hours, 8 Hours, and More Than 8 Hours. Show all work or explain your reasoning.

Exemplar Constructed Response Task Exemplar Response

Mr. Browning asked members of his science class to survey their schoolmates to find out how many hours of sleep students at their school get each night. To keep his class from asking the same students more than once, each group was given a certain grade to interview. The following chart displays the results of the survey.

Grade	Fewer Than 8 Hours	8 Hours	More Than 8 Hours
6th	23%	26%	51%
7th	3/10	¼	9/20
8th	0.28	0.2	0.52

1. Which grade has the largest ratio of students getting more than 8 hours of sleep? What is the difference between the two groups with the largest ratios? Show all of your work.

   More 8th graders get more than 8 hours of sleep. There are 1%, 0.01, or 1/100 more 8th graders than 6th graders that get more than 8 hours of sleep.
   Work should include changing numbers to percentages, decimals, or fractions in order to compare. There are three sample answers below. Any one is acceptable—not all three are needed.

   Sample answer 1: 6th graders: 51%; 7th graders: 45% because 9/20 is equal to 45/100, which is 45%; 8th graders: 52% because 0.52 is 52/100, which is 52%

   Sample answer 2: 8th graders: 0.52; 7th graders: 9/20 is equal to 45/100, which is 0.45; 6th graders: 51% is equal to 51/100, which is 0.51

   Sample answer 3: 7th graders: 9/20, which equals 45/100; 8th graders: 0.52, which is 52/100; 6th graders 51%, which is 51/100

2. Which grade has the largest ratio of students getting fewer than 8 hours of sleep? What is the difference between the two groups with the largest ratios? Show all of your work.

   More 7th graders get fewer than 8 hours of sleep. There are 2%, 2/100, or 0.02 more 7th graders than 8th graders that get fewer than 8 hours of sleep.
   Work should include changing numbers to percentages, decimals, or fractions in order to compare. There are three sample answers below. Any one is acceptable—not all three are needed.

   Sample answer 1: 7th graders: 3/10, which equals 30/100; 6th graders: 0.23, which is 23/100; 8th graders: 51%, which is 51/500

   Sample answer 2: 6th graders: 0.23; 7th graders: 3/10 equals 30/100, which is 0.30; 8th graders: 51%, which is 0.51
   Sample answer 3: 8th graders: 51%; 7th graders: 3/10 equals 30/100, which is 30%; 6th graders: 0.23, which is 23%

If there are 70 sixth graders, 68 seventh graders, and 76 eighth graders, complete the table below to show approximately how many students are in each category by grade.

Grade	**Fewer Than 8 Hours**	**8 Hours**	**More Than 8 Hours**
6th	*16*	*18*	*36*
7th	*20*	*17*	*31*
8th	*21*	*15*	*40*

3. Find the percentage of **the total number** of students surveyed across all three grades for each category: Fewer Than 8 Hours, 8 Hours, and More Than 8 Hours. Show all work or explain your reasoning.

   There are 214 students surveyed from all three grades. The group of fewer than 8 hours has 57 students, 8 hours has 50 students, and more than 8 hours has 107 students.
   57 ÷ 214 = 0.266 so about 27% of students surveyed get fewer than 8 hours of sleep.
   51 ÷ 214 = 0.234 so about 23% of students surveyed get 8 hours of sleep.
   107 ÷ 214 = 0.50 so about 50% of students surveyed get more than 8 hours of sleep.

Other explanations/work may be given and should be given credit if the reasoning is correct and complete.

Anna's Room (ECR)

Overview

In this extended constructed response students will have to apply properties of operations to write an expression that represents the area of a figure. Students will be asked to find the value of an unknown by applying their knowledge of equations. Students must also add, subtract, multiply, and divide rational numbers.

Standards

Use properties of operations to generate equivalent expressions.

7.EE.A.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

7.EE.B.3 Solve multistep real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

7.EE.B.4a Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.

Solve real-life and mathematical problems involving angle measure, surface area, and volume.

7.G.B.6 Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Prior to the Task

Standards Preparation: The material in the chart below illustrates the standards and sample tasks that are pre-requisites for student success with this task's standards.

Grade-Level Standard	The Following Standards Will Prepare Them:	Items to Check for Task Readiness:	Sample Remediation Items:
7.EE.A.1	• 6.EE.A.3 • 6.EE.A.4	1. Simplify the following expression: a. $4x + 2(3x + 8) + x$ i. $11x + 16$ b. $\frac{3}{4}x + \frac{1}{2}(5x + 10) - 2x$ i. $1\frac{1}{4}x + 5$ 2. http://www.illustrativemathematics.org/illustrations/541	• http://www.illustrativemathematics.org/illustrations/542 • http://www.illustrativemathematics.org/illustrations/461 • http://learnzillion.com/lessonsets/141-apply-properties-of-operations-to-linear-expressions-with-rational-coefficients-1 • http://learnzillion.com/lessonsets/126-apply-properties-of-operations-to-linear-expressions-with-rational-coefficients-2

7.EE.B.3	• 7.NS.A.3	1. Simplify: $9\frac{4}{5} - 6.25 + 3\frac{1}{3}$ *a.* $6\frac{53}{60}$ 2. http://www.illustrativemathematics.org/illustrations/108 3. http://www.illustrativemathematics.org/illustrations/478 4. http://www.illustrativemathematics.org/illustrations/1588	• http://www.illustrativemathematics.org/illustrations/298 • http://learnzillion.com/lessonsets/680-solve-complex-problems-with-positive-and-negative-rational-numbers-in-all-forms-converting-between-forms-and-assessing-the-reasonableness-of-answers • http://learnzillion.com/lessonsets/135-solve-multistep-reallife-and-mathematical-problems-with-positive-and-negative-rational-numbers-in-any-form
7.EE.B.4a	• 6.EE.B.6 • 6.EE.B.7 • 7.NS.A.3	1. Solve the following equation: *a.* *x + 8x + 24 = 60* *x = 4*	• http://www.illustrativemathematics.org/illustrations/425 • http://www.illustrativemathematics.org/illustrations/1107 • http://learnzillion.com/lessonsets/323-solving-word-problems-with-equations-and-inequalities
7.G.B.6	• 6.G.A.1 • 6.G.A.2 • 6.G.A.4	1. Find the area of the figure: 4 ft. 8 ft. 5ft. 12.25 ft. *a.* *Area: 73.25 ft²* 2. http://www.illustrativemathematics.org/illustrations/266	• http://www.illustrativemathematics.org/illustrations/647 • http://www.illustrativemathematics.org/illustrations/534 • http://learnzillion.com/lessonsets/452-find-the-area-volume-and-surface-area-of-two-and-three-dimensional-objects

Real-World Preparation: The following questions will prepare students for some of the real-world components of this task:

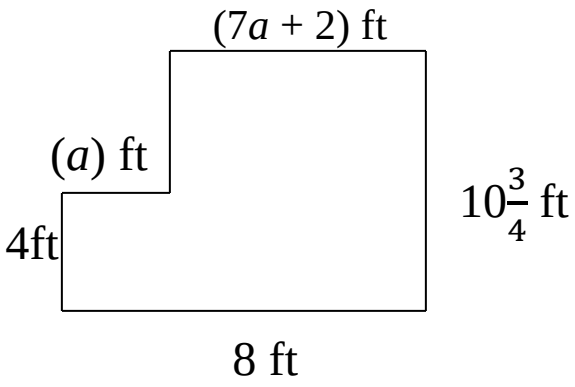
In what measurement is tile sold? Most of the time tile is sold in square feet.

After the Task

This task relates expressions and rational number operations to a real-life context. Students could go further by calculating the area of their own bedroom, and then researching the cost of tiling or carpeting their bedroom.

Student Extended Constructed Response

Use the drawing below of Anna's room to answer all of the questions.



1. Write an expression, in simplest form, that represents the area of Anna's room. Show all work.

2. Using the diagram, find the value of *a*.

3. Anna is getting a new dog, so she has decided that she needs to replace her carpet with tile. She goes to the local hardware store to figure out how many tiles she needs and how much it will cost her to tile her room. Anna finds a tile she likes and learns that each tile covers 1.25 ft². Each tile will cost Anna $1.75. Determine how many tiles Anna will need to buy in order to cover her floor. Then find out how much Anna will spend on her new floor. Justify your answer by showing all of your work or explaining your reasoning.

Extended Constructed Response Exemplar Response

1. Write an expression in simplest form that represents the area of Anna's room. Show all work.

$$\left[10\frac{3}{4}(7a+2)+4a\right]\ square\ feet$$
$$\left[75\frac{1}{4}a+21\frac{1}{2}+4a\right]\ square\ feet$$
$$\left(79\frac{1}{4}a+21\frac{1}{2}\right)\ square\ feet$$

Students may convert the fractions to decimals, or write the expression using mixed numbers. In this sample response, students would divide the complex figure into two rectangles and calculate the area of each rectangle. There is more than one way to divide the figure, but students should all end with equivalent expressions. Students might also find the area of the "whole" rectangle and subtract the "missing" rectangle in the upper left corner. This expression would be $\left(86-6\frac{3}{4}a\right)$ *square feet.*

2. Using the diagram, find the value of *a*.

Students should set up an equation. $a + 7a + 2 = 8$

$8a + 2 = 8$
$-2 \quad -2$
$8a = 6$
$8 \quad 8$
$a = \frac{3}{4}$

3. Anna is getting a new dog, so she has decided that she needs to replace her carpet with tile. She goes to the local hardware store to figure out how many tiles she needs, and how much it will cost her to tile her room. Anna finds a tile she likes and learns that each tile covers 1.25 ft². Each tile will cost Anna $1.75. Determine how many tiles Anna will need to buy in order to cover her floor. Then find out how much Anna will spend on her new floor. Justify your answer by showing all of your work or explaining your reasoning.

**Note: If students get the previous questions wrong, it could cause them to have an incorrect answer to this portion. Student work should be checked to determine if the correct procedures were used with incorrect values.*

Students should substitute ¾ in. for a and simplify the expression they wrote in question 1. Students should get an area of $80\frac{15}{16}$ *ft². Students should then divide that amount by 1.25, converting fractions to decimals (or vice versa) as needed. Students will need to round up to a whole number of tiles, so Anna will need to buy 65 tiles. If each tile costs $1.75, students should multiply $1.75 by 65. Anna will spend $113.75 to tile her room.*

$$\left(79\frac{1}{4}\left(\frac{3}{4}\right)+21\frac{1}{2}\right)\ square\ feet$$
$$59\frac{7}{16}+21\frac{1}{2}\ square\ feet$$

$$80\frac{15}{16}\ square\ feet$$

Number of tiles:

$80\frac{15}{16} \div 1.25$

$80.9375\ square\ feet \div 1.25\ square\ feet\ per\ tile = 64.75\ tiles$

Because we can only buy whole tiles, Anna needs to buy 65 tiles.

Cost of tiles:

65 tiles x $1.75 per tile = $113.75

Cookies for the Bake Sale (ECR)

Overview

Students are asked to use information from an ingredient list to answer questions about making bags of cookies for a school bake sale. They will work with multiplying fractions.

Standards

Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

7.EE.B.3 Solve multistep real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50 hour. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation*.

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality, and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions*.

Analyze proportional relationships and use them to solve real-world and mathematical problems.

7.RP.A.2 Recognize and represent proportional relationships between quantities.

b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
c. Represent proportional relationships by equations. *For example, if 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*.

7.RP.A.3 Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

Prior to the Task

Standards Preparation: The material in the chart below illustrates the standards and sample tasks that are pre-requisites for student success with this task's standards.

Grade-Level Standard	The Following Standards Will Prepare Them:	Items to Check for Task Readiness:	Sample Remediation Items:
7.EE.B.3	• 7.NS.A.3	1. What is $18.25 divided by 25? a. $0.73 2. How do you interpret 0.549 as a money amount? a. $0.55 3. http://www.illustrativemathematics.org/illustrations/108 4. http://www.illustrativemathematics.org/illustrations/478 5. http://www.illustrativemathematics.org/illustrations/1588	• http://www.illustrativemathematics.org/illustrations/298 • http://learnzillion.com/lessonsets/680-solve-complex-problems-with-positive-and-negative-rational-numbers-in-all-forms-converting-between-forms-and-assessing-the-reasonableness-of-answers • http://learnzillion.com/lessonsets/135-solve-multistep-reallife-and-mathematical-problems-with-positive-and-negative-rational-numbers-in-any-form
7.EE.B.4b	• 6.EE.B.6 • 6.EE.B.8 • 7.EE.B.4a	1. Write an inequality for a number that is no more than 8. a. n < 8 2. Write an inequality to model that 5 times a number is at least 25. a. 5n ≥ 25 3. Write an inequality to model an amount of money divided by 24 that is no more than $15. a. n ÷24 ≤ 15 4. http://www.illustrativemathematics.org/illustrations/986	• http://www.illustrativemathematics.org/illustrations/425 • http://www.illustrativemathematics.org/illustrations/642 • http://www.illustrativemathematics.org/illustrations/643 • http://learnzillion.com/lessonsets/323-solving-word-problems-with-equations-and-inequalities
7.RP.A.2b	• 6.RP.A.2 • 6.RP.A.3 • 7.RP.A.1	1. What is the constant of proportionality of 3x = y? a. 3 2. What is the constant of proportionality of 2x = y? a. 2	• http://www.illustrativemathematics.org/illustrations/77 • http://www.illustrativemathematics.org/illustrations/549 • http://www.illustrativemathematics.org/illustrations/131 • http://www.illustrativemathematics.org/illustrations/470 • http://learnzillion.com/lessonsets/367-identifying-the-constant-of-proportionality-unit-rate • http://learnzillion.com/lessonsets/136-identify-the-constant-of-proportionality-unit-rate-1
7.RP.A.2c	• 6.RP.A.2 • 6.RP.A.3 • 7.RP.A.1	1. Write an equation for the proportional relationship of 5 miles per hour with the variable *h* representing any hour and *m* representing total miles. a. 5h = m 2. Write an equation for the proportional relationship of 60 words per minute with *m* representing the minutes and *w* representing the total number of words. a. 60m = w 3. http://www.illustrativemathematics.org/illustrations/1527	• http://www.illustrativemathematics.org/illustrations/1611 • http://www.illustrativemathematics.org/illustrations/134 • http://www.illustrativemathematics.org/illustrations/498 • http://www.illustrativemathematics.org/illustrations/828 • http://learnzillion.com/lessonsets/325-represent-proportional-relationships-by-equations
7.RP.A.3	• 6.RP.A.3 • 7.RP.A.2	1. What is 5 times ½? a. 2 ½	• http://www.illustrativemathematics.org/illustrations/1175

Grade-Level Standard	The Following Standards Will Prepare Them:	Items to Check for Task Readiness:	Sample Remediation Items:
		2. What is 4 times ⅓? a. 1 ⅓ 3. http://www.illustrativemathematics.org/illustrations/106 4. http://www.illustrativemathematics.org/illustrations/105	• http://www.illustrativemathematics.org/illustrations/118 • http://www.illustrativemathematics.org/illustrations/100 • http://learnzillion.com/lessonsets/658-use-proportional-relationships-to-solve-multistep-ratio-and-percent-problems • http://learnzillion.com/lessonsets/608-use-proportional-relationships-to-solve-ratio-and-percent-problems • http://learnzillion.com/lessonsets/224-use-proportional-relationships-to-solve-multistep-ratio-and-percent-problems • http://learnzillion.com/lessonsets/55-solve-proportional-problems

Real-World Preparation: The following questions will prepare students for some of the real-world components of this task:

What is a profit? It is the money made after the price of materials is subtracted.

What information does an ingredient list of a recipe provide? It includes the items needed to make the recipe and the amount of each item needed.

After the Task

Students may misinterpret the 36 bags of cookies as 36 cookies and may adjust their ingredient list by multiplying by 1½ instead of 9. Students may try to divide the amount spent by the number of batches instead of the number of bags they are creating. They may even try to divide it per cookie. Students may need further explanation of profit in order to get started on the final question.

Student Extended Constructed Response

Suzy has the following recipe for her favorite cookies. She is going to make them for an upcoming class bake sale. The ingredients are shown in the list below.

½ cup butter	½ cup sugar
⅓ cup brown sugar	1 egg
½ tsp. vanilla	1 ½ cup flour
¼ tsp. salt	½ tsp. baking soda

1. This ingredient list allows Suzy to make 24 cookies. If 1 batch of cookies makes 4 bags, write an equation to find how many batches, *c*, are needed to fill a total number of bags, *b*. Identify the constant of proportionality in the equation you wrote.

2. Suzy has decided to make 36 **bags** of cookies for the bake sale. Rewrite the ingredient list so Suzy has the correct quantities of ingredients to make the correct number of cookies.

3. If Suzy purchases her items at a local grocery store for $15.48, how much does it cost Suzy to make one bag of cookies?

4. Suzy needs to make a profit of at least $10 for her part of the bake sale. What is the least amount she can sell each bag of her cookies for in order to make a profit of at least $10? A *profit* is the amount of money remaining after Suzy sells the cookies and takes out the money used to purchase the items to make the cookies. Write and solve an inequality for the situation. Be sure to define the variable.

Extended Constructed Response Exemplar Response

Suzy has the following recipe for her favorite cookies. She is going to make them for an upcoming class bake sale. The ingredients are shown in the list below.

½ cup butter	½ cup sugar
⅓ cup brown sugar	1 egg
½ tsp. vanilla	1 ½ cup flour
¼ tsp. salt	½ tsp. baking soda

1. This ingredient list allows Suzy to make 24 cookies. If 1 batch of cookies makes 4 bags, write an equation to find how many batches, *c*, are needed to fill a total number of bags, *b*. Identify the constant of proportionality in the equation you wrote.

   b = 4c ; the constant of proportionality is 4
2. Suzy has decided to make 36 **bags** of cookies for the bake sale. Rewrite the ingredient list so Suzy has the correct quantities of ingredients to make the correct number of cookies.

   4c = 36, c = 9; she needs to bake 9 batches
   4 ½ cups butter *4 ½ cups sugar*
   3 cups brown sugar *9 eggs*
   4 ½ tsp. vanilla *13 ½ cups flour*
   2 ¼ tsp. salt *4 ½ tsp. baking soda*
3. If Suzy purchases her items at a local grocery store for $15.48, how much does it cost Suzy to make one bag of cookies?

   $15.48 ÷ 36 = $0.43; each bag costs $0.43 to make

4. Suzy needs to make a profit of at least $10 for her part of the bake sale. What is the least amount she can sell each bag of her cookies for in order to make a profit of at least $10? A profit is the amount of money remaining after Suzy sells the cookies and takes out the money used to purchase the items to make the cookies. Write and solve an inequality for the situation. Be sure to define the variable.

   36p - $15.48 ≥ $10; p = the price per bag of cookies
   36p ≥ $10 + $15.48
   36p ≥ $25.48
   p ≥ $25.48 ÷36
   p ≥ $0.71
   She needs to sell her cookies for at least 71 cents per bag to make at least $10.

The Equation Competition (ECR)

Overview

In this task, students will be asked to determine if a set of data is proportional using a coordinate plane and a table. Students must identify the constant of proportionality when given a set of data in table form. Students will explain the meaning of ordered pairs within the context of a given situation, as well as write and solve equations based on the given information.

Standards

Analyze proportional relationships and use them to solve real-world and mathematical problems.

7.RP.A.2 Recognize and represent proportional relationships between quantities.

a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
c. Represent proportional relationships by equations. *For example, if 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*.
d. Explain what a point (*x*, *y*) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r*) where *r* is the unit rate.

Prior to the Task

Standards Preparation: The material in the chart below illustrates the standards and sample tasks that are pre-requisites for student success with this task's standards.

Grade-Level Standard	The Following Standards Will Prepare Them:	Items to Check for Task Readiness:	Sample Remediation Items:
7.RP.A.2	• 6.RP.A.2 • 6.RP.A.3 • 7.RP.A.1	• Identify the constant of proportionality for each situation. o # of People | Total Cost 6 | 14 12 | 28 24 | 56 ▪ $k = \frac{7}{3}$ o Sarah biked a constant rate of 14 mph. ▪ $k = 14$ o $y = \frac{1}{4}x$ ▪ $k = \frac{1}{4}$ • http://www.illustrativemathematics.org/illustrations/181 • http://www.illustrativemathematics.o	• http://www.illustrativemathematics.org/illustrations/82 • http://www.illustrativemathematics.org/illustrations/828 • http://www.illustrativemathematics.org/illustrations/1175 • http://www.illustrativemathematics.org/illustrations/193 • http://www.illustrativemathematics.org/illustrations/137 • http://learnzillion.com/lessonsets/612-explain-what-point-xy-on-the-graph-of-a-proportional-relationship-means • http://learnzillion.com/lessonsets/590-recognize-and-represent-proportional-relationships-interpret-a-point-on-the-graph-of-a-proportional-relationship

Grade-Level Standard	The Following Standards Will Prepare Them:	Items to Check for Task Readiness:	Sample Remediation Items:
		rg/illustrations/1527 • http://www.illustrativemathematics.org/illustrations/100 • http://www.illustrativemathematics.org/illustrations/1526	

Real-World Preparation: The following questions will prepare students for some of the real-world components of this task:

What is a Mathcounts Team? A Mathcounts Team is a group of students who attend math competitions around the state and country. The students usually practice after school with one of the math teachers at their school.

After the Task

Students may have trouble determining how to label the coordinate plane. Discuss with students the wording of the problem. If it states that one value is proportional to another value, then the first value is *y* and the second value is *x*. However, this would change if the wording discussed a ratio of two quantities (it would then be *x*:*y*). Students need to understand that a proportional relationship is the value of *y* to *x*, and need to relate this to the constant of proportionality and the unit rate.

Students may also have trouble describing the different points on the graph and how they relate to the context of the situation. Remind them that the ordered pair represents *(x, y)*, so they can use the labels of the graph or table to help determine the relationship.

Students may also struggle when trying to write an equation. Be sure students understand which value is *y* and which value is *x.* If they know the equation, $y = kx$, and they understand that *k* is the constant of proportionality, it will help them set up the equation.

Student Extended Constructed Response

Markeyah and Cameron are on the Reagan Middle School Mathcounts team. During one of their weekly practices, their teacher Mrs. Bratlie challenged them to a competition. Markeyah and Cameron had to see how many equations they could each solve correctly in 10 minutes. After the 10 minutes were up, it was discovered that Markeyah had solved four equations correctly for every three equations Cameron had solved correctly.

1. Is the number of equations Markeyah solved correctly proportional to the number of equations Cameron solved correctly? Explain your reasoning using a graph on the coordinate plane. Be sure to label the axes.

Mrs. Bratlie decided to have another pair of students try the equation competition for 20 minutes. Drake and Lakeisha were asked to solve as many equations as they each could in 20 minutes. Mrs. Bratlie recorded the number of equations each student solved correctly after 10 minutes and again after 20 minutes.

	Total Number of Questions Solved Correctly After 10 minutes	Total Number of Questions Solved Correctly After 20 minutes
Drake	18	30
Lakeisha	21	35

2. Determine the constant of proportionality if Drake's values represent the *x*-coordinates and Lakeisha's values represent the *y*-coordinates.

3. What ordered pair would represent the number of equations solved correctly by both Drake and Lakeisha when Drake solves one equation correctly?

4. Explain what the point (0, 0) represents in the context of this situation.

5. In 40 minutes, Lakeisha solved a total of 63 equations. Write and solve an equation that can be used to find the total number of equations Drake solved correctly.

Extended Constructed Response Exemplar Response

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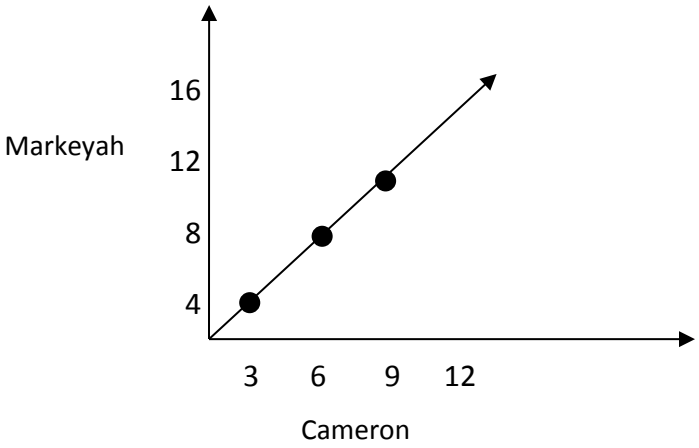
1. Is the number of equations Markeyah solved correctly proportional to the number of equations Cameron solved correctly? Explain your reasoning using a graph on the coordinate plane. Be sure to label the axes.



YES, the relationship is proportional. The graph is a straight line, and it goes through the origin.

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	Total Number of Questions Solved Correctly After 10 minutes	Total Number of Questions Solved Correctly After 20 minutes
Drake	18	30
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2. Determine the constant of proportionality if Drake's values represent the *x*-coordinates and Lakeisha's values represent the *y*-coordinates.

$k = \frac{7}{6}$ if Lakeisha's values are graphed on the y-axis and Drake's values are graphed on the x-axis.

3. What ordered pair would represent the number of equations solved correctly by both Drake and Lakeisha when Drake solves one equation correctly?

   (1, $\frac{7}{6}$); students need to know that if the x-coordinate is 1, the y-coordinate represents the unit rate (1, r).

4. Explain what the point (0, 0) represents in the context of this situation.

   Sample answer: Zero problems had been solved by Drake, so Lakeisha had not solved any problems.

5. In 40 minutes, Lakeisha solved a total of 63 equations. Write and solve an equation that can be used to find the total number of equations Drake solved correctly.

   $y = \frac{7}{6}x$; $63 = \frac{7}{6}x$; x = 54 equations; Drake solved 54 equations in 40 minutes.

Distance Between Houses (ECR)

Overview

Students will represent the locations of the houses of friends relative to the school on a number line and use that information to help find the distances between the friends' houses.

Standards

Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

7.NS.A.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

a. Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.

7.NS.A.3 Solve real-world and mathematical problems involving the four operations with rational numbers.

Prior to the Task

Standards Preparation: The material in the chart below illustrates the standards and sample tasks that are pre-requisites for student success with this task's standards.

Grade-Level Standard	The Following Standards Will Prepare Them:	Items to Check for Task Readiness:	Sample Remediation Items:
7.NS.A.1c	• 6.NS.C.7c • 7.NS.A.1b	1. What is the difference between 3 and -5? a. 8 2. What is the distance between $-2\frac{1}{3}$ and $-5\frac{3}{8}$? a. $3\frac{1}{24}\ units$ 3. http://www.illustrativemathematics.org/illustrations/314 4. http://www.illustrativemathematics.org/illustrations/317	• http://learnzillion.com/lessonsets/659-understand-subtraction-as-addition-of-additive-inverses-and-differences-in-terms-of-distance-on-the-number-line • http://learnzillion.com/lessonsets/150-understand-subtraction-of-rational-numbers-as-adding-the-additive-inverse • http://learnzillion.com/lessonsets/137-apply-properties-of-operations-to-add-and-subtract-rational-numbers-and-understanding-subtraction-of-rational-numbers-as-adding-the-additive-inverse
7.NS.A.3	• 4.OA.A.3 • 6.NS.B.3 • 7.NS.A.2c • 7.NS.A.2d • 7.NS.A.1d	1. Jonathan lives $18\frac{2}{3}$ miles from school. His mom has already driven $4\frac{1}{4}$ miles to bring him to school. How much farther does his mom have to drive before Jonathan will be at school? a. $14\frac{5}{12}\ miles$ 2. http://www.illustrativemathematics.org/illustrations/298	• http://www.illustrativemathematics.org/illustrations/1289 • http://www.illustrativemathematics.org/illustrations/374 • http://www.illustrativemathematics.org/illustrations/274 • http://learnzillion.com/lessonsets/193-solve-realworld-problems-involving-the-four-operations-with-rational-numbers-1

After the Task

Students may have difficulty using differences to find the answers to parts b and c. Have students use the number line they created in part a to help them find the distance. Then have students explain how the distance they found on the number line can be expressed as a sum or difference, making the connection to the absolute value of the difference between the numbers.

Also, the task found at http://www.illustrativemathematics.org/illustrations/591 can be used after this task for additional practice.

Student Extended Constructed Response

Aakash, Bao Ying, Chris, and Donna all live on the same street as their school. The street runs from east to west. .

- Aakash lives 5 ½ blocks to the west of the school.
- Bao Ying lives 4 ¼ blocks to the east of the school
- Chris lives 2 ¾ blocks to the west of the school.
- Donna lives 6 ½ blocks to the east of the school.

Use this information to complete the following.

a. Represent the relative position of the houses on a number line with the school at zero, points to the west represented by negative numbers, and points to the east represented by positive numbers.

b. How far does Bao Ying live from Aakash? Show how you arrived at your answer using sums or differences.

c. Donna says she lives 3 ¾ blocks away from Chris. Is she correct? Explain your reasoning using the number line or by using sums or differences.

Extended Constructed Response Exemplar Response

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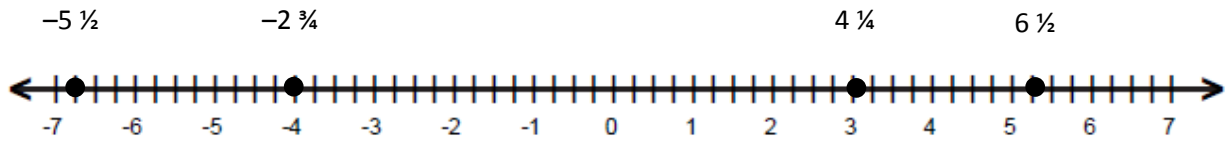

b. How far does Bao Ying live from Aakash? Show how you arrived at your answer using sums or differences.

4 ¼ – (–5 ½) = 9 ¾

Bao Ying lives 9 ¾ blocks from Aakash.

c. Donna says she lives 3 ¾ blocks away from Chris. Is she correct? Explain your reasoning using the number line or by using sums or differences.

Donna is not correct. Donna lives 9 ¼ blocks from Chris. To find the distance between two points on the number line, you can find the absolute value of the difference between the values of the two points.
|6 ½ – (–2 ¾)| = |6 ½ + 2 ¾| = 9 ¼.
Other valid explanations may also be accepted.