3.07 *Literal Equations*

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Formulas are equations that express one variable in terms of other variables. You will probably recognize some of the formulas that we use here, since many of them come from science, business, geometry, and other areas of life. Other formulas have been made up especially for practice in this section.

These formulas are also called **literal equations**, because there are so many different "litters" (joke) in them. In these equations, you will be solving for one variable (letter) in terms of all the other variables (letters) in the equation. In order to solve literal equations,

STEP 1: **Identify the "variable" terms** (that is, the terms that have the variable you are solving for), and **get them all on one side of the equation**.

STEP 2: **Identify all "non-variable" terms** (that is, all terms that do not have the variable you are solving for), and **get these terms on the other side of the equation**. Remember, "non-variable" terms may have other variables or constants--just not the variable you are solving for. **(Be careful not to combine unlike terms.)**

STEP 3: If you have more than one variable term, you must **factor in order to get the variable in one place**.

STEP 4: **Divide both sides of the equation by all factors that are in the product with the variable**. This leaves the variable alone, and the answer may be a very strange-looking fraction. That's okay--the answers will probably be very abstract. Just do what you know is correct algebraically and have confidence in your work!

EXERCISES. **The following series of exercises are designed to lead you through the process. In each of the following, solve for *x*:**

1. $ax = b$ **(Divide both sides by a.)**

2. $ax + b = c$ **(Subtract b from each side.)**

(Divide by each side by a.)

3. $ax - b = c$

4. $ax + bx = c$ **(Factor the common factor x.)**

(Divide each side by _____.)

5. $ax = bx + c$ **(Subtract bx.)**

(Factor the x.)

(Divide by _____)

6. $ax + b = cx + d$ **(Subtract cx.)**

(Subtract b.)

(Factor x)

(Divide by _____.)

7. $ax - b = c - dx$ (Add dx)

8. $ax - b = cx - d$

9. $a(x + b) = c(x + d)$

10. $a(x - b) = c(d - x)$

11. $y = mx + b$

12. $y - a = m(x - b)$

13. $Ax + By = C$

14. $Ax - By = C$ **15.** $Bx - Ay = C$ **16.** $P = 2x + 2y$

Frequently, you are asked to solve for a variable other than *x*. In each of the following, solve for the variable as indicated:

17. $a = bx + c$, for c **18.** $a = bx + c$, for b

19. $a = bx + c$, for x **20.** $I = Prt$, for P **21.** $I = Prt$, for r

22. $C = 2\pi r$, for r **23.** $V = LWH$, for H **24.** $V = LWH$, for W

25. $A = \frac{1}{2}bh$, for h **(Multiply both sides of the equation by 2)**

(Divide both sides by b)

26. $A = \frac{1}{2} bh$, for b

27. $V = \frac{1}{3} \pi r^2 h$, for h (Multiply by ____)

(Divide by ____)

28. $V = \frac{1}{3} \pi r^2 h$, for r^2

29. $A = \frac{1}{2} (B + b) h$, for h

30. $A = \frac{1}{2} (B + b) h$, for B

31. $F = \frac{9}{5} C + 32$, for C

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

EXTRA CHALLENGE:

33. $\frac{1}{F} = \frac{1}{S} + \frac{1}{U}$, for S

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1. $\frac{b}{a}$; **2.** $\frac{c-b}{a}$; **3.** $\frac{c+b}{a}$; **4.** $\frac{c}{a+b}$; **5.** $\frac{c}{a-b}$; **6.** $\frac{d-b}{a-c}$; **7.** $\frac{c+b}{a+d}$; **8.** $\frac{b-d}{a-c}$; **9.** $\frac{cd-ab}{a-c}$;

10. $\frac{ab+cd}{a+c}$; **11.** $\frac{y-b}{m}$; **12.** $\frac{y-a+mb}{m}$; **13.** $\frac{C-By}{A}$; **14.** $\frac{C+By}{A}$; **15.** $\frac{C+Ay}{B}$;

16. $\frac{P-2y}{2}$; **17.** $a-bx$; **18.** $\frac{a-c}{x}$; **19.** $\frac{a-c}{b}$; **20.** $\frac{I}{rt}$; **21.** $\frac{I}{Pt}$; **22.** $\frac{C}{2\pi}$; **23.** $\frac{V}{LW}$;

24. $\frac{V}{LH}$; **25.** $\frac{2A}{b}$; **26.** $\frac{2A}{h}$; **27.** $\frac{3V}{\pi r^2}$; **28.** $\frac{3V}{\pi h}$; **29.** $\frac{2A}{B+b}$; **30.** $\frac{2A-bh}{h}$;

31. $\frac{5}{9}(F-32)$ or $\frac{5F-160}{9}$; **32.** $\frac{9}{5}C+32$ or $\frac{9C+160}{5}$; **33.** $\frac{UF}{U-F}$.