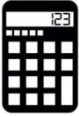


Name: \_\_\_\_\_

Date: \_\_\_\_\_



## PROPORTIONAL VARIABLES N-GEN MATH® 8



As you learned in Math 7, two variables are **proportional** if their **ratio** is a **constant**.

### PROPORTIONAL VARIABLES

Two variables, say  $x$  and  $y$ , are proportional if  $\frac{y}{x} = k$ , where  $k$  is a constant value known as the **constant of proportionality**. This equation is **equivalent** to saying that the **value of  $y$**  will always be  **$k$ -times the value of  $x$** , or  $y = kx$ .

**Exercise #1:** In science class, Maria measures the distance two objects have traveled at certain times. The results are shown in the table below.

time, $t$ (seconds)	2	6	8	12	14
Object #1 Distance, in feet, $d_1$	9	24	30	42	45.5
Object #2 Distance, in feet, $d_2$	7	21	28	42	49

- (a) One of the two objects has a distance that is proportional to the time it has been traveling. Determine which one and explain.
- (b) For the object whose distance is proportional to time, what is the constant of proportionality? Include proper units.
- (c) What is the meaning of the constant you found in (b)? What does it tell you about the object?
- (d) Write an equation for the object's distance,  $d$ , given the time,  $t$ , it has traveled for the object from (b). Use it to predict how far the object has moved in 20 seconds.

If we know that two variables, or quantities, are proportional, then any pair of their values will allow us to find other pairs.

**Exercise #2:** At a gas station, the total cost of gasoline is proportional to the number of gallons purchased. If 8 gallons of gas cost \$30.32, then how much will 10 gallons of gas cost? Set up and solve an equation to find the answer.



A common situation where quantities are proportional occurs when **images** are **scaled up** or **down**. The lengths of the new image are always proportional to the lengths of the older image.

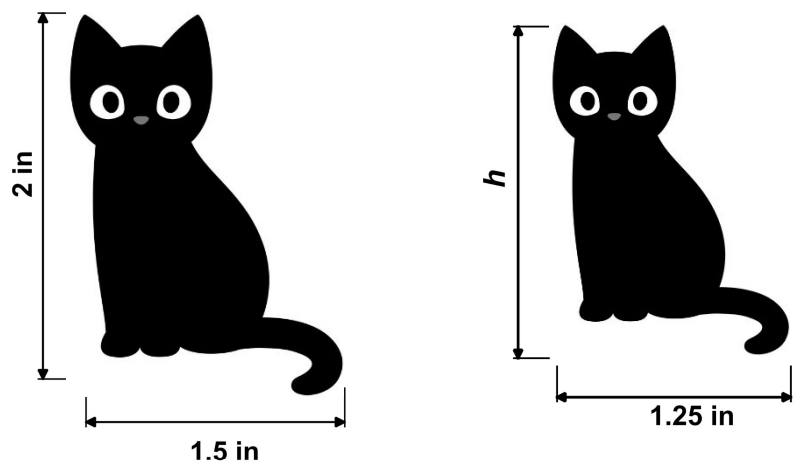
**Exercise #3:** A rectangular image was originally 2 inches by 5 inches as shown. It was scaled up in size so that its smaller dimension is now 6 inches.



- (a) Lengths in image 2 will be how many times greater than lengths in image 1?      (b) What is the longer dimension of the rectangle in image 2?

In this case of image scaling it was easy to see what the **scaling constant** was. But, we do not always scale by a whole number factor.

**Exercise #4:** An image of a cat was originally 1.5 inches wide and 2 inches tall. It was scaled down slightly such that its new width is 1.25 inches. What is its new height,  $h$ , to the nearest hundredth of an inch?

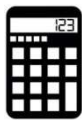


**Exercise #5:** On a set of architectural plans, 2 inches on the drawing is scaled to 17 feet in real distance. If the plans included a building that was 130 feet tall, how tall was it on the plans in inches? Round to the nearest tenth of an inch.



Name: \_\_\_\_\_

Date: \_\_\_\_\_



## PROPORTIONAL VARIABLES N-GEN MATH<sup>®</sup> 8 HOMEWORK

### FLUENCY

1. When two variables are proportional which of the following is constant?

- (1) their sum                      (3) their product  
(2) their ratio                      (4) their difference
- \_\_\_\_\_

2. The variables  $a$  and  $b$  are proportional. When  $a = 12$  we know that  $b = 3$ . What is the value of  $a$  when  $b = 5$ ?

- (1) 9                                  (3) 17  
(2) 14                                (4) 20
- \_\_\_\_\_

### USING YOUR MATH

3. A food truck is selling hamburgers. The total cost of buying hamburgers is proportional to the number of burgers purchased. It is known that five burgers cost a total of \$21.25.

- (a) How much does one burger cost?              (b) How much do seven burgers cost?

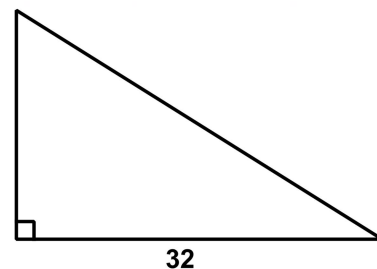
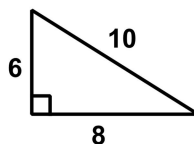
4. The distance a circular wheel rolls in one complete turn is proportional to the diameter of the wheel. A small wheel with a diameter of 5 inches will roll approximately 15.7 inches. Which of the following is closest to the distance an 18-inch diameter wheel will roll in one complete turn? Show your work.

- (1) 28.7 inches                      (3) 56.5 inches  
(2) 48.3 inches                      (4) 67.1 inches
- \_\_\_\_\_

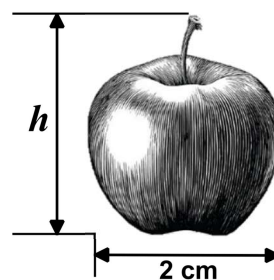
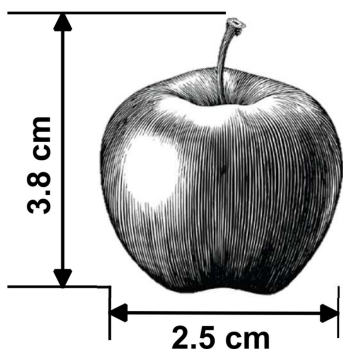


5. The right triangle on the left has been scaled to produce the larger triangle on the right.

Fill in the two missing lengths of the larger triangle. Explain how you found the side lengths.



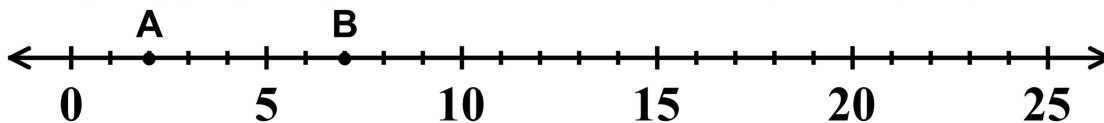
6. The image of the apple below has been scaled down such that its width is now 2 cm.



Is its new height,  $h$ , greater than or less than 3 centimeters? Show how you found your answer.

## REASONING

7. On the number line below, points A and B have been plotted at 2 and at 7.



- (a) Map (transform) each point such that its distance from the origin (zero) is three times its original distance. Label the image points A' and B'.
- (b) How does the distance between A' and B' compare to the distance between A and B.

