

# Two Quantities That Change Together

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

Sometimes two quantities change together, and one depends on the other. The **independent variable** is the one you choose or that changes on its own (often called the *input*), and the **dependent variable** is the one that responds (the *output*). You can connect them with an **equation** like  $y = 3x$ , make a **table** of matching values, or describe the pattern in words. For example, if a snack costs \$2 each, then total cost  $y$  depends on the number bought  $x$ , and the rule is  $y = 2x$ .

◇ **Example:** A car travels 60 miles each hour. Write an equation relating distance  $d$  to time  $t$ , and find  $d$  when  $t = 4$ .  
 ⇒ Let's think about which quantity depends on which. The distance depends on how much time has passed, so  $t$  is the independent variable and  $d$  is the dependent one. Each hour adds 60 miles, so the rule is  $d = 60t$ . Now substitute  $t = 4$ :  
 $d = 60 \times 4 = 240$ . After 4 hours, the car has gone 240 miles.

**Answer:**  $d = 60t$ ;  $d = 240$  miles

## PRACTICE

Write an equation or find the missing value for each situation.

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| 1. Equation: cost $y$ for $x$ pens at 3 dollars _____ | 11. Equation: $y$ dollars for $x$ hours at 15 per hour _____ |
| 2. Equation: total $y$ legs on $x$ cats _____         | 12. Equation: $y$ days in $x$ weeks _____                    |
| 3. Equation: $y$ inches in $x$ feet _____             | 13. If $y = 4x$ , find $y$ when $x = 0$ _____                |
| 4. Equation: $y$ wheels on $x$ bicycles _____         | 14. If $y = x + 5$ , find $y$ when $x = 8$ _____             |
| 5. If $y = 5x$ , find $y$ when $x = 6$ _____          | 15. If $y = x + 10$ , find $y$ when $x = 12$ _____           |
| 6. If $y = 8x$ , find $y$ when $x = 3$ _____          | 16. If $y = x - 3$ , find $y$ when $x = 20$ _____            |
| 7. If $y = 10x$ , find $y$ when $x = 7$ _____         | 17. In $y = 3x$ , which variable is independent? _____       |
| 8. If $y = 2x$ , find $x$ when $y = 14$ _____         | 18. In $y = 7x$ , which variable is dependent? _____         |
| 9. If $y = 6x$ , find $x$ when $y = 42$ _____         | 19. If $y = 25x$ , find $y$ when $x = 4$ _____               |
| 10. If $y = 9x$ , find $x$ when $y = 36$ _____        | 20. If $y = 11x$ , find $x$ when $y = 88$ _____              |

### ◆ Word Problems

21. A printer makes 20 pages per minute. Write an equation relating pages  $p$  to minutes  $m$ , then find  $p$  when  $m = 6$ . \_\_\_\_\_
22. A plant grows 3 inches per week. Write an equation relating height  $h$  to weeks  $w$ , then find how many weeks it takes to grow 21 inches. \_\_\_\_\_
23. A taxi charges \$2 per mile. In the equation  $c = 2d$ , where  $c$  is cost and  $d$  is distance, which is the independent variable and which is the dependent variable? \_\_\_\_\_
24. A water tank fills at 5 gallons per minute. Write an equation relating gallons  $g$  to minutes  $m$ , then find the gallons after 9 minutes. \_\_\_\_\_



## Answer Keys

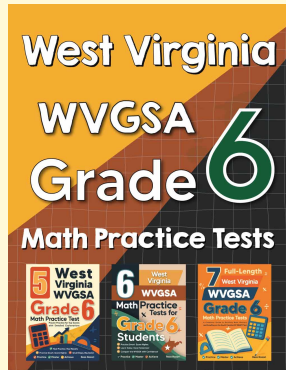
- |               |                                       |
|---------------|---------------------------------------|
| 1. $y = 3x$   | 13. 0                                 |
| 2. $y = 4x$   | 14. 13                                |
| 3. $y = 12x$  | 15. 22                                |
| 4. $y = 2x$   | 16. 17                                |
| 5. 30         | 17. $x$                               |
| 6. 24         | 18. $y$                               |
| 7. 70         | 19. 100                               |
| 8. 7          | 20. 8                                 |
| 9. 7          | 21. $p = 20m$ ; $p = 120$ pages       |
| 10. 4         | 22. $h = 3w$ ; 7 weeks                |
| 11. $y = 15x$ | 23. Independent: $d$ ; dependent: $c$ |
| 12. $y = 7x$  | 24. $g = 5m$ ; 45 gallons             |

### Step-by-Step Explanations

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| <p>1. Each pen costs 3 dollars, so total cost is <math>y = 3x</math>.</p> <p>2. Each cat has 4 legs, so <math>y = 4x</math>.</p> <p>3. Each foot is 12 inches, so <math>y = 12x</math>.</p> <p>4. Each bicycle has 2 wheels, so <math>y = 2x</math>.</p> <p>5. Substitute <math>x = 6</math>: <math>y = 5 \times 6 = 30</math>.</p> <p>6. Substitute <math>x = 3</math>: <math>y = 8 \times 3 = 24</math>.</p> <p>7. Substitute <math>x = 7</math>: <math>y = 10 \times 7 = 70</math>.</p> <p>8. Solve <math>2x = 14</math> by dividing: <math>x = 14 \div 2 = 7</math>.</p> <p>9. Solve <math>6x = 42</math> by dividing: <math>x = 42 \div 6 = 7</math>.</p> <p>10. Solve <math>9x = 36</math> by dividing: <math>x = 36 \div 9 = 4</math>.</p> <p>11. Each hour pays 15 dollars, so <math>y = 15x</math>.</p> <p>12. Each week has 7 days, so <math>y = 7x</math>.</p> <p>13. Substitute <math>x = 0</math>: <math>y = 4 \times 0 = 0</math>.</p> | <p>14. Substitute <math>x = 8</math>: <math>y = 8 + 5 = 13</math>.</p> <p>15. Substitute <math>x = 12</math>: <math>y = 12 + 10 = 22</math>.</p> <p>16. Substitute <math>x = 20</math>: <math>y = 20 - 3 = 17</math>.</p> <p>17. In <math>y = 3x</math>, you choose <math>x</math> (the input), so <math>x</math> is the independent variable.</p> <p>18. The value of <math>y</math> depends on <math>x</math>, so <math>y</math> is the dependent variable.</p> <p>19. Substitute <math>x = 4</math>: <math>y = 25 \times 4 = 100</math>.</p> <p>20. Solve <math>11x = 88</math> by dividing: <math>x = 88 \div 11 = 8</math>.</p> <p>21. Each minute prints 20 pages, so <math>p = 20m</math>. When <math>m = 6</math>: <math>p = 20 \times 6 = 120</math> pages.</p> <p>22. The rule is <math>h = 3w</math>. To grow 21 inches, solve <math>3w = 21</math>, so <math>w = 7</math> weeks.</p> <p>23. The distance <math>d</math> is chosen first, so it is independent. The cost <math>c</math> responds to it, so <math>c</math> is dependent.</p> <p>24. Each minute adds 5 gallons, so <math>g = 5m</math>. After 9 minutes: <math>g = 5 \times 9 = 45</math> gallons.</p> |
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