

# Literal Equations

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

## Q Quick Review

A **literal equation** is an equation with several letters, like a formula. “Solving” one means **isolating one variable** — getting it alone on one side — while the other letters just come along for the ride. You use the *same moves* as with number equations: add, subtract, multiply, and divide both sides, and undo operations in reverse order. The answer will be an expression in the *other* letters. This is exactly how you rearrange formulas like  $A = lw$  or  $d = rt$ .

◇ **Example:** Solve  $d = rt$  for  $t$ .

⇒ We want  $t$  all by itself, but right now it’s stuck being multiplied by  $r$ . To undo a multiplication, we divide — and we do it to *both* sides to keep the equation balanced. Dividing both sides by  $r$  gives  $\frac{d}{r} = \frac{rt}{r}$ , and on the right the  $r$ ’s cancel, leaving just  $t$ . So  $t = \frac{d}{r}$ . The letters  $d$  and  $r$  stay put — only  $t$  had to move. This is the distance formula rearranged to find time.

**Answer:**  $t = \frac{d}{r}$

## PRACTICE

Solve each literal equation for the indicated variable.

- |                            |       |                                   |       |
|----------------------------|-------|-----------------------------------|-------|
| 1. $A = lw$ , for $w$      | _____ | 11. $ax = b$ , for $x$            | _____ |
| 2. $A = lw$ , for $l$      | _____ | 12. $x + y = c$ , for $x$         | _____ |
| 3. $d = rt$ , for $r$      | _____ | 13. $\frac{x}{a} = b$ , for $x$   | _____ |
| 4. $P = 4s$ , for $s$      | _____ | 14. $2x + k = m$ , for $x$        | _____ |
| 5. $C = 2\pi r$ , for $r$  | _____ | 15. $A = \frac{1}{2}bh$ , for $h$ | _____ |
| 6. $y = mx + b$ , for $b$  | _____ | 16. $F = ma$ , for $a$            | _____ |
| 7. $y = mx + b$ , for $m$  | _____ | 17. $y - k = m(x - h)$ , for $y$  | _____ |
| 8. $P = 2l + 2w$ , for $l$ | _____ | 18. $ax + by = c$ , for $y$       | _____ |
| 9. $V = lwh$ , for $h$     | _____ | 19. $p = \frac{q}{r}$ , for $q$   | _____ |
| 10. $I = prt$ , for $p$    | _____ | 20. $3a - b = 2c$ , for $a$       | _____ |

### ◆ Word Problems

21. The area of a triangle is  $A = \frac{1}{2}bh$ . Solve for the base  $b$ , then find  $b$  when  $A = 24$  and  $h = 6$ . \_\_\_\_\_
22. The distance formula is  $d = rt$ . Solve for the rate  $r$ , then find  $r$  when  $d = 240$  miles and  $t = 4$  hours. \_\_\_\_\_
23. The perimeter of a rectangle is  $P = 2l + 2w$ . Solve for the width  $w$ , then find  $w$  when  $P = 30$  and  $l = 9$ . \_\_\_\_\_
24. Simple interest is  $I = prt$ . Solve for the time  $t$ , then find  $t$  when  $I = 90$ ,  $p = 600$ , and  $r = 0.05$ . \_\_\_\_\_



## Answer Keys

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| <p>1. <math>w = \frac{A}{l}</math></p> <p>2. <math>l = \frac{A}{w}</math></p> <p>3. <math>r = \frac{d}{t}</math></p> <p>4. <math>s = \frac{P}{4}</math></p> <p>5. <math>r = \frac{C}{2\pi}</math></p> <p>6. <math>b = y - mx</math></p> <p>7. <math>m = \frac{y-b}{x}</math></p> <p>8. <math>l = \frac{P-2w}{2}</math></p> <p>9. <math>h = \frac{V}{lw}</math></p> <p>10. <math>p = \frac{I}{rt}</math></p> <p>11. <math>x = \frac{b}{a}</math></p> <p>12. <math>x = c - y</math></p> <p>13. <math>x = ab</math></p> | <p>14. <math>x = \frac{m-k}{2}</math></p> <p>15. <math>h = \frac{2A}{b}</math></p> <p>16. <math>a = \frac{F}{m}</math></p> <p>17. <math>y = m(x - h) + k</math></p> <p>18. <math>y = \frac{c-ax}{b}</math></p> <p>19. <math>q = pr</math></p> <p>20. <math>a = \frac{2c+b}{3}</math></p> <p>21. <math>b = \frac{2A}{h}; b = 8</math></p> <p>22. <math>r = \frac{d}{t}; r = 60 \text{ mph}</math></p> <p>23. <math>w = \frac{P-2l}{2}; w = 6</math></p> <p>24. <math>t = \frac{I}{pr}; t = 3 \text{ years}</math></p> |
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### Step-by-Step Explanations

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| <p>1. Divide both sides by <math>l</math>: <math>w = \frac{A}{l}</math>.</p> <p>2. Divide both sides by <math>w</math>: <math>l = \frac{A}{w}</math>.</p> <p>3. Divide both sides by <math>t</math>: <math>r = \frac{d}{t}</math>.</p> <p>4. Divide both sides by 4: <math>s = \frac{P}{4}</math>.</p> <p>5. Divide both sides by <math>2\pi</math>: <math>r = \frac{C}{2\pi}</math>.</p> <p>6. Subtract <math>mx</math> from both sides: <math>b = y - mx</math>.</p> <p>7. Subtract <math>b</math>: <math>y - b = mx</math>, then divide by <math>x</math>: <math>m = \frac{y-b}{x}</math>.</p> <p>8. Subtract <math>2w</math>: <math>P - 2w = 2l</math>, then divide by 2.</p> <p>9. Divide both sides by <math>lw</math>: <math>h = \frac{V}{lw}</math>.</p> <p>10. Divide both sides by <math>rt</math>: <math>p = \frac{I}{rt}</math>.</p> <p>11. Divide both sides by <math>a</math>: <math>x = \frac{b}{a}</math>.</p> <p>12. Subtract <math>y</math> from both sides: <math>x = c - y</math>.</p> <p>13. Multiply both sides by <math>a</math>: <math>x = ab</math>.</p> <p>14. Subtract <math>k</math>: <math>2x = m - k</math>, then divide by 2.</p> | <p>15. Multiply by 2: <math>2A = bh</math>, then divide by <math>b</math>: <math>h = \frac{2A}{b}</math>.</p> <p>16. Divide both sides by <math>m</math>: <math>a = \frac{F}{m}</math>.</p> <p>17. Add <math>k</math> to both sides: <math>y = m(x - h) + k</math>.</p> <p>18. Subtract <math>ax</math>: <math>by = c - ax</math>, then divide by <math>b</math>.</p> <p>19. Multiply both sides by <math>r</math>: <math>q = pr</math>.</p> <p>20. Add <math>b</math>: <math>3a = 2c + b</math>, then divide by 3.</p> <p>21. Multiply by 2: <math>2A = bh</math>, then divide by <math>h</math>: <math>b = \frac{2A}{h}</math>. With <math>A = 24</math>, <math>h = 6</math>: <math>b = \frac{48}{6} = 8</math>.</p> <p>22. Divide both sides by <math>t</math>: <math>r = \frac{d}{t}</math>. With <math>d = 240</math> and <math>t = 4</math>: <math>r = \frac{240}{4} = 60</math> mph.</p> <p>23. Subtract <math>2l</math>: <math>P - 2l = 2w</math>, then divide by 2: <math>w = \frac{P-2l}{2}</math>. With <math>P = 30</math>, <math>l = 9</math>: <math>w = \frac{30-18}{2} = 6</math>.</p> <p>24. Divide both sides by <math>pr</math>: <math>t = \frac{I}{pr}</math>. With the numbers: <math>t = \frac{90}{600 \times 0.05} = \frac{90}{30} = 3</math> years.</p> |
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