

# Writing Equations for Proportional Relationships

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

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

Score: \_\_\_\_\_ / 18

This is where all of Chapter 3 comes together in one neat package: the equation  $y = kx$ . It says that  $y$  is always a constant multiple of  $x$ , and that multiplier is  $k$ —the constant of proportionality you already know how to find. Pull  $k$  from a table, a graph, or a word problem, write the equation, and you can predict *any* missing value. Think of  $y = kx$  as the bridge that turns a pattern you notice into algebra you can use!

## Key Concepts & Quick Review

**From a table:**  $k = \frac{y}{x}$ , then write  $y = kx$ . **From a graph:** read any point  $(x, y)$ ;  $k = \frac{y}{x}$ ; write  $y = kx$ .

**From a description:** identify the two quantities and the constant rate. Let  $x$  = independent quantity,  $y$  = dependent quantity,  $k$  = rate. Then  $y = kx$ . Use the equation to predict any value.

## Examples

① A table shows hours worked ( $x$ ) and pay ( $y$ ): (1, \$12.50), (3, \$37.50), (5, \$62.50). Write an equation and find pay for 8 hours.

**Think It Through:** Find the constant of proportionality by dividing pay by hours. Using any point,  $k = \frac{12.50}{1} = 12.50$ . That means the pay equation is  $y = 12.5x$ . Once the equation is written, substitute  $x = 8$ :  $y = 12.5 \times 8 = 100$ . So the pay for 8 hours is \$100. The equation is a shortcut that lets you find any value in the pattern.

**Answer:**  $y = 12.5x$ ; \$100 for 8 hours

② A recipe uses  $\frac{2}{3}$  cup of olive oil per serving. Write an equation for the total oil  $y$  needed for  $x$  servings. How much oil is needed for 15 servings? For  $\frac{3}{2}$  servings?

**Think It Through:** The recipe uses  $\frac{2}{3}$  cup for each serving, so the constant of proportionality is  $k = \frac{2}{3}$ . That means the equation is  $y = \frac{2}{3}x$ , where  $x$  is servings and  $y$  is cups of oil. For 15 servings,  $y = \frac{2}{3} \times 15 = 10$  cups. For  $\frac{3}{2}$  servings,  $y = \frac{2}{3} \times \frac{3}{2} = 1$  cup. The same equation works whether the number of servings is a whole number or a fraction.

**Answer:**  $y = \frac{2}{3}x$ ; 10 cups for 15 serv.; 1 cup for  $\frac{3}{2}$  serv.

## Practice Problems




Write the equation  $y = kx$  using the given information, or evaluate the equation for the given value.

- Write the equation  $y = kx$  when  $k = 4$ , \_\_\_\_\_ then find  $y$  for  $x = 6$ .
- Write the equation  $y = kx$  when  $k = 7$ , \_\_\_\_\_ then find  $y$  for  $x = 9$ .
- Write the equation  $y = kx$  when  $k = 2.5$ , \_\_\_\_\_ then find  $y$  for  $x = 8$ .
- Write the equation  $y = kx$  when  $k = \frac{1}{4}$ , \_\_\_\_\_ then find  $y$  for  $x = 20$ .



5. Use  $y = kx$  with  $k = 3$  and  $y = 24$  to find  $x$ .
6. Use  $y = kx$  with  $k = 6$  and  $y = 42$  to find  $x$ .
7. Use  $y = kx$  with  $k = 0.5$  and  $y = 3.5$  to find  $x$ .
8. Use  $y = kx$  with  $k = \frac{3}{5}$  and  $y = 12$  to find  $x$ .
9. The point  $(2, 10)$  lies on  $y = kx$ . Find  $k$  and write the equation.
10. The point  $(4, 6)$  lies on  $y = kx$ . Find  $k$  and write the equation.
11. The point  $(5, \frac{5}{3})$  lies on  $y = kx$ . Find  $k$  and write the equation.
12. The point  $(9, 27)$  lies on  $y = kx$ . Find  $k$  and write the equation.
13. Use the equation  $y = 8x$  to find  $y$  when  $x = 3.5$ .
14. Use the equation  $y = \frac{2}{3}x$  to find  $y$  when  $x = 9$ .
15. Use the equation  $y = 1.2x$  to find  $y$  when  $x = 15$ .

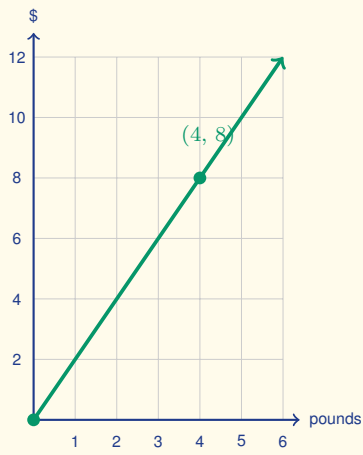
### Study Tips

-  The equation  $y = kx$  is the **algebraic form** of a proportional relationship. Every table, graph, and word problem in this chapter leads to exactly this form.
-  Always define your **variables with units** before writing the equation: “Let  $x =$  hours,  $y =$  miles,  $k = 55$  mph,” then  $y = 55x$ .
-  Use the equation to **work backwards**: if you know  $y$  and  $k$ , solve  $x = \frac{y}{k}$  — this is just a proportion in disguise.

### Word Problems

16. A printing press produces 1,800 pages in  $\frac{3}{4}$  of an hour. Let  $x$  be the time in hours and  $y$  the total pages printed. Find  $k$ , write the equation, and determine how many pages are printed in a 7.5-hour shift. How many minutes does it take to print 600 pages? \_\_\_\_\_
17. Three friends each run at a constant speed. Amir runs  $2$  mi in  $\frac{1}{4}$  hour. Bea runs  $9$  mi in  $\frac{3}{4}$  hour. Carlos's equation is  $y = 11x$  where  $y$  is miles and  $x$  is hours. Write equations for Amir and Bea, identify who is fastest and who is slowest, and find how far each person runs in 2 hours. \_\_\_\_\_
18. This graph shows the cost in dollars of buying  $x$  pounds of trail mix. Use the highlighted lattice point to write the equation that models the relationship in the form  $y = kx$ , and use it to find the cost of 9 pounds of trail mix.





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## Answer Keys

1) 24

2) 63

3) 20

4) 5

5) 8

6) 7

7) 7

8) 20

9) 5

10) 1.5

11)  $\frac{1}{3}$ 

12) 3

13) 28

14) 6

15) 18

16)  $k = 2400$  pages/hr;  $y = 2400x$ ; 18,000 pages; 15 min17) Amir:  $y = 8x$ ; Bea:  $y = 12x$ ; Bea fastest; Amir slowest; 16, 24, and 22 mi18)  $k = 2$ ;  $y = 2x$ ; \$18

### Step-by-Step Explanations

*Tutoring notes not found for this topic.*



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