Two Quantities That Change Together

Name: _____	Date: _____	Score: _____ / 24

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.

1. Equation: cost y for x pens at 3 dollars _____
2. Equation: total y legs on x cats _____
3. Equation: y inches in x feet _____
4. Equation: y wheels on x bicycles _____
5. If $y = 5x$, find y when $x = 6$ _____
6. If $y = 8x$, find y when $x = 3$ _____
7. If $y = 10x$, find y when $x = 7$ _____
8. If $y = 2x$, find x when $y = 14$ _____
9. If $y = 6x$, find x when $y = 42$ _____
10. If $y = 9x$, find x when $y = 36$ _____
11. Equation: y dollars for x hours at 15 per hour _____
12. Equation: y days in x weeks _____
13. If $y = 4x$, find y when $x = 0$ _____
14. If $y = x + 5$, find y when $x = 8$ _____
15. If $y = x + 10$, find y when $x = 12$ _____
16. If $y = x - 3$, find y when $x = 20$ _____
17. In y = 3x, which variable is independent? _____
18. In y = 7x, which variable is dependent? _____
19. If $y = 25x$, find y when $x = 4$ _____
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. $y = 3x$
2. $y = 4x$
3. $y = 12x$
4. $y = 2x$
5. 30
6. 24
7. 70
8. 7
9. 7
10. 4
11. $y = 15x$
12. $y = 7x$
13. 0
14. 13
15. 22
16. 17
17. x
18. y
19. 100
20. 8
21. $p = 20m$; $p = 120$ pages
22. $h = 3w$; 7 weeks
23. Independent: d; dependent: c
24. $g = 5m$; 45 gallons

Step-by-Step Explanations

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

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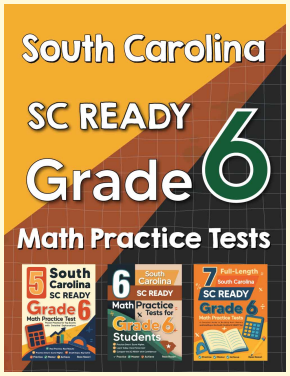

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