Name ______________________________ Date ________________

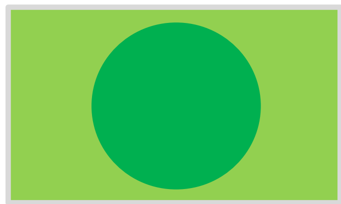
1. It is a Saturday morning and Jeremy has discovered he has a leak coming from the water heater in his attic. Since plumbers charge extra to come out on weekends, Jeremy is planning to use buckets to catch the dripping water. He places a bucket under the drip and steps outside to walk the dog. In half an hour, the bucket is $\frac{1}{5}$ of the way full.

   a. What is the rate at which the water is leaking per hour?

   b. Write an equation that represents the relationship between the number of buckets filled, y, in x hours.

   c. What is the longest that Jeremy can be away from the house before the bucket will overflow?

2. Farmers often plant crops in circular areas because one of the most efficient watering systems for crops provides water in a circular area. Passengers in airplanes often notice the distinct circular patterns as they fly over land used for farming. A photographer takes an aerial photo of a field on which a circular crop area has been planted. He prints the photo out and notes that 2 centimeters of length in the photo corresponds to 100 meters in actual length.



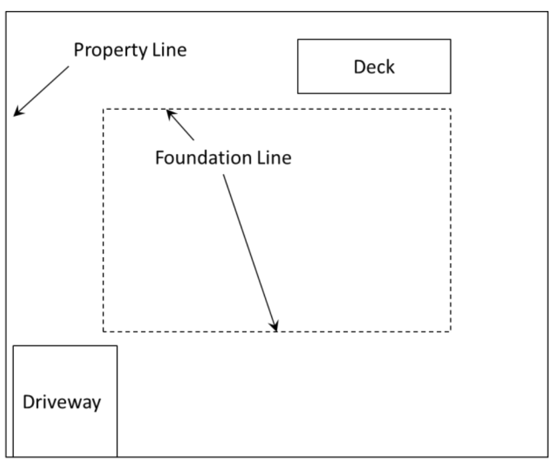
   a. What is the scale factor of the actual farm to the photo?

   b. If the dimensions of the entire photo are 25 cm by 20 cm, what are the actual dimensions of the rectangular land area in meters captured by the photo?

   c. If the area of the rectangular photo is 5 cm^2, what is the actual area of the rectangular area in square meters?

3. A store is having a sale to celebrate President's Day. Every item in the store is advertised as one fifth off the original price. If an item is marked with a sale price of $\$140$, what was its original price? Show your work.

4. Over the break, your uncle and aunt ask you to help them cement the foundation of their newly purchased land and give you a top-view blueprint of the area and proposed layout. A small legend on the corner states that 4 inches of the length corresponds to an actual length of 52 feet.



a. What is the scale factor of the actual foundation to the blueprint?

b. If the dimensions of the foundation on the blueprint are 11 inches by 13 inches, what are the actual dimensions in feet?

c. You are asked to go buy bags of dry cement and know that one bag covers 350 square feet. How many bags do you need to buy to finish this project?

d. After the first 15 minutes of laying down the cement, you had used $\frac{1}{5}$ of the bag. What is the rate you are laying cement in bags per hour? What is the unit rate?

e. Write an equation that represents the relationship between the number of bags used, y, in x hours.

f. Your uncle is able to work faster than you. He uses 3 bags for every 2 bags you use. Is the relationship proportional? Explain your reasoning using a graph on a coordinate plane.

g. What does $(0,0)$ represent in terms of the situation being described by the graph created in part (f)?

h. Using a graph, show how many bags you would have used if your uncle used 18 bags.

A Progression Toward Mastery					
Assessment Task Item		STEP 1 Missing or incorrect answer and little evidence of reasoning or application of mathematics to solve the problem.	STEP 2 Missing or incorrect answer but evidence of some reasoning or application of mathematics to solve the problem.	STEP 3 A correct answer with some evidence of reasoning or application of mathematics to solve the problem, <u>or</u> an incorrect answer with substantial evidence of solid reasoning or application of mathematics to solve the problem.	STEP 4 A correct answer supported by substantial evidence of solid reasoning or application of mathematics to solve the problem.
1	a 7.RP.A.1	Student answered rate incorrectly and showed no or very limited calculations.	Student set the problem up incorrectly resulting in an incorrect rate.	Student set the problem up correctly but made minor mistakes in the calculation.	Student correctly set up the problem and calculated the rate as $\frac{2}{5}$ buckets per hour.
	b 7.RP.A.1 7.RP.A.2c 7.EE.B.4a	Student was unable to write an equation or wrote an equation that was not in the form $y = kx$ or even $x = ky$ for any value k.	Student wrote an incorrect equation, such as $y = \frac{5}{2}x$ or $x = \frac{2}{5}y$, and/or used an incorrect value of unit rate from part (a) to write their equation in the form $y = kx$.	Student created an equation using the constant of proportionality, but wrote the equation in the form $x = \frac{5}{2}y$ or some other equivalent equation.	Student correctly answered $y = \frac{2}{5}x$.
	c 7.RP.A.1 7.RP.A.2c 7.EE.B.4a	Student answer is incorrect. Little or no evidence of reasoning is given.	Student answer is incorrect, but shows some evidence of reasoning and usage of an equation for the proportional relationship (though the equation itself may be incorrect).	Student correctly answers 2.5 hours but with minor errors in the use of and calculations based on the equation $y = \frac{2}{5}x$.	Student correctly answers 2.5 hours with correct work and the calculations were based on the equation $y = \frac{2}{5}x$.
2	a 7.G.A.1	Student is unable to answer or the answer gives no evidence of understanding the fundamental concept of scale factor as a ratio comparison of corresponding lengths between the image and the actual object.	Student incorrectly calculates the scale factor to be $2:100$, $1:150$, or $\frac{1}{50}$. The answer expresses scale factor as a comparison of corresponding lengths, but does not show evidence of choosing the same measurement unit to make the comparison.	Student correctly calculates the scale factor to be $1:5000$ or $\frac{1}{5000}$, but has a minor error in calculations or notation. For example, student writes $\frac{1}{5000}$ *cm*.	Student correctly calculates the scale factor to be $1:5000$ or $\frac{1}{5000}$ with correct calculations and notation.

	b **7.G.A.1**	Student answers incorrectly and gives little or no evidence of understanding scale factor.	Student shows some evidence of reasoning, but makes one or more calculation errors thereby providing an incorrect answer.	Student correctly answers the actual dimensions as $1{,}250\ m \times 1{,}000\ m$, but does not show work to support their answer.	Student correctly answers the actual dimensions as $1{,}250$ m$\times$ $1{,}000$ m with correct calculations.
	c **7.G.A.1**	Student answers incorrectly and gives little or no evidence of understanding scale factor.	Student shows some evidence of reasoning, but makes one or more calculation errors thereby providing an incorrect answer.	Student correctly answers the actual area as $1{,}250{,}000\ m^2$, but does not show work to support their answer.	Student correctly answers the actual area as$1{,}250{,}000\ m^2$ with correct calculations.
3	**7.RP.A.3**	Student answer is missing or incorrect. Student shows little or no evidence of reasoning.	Student answers the original price incorrectly, but only provides some evidence of reasoning.	Student shows solid evidence of reasoning, but makes minor errors in calculations or representations. The answer may or may not be accurate.	Student correctly answers the original price as $\$175$; student's work demonstrates solid reasoning and calculations were made without error.
4	**a** **7.G.A.1**	Student answers incorrectly. No or little evidence of understanding scale factor is shown.	Student incorrectly answers the scale factor to be $\frac{4}{52}$ or another incorrect response. Limited calculations are shown.	Student incorrectly answers the scale factor to be $\frac{1}{13}$ or one other minor error in calculations.	Student correctly answers the scale factor to be $\frac{1}{156}$ with correct calculations.
	b **7.G.A.1**	Student answers both of the actual dimensions incorrectly. No or little evidence of understanding scale factor is shown.	Student correctly answers at least one of the dimensions correctly with errors in calculations.	Student correctly answers the actual dimensions as 143 feet $\times$ 169 feet with one or two minor errors in calculations.	Student correctly answers the actual dimensions as 143 feet $\times$ 169 feet with correct calculations.
	c **7.RP.A.2** **7.RP.A.3**	Student answers incorrectly with no or little evidence of understanding scale factor shown.	Student answers incorrectly, but showed some understanding of scale factor in calculations.	Student incorrectly answers 69 bags OR correctly answers 70 bags with one or two minor errors in calculations.	Student correctly answers 70 bags with correct calculations.
	d **7.RP.A.1** **7.RP.A.2b**	Student answered rate incorrectly and showed no or very limited calculations.	Student set the problem up incorrectly resulting in an incorrect rate.	Student set the problem up correctly, but made minor mistakes in the calculation.	Student correctly stated the rate as $\frac{4}{5}$ bags per hour AND identified the unit rate as $\frac{4}{5}$ with correct problem setup and calculations.

	e **7.RP.A.2c** **7.EE.B.4a**	Student was unable to write an equation or wrote an equation that was not in the form $y = kx$ or even $x = ky$ for any value k.	Student wrote an incorrect equation, such as $y = \frac{5}{4}x$, or $x = \frac{4}{5}y$, and/or used an incorrect value of unit rate from part (d) to write an their equation in the form $y = kx$.	Student created an equation using the constant of proportionality, but wrote the equation in the form $x = \frac{5}{4}y$ or some other equivalent equation.	Student correctly answered $y = \frac{4}{5}x$.
	f **7.RP.A.2**	Student may or may not have answered that the relationship was proportional. Student was unable to provide a complete graph. Student was unable to relate the proportional relationship to the graph.	Student may or may not have answered that the relationship was proportional. Student provided a graph with mistakes (i.e., unlabeled axes, incorrect points). Student provided a limited expression of reasoning.	Student correctly answered that the relationship was proportional. Student labeled the axes but plotted points with minor error. Student explanation was slightly incomplete.	Student correctly answered that the relationship was proportional. Student correctly labeled the axes and plotted the graph on the coordinate plane. Student reasoned that the proportional relationship was due to the graph being straight and going through the origin.
	g **7.RP.A.2d**	Student was unable to describe the situation correctly.	Student was able to explain that the zero was the amount of bags used by either him or the uncle, but unable to describe the relationship.	Student describes the relationship correctly, but with minor error.	Student correctly explains that $(0,0)$ represents when he used zero bags, the uncle doesn't use any bags.
	h **7.RP.A.2**	Student answers incorrectly and shows no or little understanding of analyzing graphs.	Student answers incorrectly, but shows some understanding of analyzing graphs.	Student correctly answers 12 bags, but does not identify the point on the graph clearly.	Student correctly answers 12 bags by identifying the point on the graph.

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1. It is a Saturday morning and Jeremy has discovered he has a leak coming from the water heater in his attic. Since plumbers charge extra to come out on weekends, Jeremy is planning to use buckets to catch the dripping water. He places a bucket under the drip and steps outside to the walk the dog. In half an hour, the bucket is $\frac{1}{5}$ of the way full.

   a. What is the rate at which the water is leaking per hour?

   rate: $\dfrac{\frac{1}{5}\text{ bucket}}{\frac{1}{2}\text{ hour}} = \frac{1}{5} \div \frac{1}{2}$ buckets/hr

   $= \frac{2}{5}$ buckets/hr

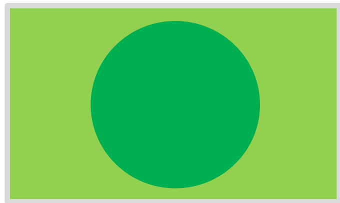
   b. Write an equation that represents the relationship between the number of buckets filled, y, in x hours.

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

   c. What is the longest that Jeremy can be away from the house before the bucket will overflow?

   $\frac{5}{2}$ or $2\frac{1}{2}$ hours

2. Farmers often plant crops in circular areas because one of the most efficient watering systems for crops provides water in a circular area. Passengers in airplanes often notice the distinct circular patterns as they fly over land used for farming. A photographer takes an aerial photo of a field on which a circular crop area has been planted. He prints the photo out and notes that 2 centimeters of length in the photo corresponds to 100 meters in actual length.



a. What is the scale factor of the actual farm to the photo?

2cm to 100 m
1 cm to 50 m
1 cm to 5000 cm

1: 5000
or 1|5000

b. If the dimensions of the entire photo are 25 cm by 20 cm, what are the actual dimensions of the rectangular land area in meters captured by the photo?

$25\text{cm} \times 50 \frac{\text{m}}{\text{cm}} = 1250$ meters

by $20\text{cm} \times 50 \frac{\text{m}}{\text{cm}} = 1000$ meters

1250 m by 1000 m

c. If the area of the rectangular photo is 5 cm^2, what is the actual area of the rectangular area in square meters?

Method 1

Scale Factor $= \frac{1}{5000}$

Area Scale drawing $= 5\text{cm}^2$

$5\text{ cm}^2 = .05\text{m}^2$

Area Scale = (Scale factor)^2(Area Actual)

$.05 = \left(\frac{1}{5000}\right)^2$(Area Actual)

$(.05)(5000^2) =$ Area Actual

1,250,000 = Area Actual

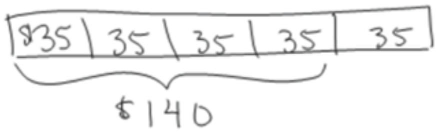
Method 2

Use part(b)

$1250 \cdot 1000$

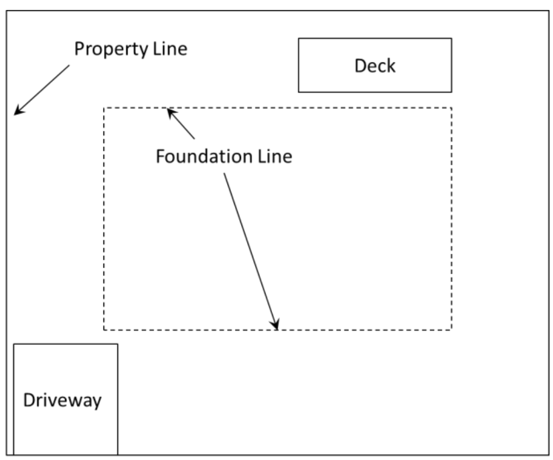
1,250,000

3. A store is having a sale to celebrate President's Day. Every item in the sore is advertised as one fifth off the original price. If an item is marked with a sale price of $\$140$, what was its original price? Show your work.



original price = $ 175

4. Over the break, your uncle and aunt ask you to help them cement the foundation of their newly purchased land and give you a top-view blueprint of the area and proposed layout. A small legend on the corner states that 4 inches of the length corresponds to an actual length of 52 feet.



a. What is the scale factor of the actual foundation to the blueprint?

4 in. to 52 ft.

1 in. to 13 ft.

1 in. to 156 in.

$13 \text{ ft.} \times \frac{12 \text{ in.}}{1 \text{ ft.}} = 156 \text{ in.}$

The scale factor is 1/156

b. If the dimensions of the foundation on the blueprint are 11 inches by 13 inches, what are the actual dimensions?

$$11 \text{ in} \times \frac{13 \text{ ft}}{\text{in}} = 143 \text{ ft}$$

$$13 \text{ in} \times \frac{13 \text{ ft}}{\text{in}} = 169 \text{ ft}$$

143 ft by 169 ft

c. You are asked to go buy bags of dry cement and know that one bag covers 350 square feet. How many bags do you need to buy to finish this project?

Area:

$$\begin{array}{r} 143 \\ \times 169 \\ \hline 1287 \\ 8580 \\ 14300 \\ \hline 24167 \end{array}$$

1 bag	350 ft²
10 bags	3500 ft²
50 bags	17500
60 bags	21,000 ft
70 bags	24,500

×5 ×5

70 bags

d. After the first 15 minutes of laying down the cement, you had used $\frac{1}{5}$ of the bag. What is the rate you are laying cement in bags per hour? What is the unit rate?

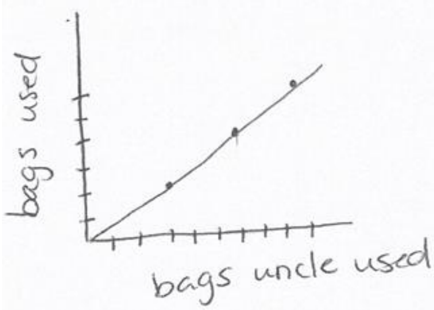
$$\frac{\frac{1}{5} \text{ bag}}{\frac{1}{4} \text{ hour}} = \frac{1}{5} \cdot \frac{4}{1} \text{ bags/hr} = \frac{4}{5} \frac{\text{bags}}{\text{hr}}$$

$$\text{unit rate} = \frac{4}{5}$$

e. Write an equation that represents the relationship between the number of bags, y, in x hours.

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

f. Your uncle is able to work faster than you. He uses 3 bags for every 2 bags you use. Is the relationship proportional? Explain your reasoning using a graph on a coordinate plane.

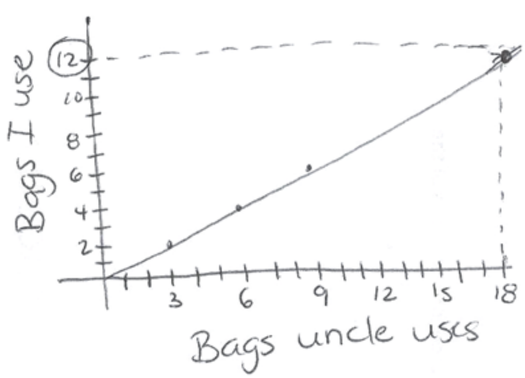


yes, the relationship is proportional, the graph is a straight line through the point (0,0).

g. What does $(0,0)$ represent in terms of the situation being described by the graph created in part (f)?

If my uncle uses 0 bags, I also use 0 bags.

h. Using a graph, show how many bags you would have used if your uncle used 18 bags.



12 bags