

Literal Equations and Formulas

Name: _____ Date: _____ Score: _____ / 24

Quick Review

A **literal equation** is an equation with more than one variable — think formulas like $d = rt$, $A = \frac{1}{2}bh$, or $C = 2\pi r$. “Solve for” a specific variable means rearrange the formula so that variable is alone on one side. Here’s the secret: treat every variable you’re *not* solving for like it’s a known number, and use the same inverse-operation moves as any other equation. The big advantage of solving for a variable up front: once you’ve done the algebra once, you can substitute different values without redoing the work. Solving $d = rt$ for t gives $t = \frac{d}{r}$; solving $P = 2l + 2w$ for w gives $w = \frac{P-2l}{2}$.

PRACTICE

Solve each formula for the indicated variable.

- | | |
|--|---|
| 1. Solve the distance formula $d = rt$ for the rate r .
_____ | 11. $V = \frac{1}{3}\pi r^2 h$; for h
_____ |
| 2. $A = lw$; for w
_____ | 12. $E = mc^2$; for m
_____ |
| 3. $P = 2l + 2w$; for l
_____ | 13. $F = \frac{9}{5}C + 32$; for C
_____ |
| 4. $V = lwh$; for h
_____ | 14. $K = \frac{1}{2}mv^2$; for v^2
_____ |
| 5. Solve the circumference formula $C = 2\pi r$ for the radius r .
_____ | 15. $y - y_1 = m(x - x_1)$; for m
_____ |
| 6. $I = Prt$; for t
_____ | 16. $P = 2(l + w)$; for w
_____ |
| 7. $y = mx + b$; for x
_____ | 17. $a = \frac{v - v_0}{t}$; for v
_____ |
| 8. $ax + by = c$; for y
_____ | 18. $A = \frac{h}{2}(b_1 + b_2)$; for b_1
_____ |
| 9. $S = 2\pi r^2 + 2\pi rh$; for h
_____ | 19. $P = R - C$; for C
_____ |
| 10. Solve the simple-interest amount formula $A = P(1 + rt)$ for the rate r .
_____ | 20. Solve the formula $S = \frac{a}{1 - r}$ for the rate r .
_____ |

Word Problems

21. The perimeter of a rectangle is $P = 2l + 2w$. A garden has a perimeter of 56 ft and a length of 18 ft. First solve for w , then find the width.

22. A car travels at a constant speed: $d = rt$. The car covers 210 miles in 3.5 hours. Solve the formula for r and find the speed.

23. The area of a triangle is $A = \frac{1}{2}bh$. A triangle has area 30 in² and base 12 in. Solve for h and find the height.

24. The formula $C = \frac{5}{9}(F - 32)$ converts Fahrenheit to Celsius. Solve it for F , then use your formula to find F when $C = 25^\circ\text{C}$.



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Answer Keys

1. $r = \frac{d}{t}$

2. $w = \frac{A}{l}$

3. $l = \frac{P - 2w}{2}$

4. $h = \frac{V}{lw}$

5. $r = \frac{C}{2\pi}$

6. $t = \frac{I}{Pr}$

7. $x = \frac{y - b}{m}$

8. $y = \frac{c - ax}{b}$

9. $h = \frac{S - 2\pi r^2}{2\pi r}$

10. $r = \frac{A - P}{Pt}$

11. $h = \frac{3V}{\pi r^2}$

12. $m = \frac{E}{c^2}$

13. $C = \frac{5(F - 32)}{9}$

14. $v^2 = \frac{2K}{m}$

15. $m = \frac{y - y_1}{x - x_1}$

16. $w = \frac{P - 2l}{2}$

17. $v = at + v_0$

18. $b_1 = \frac{2A}{h} - b_2$

19. $C = R - P$

20. $r = 1 - \frac{a}{S}$

21. $w = 10 \text{ ft}$

22. $r = 60 \text{ mph}$

23. $h = 5 \text{ in}$

24. $F = 77^\circ \text{ F}$

Step-by-Step Tutor Notes

- Work one inverse operation at a time and keep both sides balanced. r is multiplied by t . Divide both sides by t : $r = \frac{d}{t}$. After simplifying, the answer is $r = \frac{d}{t}$.
- Work one inverse operation at a time and keep both sides balanced. Divide both sides by l : $w = \frac{A}{l}$. After simplifying, the answer is $w = \frac{A}{l}$.
- Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract $2w$ from both sides: $P - 2w = 2l$. Divide by 2: $l = \frac{P - 2w}{2}$. After simplifying, the answer is $l = \frac{P - 2w}{2}$.
- Keep the order of operations in view, then simplify without skipping the sign check. h is multiplied by lw . Divide both sides by lw : $h = \frac{V}{lw}$. After simplifying, the answer is $h = \frac{V}{lw}$.
- Work one inverse operation at a time and keep both sides balanced. r is multiplied by 2π . Divide both sides by 2π : $r = \frac{C}{2\pi}$. After simplifying, the answer is $r = \frac{C}{2\pi}$.
- Work one inverse operation at a time and keep both sides balanced. t is multiplied by Pr . Divide both sides by Pr : $t = \frac{I}{Pr}$. After simplifying, the answer is $t = \frac{I}{Pr}$.
- Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract b : $y - b = mx$. Divide by m : $x = \frac{y - b}{m}$. After simplifying, the answer is $x = \frac{y - b}{m}$.
- Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract ax : $by = c - ax$. Divide by b : $y = \frac{c - ax}{b}$. After simplifying, the answer is $y = \frac{c - ax}{b}$.
- Subtract $2\pi r^2$ from both sides: $S - 2\pi r^2 = 2\pi r h$. Divide by $2\pi r$: $h = \frac{S - 2\pi r^2}{2\pi r}$.
- Distribute or divide first — divide both sides by P : $\frac{A}{P} = 1 + rt$. Subtract 1: $\frac{A}{P} - 1 = rt$. Divide by t : $r = \frac{A - P}{Pt}$ (after combining $\frac{A}{P} - 1 = \frac{A - P}{P}$).
- Multiply both sides by 3 to clear the fraction: $3V = \pi r^2 h$. Divide by πr^2 : $h = \frac{3V}{\pi r^2}$.
- Keep the order of operations in view, then simplify without skipping the sign check. Divide both sides by c^2 : $m = \frac{E}{c^2}$. Famous formula, simple algebra. After simplifying, the answer is $m = \frac{E}{c^2}$.
- Subtract 32: $F - 32 = \frac{9}{5}C$. Multiply by $\frac{5}{9}$: $C = \frac{5(F - 32)}{9}$. (This converts Fahrenheit to Celsius).
- Multiply both sides by 2: $2K = mv^2$. Divide by m : $v^2 = \frac{2K}{m}$. (Solving for v^2 stops short of taking the square root — only v^2 is requested.)
- Divide both sides by $(x - x_1)$: $m = \frac{y - y_1}{x - x_1}$. That's the slope formula — the rate of change between two points.
- Two ways: distribute first or divide first. Divide by 2: $\frac{P}{2} = l + w$. Subtract l : $w = \frac{P}{2} - l$, which equals $\frac{P - 2l}{2}$. Same answer either way.
- Multiply both sides by t : $at = v - v_0$. Add v_0 : $v = at + v_0$. (Physics: this is the velocity-time formula.)
- Multiply both sides by $\frac{2}{h}$: $\frac{2A}{h} = b_1 + b_2$. Subtract b_2 : $b_1 = \frac{2A}{h} - b_2$. (Trapezoid area, solved for one of the parallel bases.)
- Subtract R from both sides: $P - R = -C$. Multiply by -1 (or just flip the sides): $C = R - P$. (Profit equals revenue minus cost — rearranged to solve for cost.)
- Multiply both sides by $(1 - r)$: $S(1 - r) = a$. Divide by S : $1 - r = \frac{a}{S}$. Subtract 1: $-r = \frac{a}{S} - 1$. Multiply by -1 : $r = 1 - \frac{a}{S}$.
- Solve for w : subtract $2l$, then divide by 2 to get $w = \frac{P - 2l}{2}$. Substitute the garden's values: $w = \frac{56 - 2(18)}{2} = \frac{56 - 36}{2} = \frac{20}{2} = 10$ feet.
- Divide both sides of $d = rt$ by t : $r = \frac{d}{t}$. Use the trip's distance and time: $r = \frac{210}{3.5} = 60$ miles per hour.
- Solve for h : multiply by 2 then divide by b to get $h = \frac{2A}{b}$. Substitute the area and base: $h = \frac{2(30)}{12} = \frac{60}{12} = 5$ inches.
- Multiply both sides by $\frac{9}{5}$: $\frac{9}{5}C = F - 32$. Add 32: $F = \frac{9}{5}C + 32$. $C = 25$: $F = \frac{9}{5}(25) + 32 = 45 + 32 = 77^\circ \text{ F}$.



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