UNIT 4

Michael Faraday

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4.1

Solving Literal Equations

The word *literal* comes from a Latin word meaning "letter of the alphabet." A literal equation in math refers to an equation that uses letters.

$C = \pi d$ $\quad$ $A = bh$ $\quad$ $Ax + By = -C$

Using the properties of equality, the variables of a literal equation can be rearranged to isolate a given variable. Following is the distance formula with two transformations, each isolating a different variable.

$d = rt$ $\quad$ $r = \frac{d}{t}$ $\quad$ $t = \frac{d}{r}$

Sometimes it is helpful to transform an equation so that the unknown value stands alone on one side of the equal sign. Finding the rate of travel is easier if the distance formula, $d = rt$, is transformed to $r = \frac{d}{t}$.

When transforming literal equations, always perform operations on both sides of the equation, the same as when solving equations to find a solution.

Transforming a literal equation is called "solving the equation" for another variable, although this process does not actually find any numerical values.

Example 1 **Solve the equation: $P = 2\ell + 2w$ for w.**

$P = 2\ell + 2w$	Original equation (to be solved for w).
$P = 2\ell + 2w$ $-2\ell \quad -2\ell$	2ℓ subtracted from both sides.
$P - 2\ell = 2w$	Simplified.
$\frac{P - 2\ell}{2} = \frac{2w}{2}$	Both sides divided by 2.
$\frac{P - 2\ell}{2} = w$ or $w = \frac{P - 2\ell}{2}$	Simplified.

Math in History

In 1812 Faraday attended lectures by Humphry Davy. Faraday was so impressed that he recorded the lectures in notes, which he sent to Davy with a job request. Later Davy hired Faraday as his laboratory assistant at the Royal Institution and Faraday's education under Britain's leading chemist began.

Steps **Transforming Literal Equations**

- Simplify where possible.
- If there are fractions in the equation, multiply both sides by the common denominator.
- Isolate the term containing the specified variable on one side of the equation using addition or subtraction.
- Divide both sides of the equation by any coefficient of the isolated term.

Example 2 **Solve the equation: $A = \frac{1}{2}bh$ for b.**

$A = \frac{1}{2}bh$	Original equation (to be solved for b).
$2(A) = 2(\frac{1}{2}bh)$	Both sides multiplied by 2, the common denominator.
$2A = bh$	Simplified.
$\frac{2A}{h} = \frac{bh}{h}$	Both sides divided by h.
$\frac{2A}{h} = b$ or $b = \frac{2A}{h}$	Simplified. Fractions removed.

Example 3 **Solve the equation: $A = \pi r^2$ for r.**

$A = \pi r^2$	Original equation (to be solved for r).
$\frac{A}{\pi} = \frac{\pi r^2}{\pi}$	Both sides divided by π.
$\frac{A}{\pi} = r^2$	Simplified.
$\sqrt{\frac{A}{\pi}} = \sqrt{r^2}$	Square root taken of both sides.
$\sqrt{\frac{A}{\pi}} = r$ or $r = \sqrt{\frac{A}{\pi}}$	Simplified in terms of r.

Math in History

Faraday spent long hours working in the laboratory. It was not unusual for him to work from nine o'clock in the morning to eleven at night—fifteen hours. At the end of his life, he had spent nearly fifty years working in a laboratory.

Today's Lesson

Solve the equations for the specified variable.

1. $C = pd$ for d

2. $A = \ell w$ for w

3. $V = \frac{bh}{3}$ for b

4. $i = prt$ for t

5. $A = \frac{1}{2}bh$ for h

6. $4x = 2y - 16$ for y

7. $6x + 3y = 9$ for y

8. $6x + 3y = 9$ for x

9. $E = IR$ for I

REVIEW

Simplify. If it cannot be simplified, write *cannot be simplified.* 3.14

10. $\sqrt{90}$

11. $\sqrt{150}$

12. $\sqrt{60}$

13. $\sqrt[3]{90}$

14. $\sqrt{125}$

15. $\sqrt{726}$

Factor the GCF out of the polynomials. If there is no GCF, write *no GCF***.** 3.13

16. $9m^3 + 3m^2$

17. $10d^3 + 15d^2 + 15d$

18. $4m^2n - 6mn + 2mn^2$

19. $6x^2 + 5y + 3$

Solve. 3.11

20. $\frac{x}{3} + \frac{2x}{9} + \frac{4x}{6} = 8 + \frac{x}{3}$

21. $\frac{2x}{2} + 4 = \frac{4x}{3} + 1$

22. $0.3x - 1.42 = 0.05x - 0.17$

23. $0.045x = 5.7 - 0.031x$

Add or subtract. 1.4

24. $\frac{3}{4} - \frac{8}{9}$ **25.** $\frac{1}{7} + \frac{14}{5}$ **26.** $5 - \frac{5}{8}$ **27.** $\frac{2}{7} + \frac{3}{21}$

Follow the directions. 1.14

28. What is 28% of 4,150?

29. Kathy drove 350 miles in 7 hours. Form a ratio and simplify it to show the average speed of Kathy's car in miles per hour.

30. When Mr. Yoder was laying brick sidewalks, he mixed his mortar using 30 quarts of sand and 20 quarts of masonry cement. What is the ratio between both parts and of each part to the whole?

Label and algebraically represent the value(s).

31. Susan can ride bike three times faster than she can walk. 3.2

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32. On a trip Adrian drove three hours less than Russel. 3.2

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33. The area of the large room is 4 square feet more than double the area of the small room. The porch is half of the area of the large room. 3.9

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Today's Lesson

Solve the equations for the specified variable.

34. $P = \frac{\mathrm{F}}{\mathrm{A}}$ for F **35.** $ME = PE + KE$ for PE **36.** $\frac{1}{2}x + y = 18$ for x

Extra Practice

Solve the equations for the specified variable.

37. $5x = 2y - 6$ for y **38.** $V = \frac{1}{2}\pi r^2 h$ for h **39.** $A = \frac{1}{2}bh$ for b