

# Direct Variation

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 26

## Q Quick Review

In **direct variation**, two quantities change by a constant ratio:  $y = kx$ . The number  $k$  is the **constant of variation**. A direct-variation graph is a line through the origin, and the slope is  $k$ . To find  $k$ , use  $k = \frac{y}{x}$  from any nonzero point. If a table has a constant  $y/x$  ratio and includes the origin when graphed, it represents direct variation.

## PRACTICE

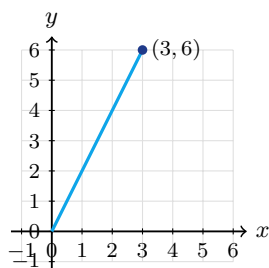
Find the direct-variation constant or write the model.

- |   |       |   |       |
|---|-------|---|-------|
| 1. $y = 5x$ ; $k$                             | _____ | 12. Line $y = 2x + 5$ ; direct?   | _____ |
| 2. $y = -3x$ ; $k$                            | _____ | 13. If $y$ varies directly with $x$ and $y = 18$ when $x = 6$ , $k$   | _____ |
| 3. $(x, y) = (4, 20)$ ; $k$                   | _____ | 14. A printing machine follows the same direct-variation model from the previous item, $y = 3x$ . What output $y$ belongs with input $x = 10$ ? | _____ |
| 4. $(x, y) = (-2, 10)$ ; $k$                  | _____ | 15. If $y = 12$ when $x = 8$ , $y$ when $x = 2$   | _____ |
| 5. $k = 7$ ; model                            | _____ | 16. Does $(5, 0)$ fit a nonzero direct variation?   | _____ |
| 6. $k = \frac{1}{2}$ ; model                  | _____ | 17. Direct variation with slope $-2$  | _____ |
| 7. $y = 4x$ ; $y$ when $x = 9$                | _____ | 18. If $x$ doubles, $y$ does what in $y = 9x$ ?   | _____ |
| 8. $y = 6x$ ; $x$ when $y = 42$               | _____ | 19. Ratio $y/x = 0.75$ ; model  | _____ |
| 9. Table $(1, 3), (2, 6), (3, 9)$ ; direct?   | _____ | 20. Point $(12, 30)$ ; direct model   | _____ |
| 10. Table $(1, 4), (2, 7), (3, 10)$ ; direct? | _____ |   |       |
| 11. Line through $(0, 0)$ and $(3, 12)$ ; $k$ | _____ |   |       |

## ◆ VISUAL PRACTICE

Use the graph, table, chart, or diagram to answer the question.

21. The line shows direct variation. What is the constant of variation?



Answer: \_\_\_\_\_

22. The table shows direct variation. Write the equation.

|     |   |    |    |    |
|-----|---|----|----|----|
| $x$ | 1 | 2  | 3  | 4  |
| $y$ | 5 | 10 | 15 | 20 |

Answer: \_\_\_\_\_



## ◆ Word Problems

23. A printer prints 18 pages in 3 minutes at a steady rate. Write a direct-variation model for pages  $p$  after  $m$  minutes. \_\_\_\_\_

24. A recipe uses 2 cups of flour for every 3 cups of oats. Write flour  $f$  as a function of oats  $o$ . \_\_\_\_\_

25. A car travels 65 miles in one hour at constant speed. Write distance  $d$  after  $t$  hours and find  $d$  when  $t = 4$ . \_\_\_\_\_

26. A store sells apples at \$1.80 per pound. Write the cost  $C$  for  $p$  pounds and find the cost of 6 pounds. \_\_\_\_\_



## Answer Keys

- |   |   |
|---|---|
| 1. <input type="text" value="5"/>         | 14. <input type="text" value="30"/>                 |
| 2. <input type="text" value="-3"/>        | 15. <input type="text" value="3"/>                  |
| 3. <input type="text" value="5"/>         | 16. <input type="text" value="no"/>                 |
| 4. <input type="text" value="-5"/>        | 17. <input type="text" value="y = -2x"/>            |
| 5. <input type="text" value="y = 7x"/>    | 18. <input type="text" value="doubles"/>            |
| 6. <input type="text" value="y = 1/2 x"/> | 19. <input type="text" value="y = 0.75x"/>          |
| 7. <input type="text" value="36"/>        | 20. <input type="text" value="y = 2.5x"/>           |
| 8. <input type="text" value="7"/>         | 21. <input type="text" value="2"/>                  |
| 9. <input type="text" value="yes"/>       | 22. <input type="text" value="y = 5x"/>             |
| 10. <input type="text" value="no"/>       | 23. <input type="text" value="p = 6m"/>             |
| 11. <input type="text" value="4"/>        | 24. <input type="text" value="f = 2/3 o"/>          |
| 12. <input type="text" value="no"/>       | 25. <input type="text" value="d = 65t; 260 miles"/> |
| 13. <input type="text" value="3"/>        | 26. <input type="text" value="C = 1.80p; \$10.80"/> |

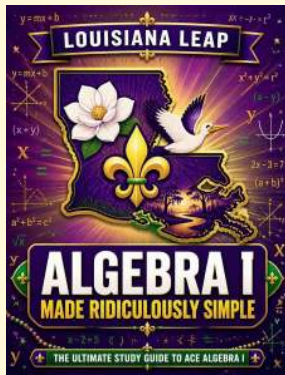
### Step-by-Step Tutor Notes

1. Focus on the main idea of the problem, then simplify carefully. The coefficient of  $x$  is the constant of variation. So the answer is 5.
2. This is a good place to slow down, check the notation, and simplify cleanly. Direct variation can have a negative constant. So the answer is  $-3$ .
3. This is a good place to slow down, check the notation, and simplify cleanly.  $k = \frac{20}{4} = 5$ . So the answer is 5.
4. Take it one clear step at a time and keep the original question in mind.  $k = \frac{-10}{2} = -5$ . So the answer is  $-5$ .
5. Start with the definition the problem is testing, then apply it directly. Direct variation always has form  $y = kx$ . So the answer is  $y = 7x$ .
6. Take it one clear step at a time and keep the original question in mind. Place  $k$  in front of  $x$ . So the answer is  $y = \frac{1}{2}x$ .
7. Focus on the main idea of the problem, then simplify carefully.  $y = 4(9) = 36$ . So the answer is 36.
8. This is a good place to slow down, check the notation, and simplify cleanly. Solve  $42 = 6x$ . So the answer is 7.
9. This is a good place to slow down, check the notation, and simplify cleanly. The ratio  $y/x$  is always 3. So the answer is yes.
10. This is a good place to slow down, check the notation, and simplify cleanly. The ratios are not equal, so it is not direct variation. So the answer is no.
11. Line up the two changes first; that keeps the rate from getting mixed up. The slope is  $\frac{12}{3} = 4$ . So the requested value is 4.
12. Use the clue in the question first, then let the arithmetic finish the job. A direct variation line must pass through the origin. So the answer is no.
13. This is a good place to slow down, check the notation, and simplify cleanly.  $k = \frac{18}{6} = 3$ . So the answer is 3.
14. This is a good place to slow down, check the notation, and simplify cleanly. Use the direct-variation model  $y = 3x$ . When  $x = 10$ ,  $y = 3(10) = 30$ . So the answer is 30.
15. Start with the definition the problem is testing, then apply it directly.  $k = \frac{12}{8} = \frac{3}{2}$ , so  $y = \frac{3}{2}(2) = 3$ . So the answer is 3.
16. First identify the feature of the graph or equation that matches the wording of the question. If  $x = 5$  and  $y = 0$ , then  $k = 0$ , the zero function. That leads to no.
17. Line up the two changes first; that keeps the rate from getting mixed up. Slope and constant of variation are the same. So the requested value is  $y = -2x$ .
18. Keep the order of operations in view, then simplify without skipping the sign check. Multiplying  $x$  by 2 also multiplies  $y$  by 2. After simplifying, the answer is doubles.
19. Focus on the main idea of the problem, then simplify carefully. The constant ratio is  $k = 0.75$ . So the answer is  $y = 0.75x$ .
20. Take it one clear step at a time and keep the original question in mind.  $k = \frac{30}{12} = 2.5$ . So the answer is  $y = 2.5x$ .
21. Focus on the main idea of the problem, then simplify carefully. For direct variation,  $k = y/x = 6/3 = 2$ . So the answer is 2.
22. Use the clue in the question first, then let the arithmetic finish the job. The ratio  $y/x$  is always 5, so  $k = 5$ . So the answer is  $y = 5x$ .
23. Compare the change in output to the change in input, because slope is a rate of change. The rate is  $18/3 = 6$  pages per minute, so  $k = 6$  and  $p = 6m$ . So the requested value is  $p = 6m$ .
24. Name the quantities first so the model is easy to read. The constant ratio is flour per cup of oats,  $2/3$ , so  $f = \frac{2}{3}o$ .
25. Put the given value into the expression first, then simplify from the inside out. Distance varies directly with time at constant speed. Substitute  $t = 4$ :  $d = 65(4) = 260$ . That confirms the final answer is  $d = 65t$ ; 260 miles.
26. Name the quantities first so the model is easy to read. Cost varies directly with pounds. Six pounds costs  $1.80(6) = 10.80$  dollars.



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