Literal Equations

Name: _____	Date: _____	Score: _____ / 24

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

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

Step-by-Step Explanations

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

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