# Two Quantities That Change Together

| Name: _____ | Date: _____ | Score: _____ / 24 |
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## 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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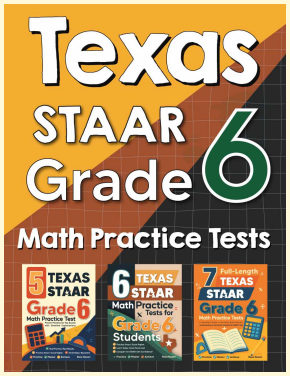


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