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. _____

2. $A = lw$; for w _____

3. $P = 2l + 2w$; for l _____

4. $V = lwh$; for h _____

5. Solve the circumference formula $C = 2\pi r$ for the radius r. _____

6. $I = Prt$; for t _____

7. $y = mx + b$; for x _____

8. $ax + by = c$; for y _____

9. $S = 2\pi r^2 + 2\pi rh$; for h _____

10. Solve the simple-interest amount formula $A = P(1 + rt)$ for the rate r. _____

11. $V = \frac{1}{3}\pi r^2 h$; for h _____

12. $E = mc^2$; for m _____

13. $F = \frac{9}{5}C + 32$; for C _____

14. $K = \frac{1}{2}mv^2$; for v^2 _____

15. $y - y_1 = m(x - x_1)$; for m _____

16. $P = 2(l + w)$; for w _____

17. $a = \dfrac{v - v_0}{t}$; for v _____

18. $A = \frac{h}{2}(b_1 + b_2)$; for b_1 _____

19. $P = R - C$; for C _____

20. Solve the formula $S = \dfrac{a}{1 - r}$ 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 in^2 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 $C = 25°$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. $w = 10$ ft
22. $r = 60$ mph
23. $h = 5$ in
24. $F = 77°F$

Step-by-Step Tutor Notes

1. 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 $r = \frac{d}{t}$.
2. 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 $w = \frac{A}{l}$.
3. 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 $l = \frac{P - 2w}{2}$.
4. 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 $h = \frac{V}{lw}$.
5. 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 $r = \frac{C}{2\pi}$.
6. 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 $t = \frac{I}{Pr}$.
7. 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 $x = \frac{y - b}{m}$.
8. 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 $y = \frac{c - ax}{b}$.
9. Subtract $2\pi r^2$ from both sides: $S - 2\pi r^2 = 2\pi rh$. Divide by $2\pi r$: $h = \frac{S-2\pi r^2}{2\pi r}$.
10. 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 $\frac{A}{P} - 1 = \frac{A-P}{P}$).
11. Multiply both sides by 3 to clear the fraction: $3V = \pi r^2 h$. Divide by πr^2: $h = \frac{3V}{\pi r^2}$.
12. 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 $m = \frac{E}{c^2}$.
13. Subtract 32: $F - 32 = \frac{9}{5}C$. Multiply by $\frac{5}{9}$: $C = \frac{5(F-32)}{9}$. (This converts Fahrenheit to Celsius.).
14. 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.).
15. 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.
16. 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.
17. Multiply both sides by t: $at = v - v_0$. Add v_0: $v = at + v_0$. (Physics: this is the velocity-time formula.).
18. 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.).
19. 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.).
20. 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: $r = 1 - \frac{a}{S}$.
21. 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.
22. 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.
23. 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.
24. Multiply both sides by $\frac{9}{5}$: $\frac{9}{5}C = F - 32$. Add 32: $F = \frac{9}{5}C + 32$. $C = 25$: $F = \frac{9}{5}(25) + 32 = 45 + 32 = 77°$F.

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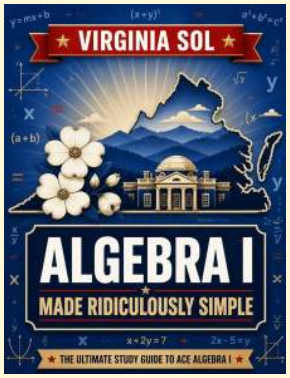

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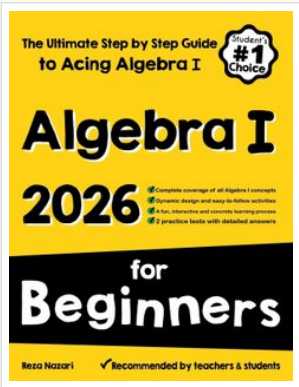

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