

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

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