

Lesson 1-9

Objective - To solve multi-step variable equations.

$$2x + 3 = 11$$

<p>Hard way</p> $2x + 3 = 11$ <p>- Undo Multiplication or Division first</p>	<p>Easy way</p> $2x + 3 = 11$ <p>- Undo Addition or Subtraction first</p>
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<p>Hard way - Undo Mult./ Div. first</p> $\frac{2x + 3}{2} = \frac{11}{2}$ $x + \frac{3}{2} = \frac{11}{2}$ $x + \frac{3}{2} = \frac{11}{2}$ $-\frac{3}{2} \quad -\frac{3}{2}$ <hr style="width: 50%; margin-left: auto; margin-right: auto;"/> $x = \frac{8}{2}$ $x = 4$	<p>Easy way - Undo Add./ Subt. first</p> $2x + 3 = 11$ $-\quad -3 \quad -3$ <hr style="width: 50%; margin-left: auto; margin-right: auto;"/> $\frac{2x}{2} = \frac{8}{2}$ $x = 4$
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Rules for Solving Equations

- 1) Goal: Isolate the variable.
- 2) Undo operations with their opposite operation.
- 3) Always do the same thing to both sides of the equation.

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- 1) Goal: Isolate the variable.
- 2) Undo operations with their opposite operation.
- 3) Always do the same thing to both sides of the equation.
- 4) Easiest to undo add/subtract before multiply/divide.

Solve.

<p>1) $5x + 4 = 39$</p> $\begin{array}{r} -4 \quad -4 \\ 5x + 4 = 39 \\ \hline 5x = 35 \\ \frac{5x}{5} = \frac{35}{5} \\ x = 7 \end{array}$ <p>2) $\frac{x}{3} - 4 = 2$</p> $\begin{array}{r} +4 \quad +4 \\ \frac{x}{3} - 4 = 2 \\ \hline \frac{x}{3} = 6 \quad (3) \\ \frac{3}{3} \cdot \frac{x}{3} = \frac{6}{3} \cdot (3) \\ x = 18 \end{array}$	<p>3) $7 - x = 12$</p> $\begin{array}{r} -7 \quad -7 \\ 7 - x = 12 \\ \hline -x = 5 \\ (-1)(-x) = 5(-1) \\ x = -5 \end{array}$ <p>4) $13 = 6 - \frac{x}{5}$</p> $\begin{array}{r} -6 \quad -6 \\ 13 = 6 - \frac{x}{5} \\ \hline -7 = -\frac{x}{5} \quad (-5) \\ (-5)(-7) = (-5)(-\frac{x}{5}) \\ -35 = x \end{array}$
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Solve the following equations.

<p>5) $2x - 5 = 19$</p> $\begin{array}{r} +5 \quad +5 \\ 2x - 5 = 19 \\ \hline 2x = 24 \\ \frac{2x}{2} = \frac{24}{2} \\ x = 12 \end{array}$ <p>6) $8x + 1 = 25$</p> $\begin{array}{r} -1 \quad -1 \\ 8x + 1 = 25 \\ \hline 8x = 24 \\ \frac{8x}{8} = \frac{24}{8} \\ x = 3 \end{array}$	<p>7) $15 + \frac{x}{3} = 6$</p> $\begin{array}{r} -15 \quad -15 \\ 15 + \frac{x}{3} = 6 \\ \hline \frac{x}{3} = -9 \quad (3) \\ \frac{3}{3} \cdot \frac{x}{3} = \frac{-9}{3} \cdot (3) \\ x = -27 \end{array}$ <p>8) $\frac{x}{5} - 4 = 3$</p> $\begin{array}{r} +4 \quad +4 \\ \frac{x}{5} - 4 = 3 \\ \hline \frac{x}{5} = 7 \quad (5) \\ \frac{5}{5} \cdot \frac{x}{5} = \frac{7}{5} \cdot (5) \\ x = 35 \end{array}$
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Lesson 1-9 (cont.)

Solve the following equations.

<p>9) $10 + 3x = 40$</p> $\begin{array}{r} -10 \quad -10 \\ \hline 3x = 30 \\ \frac{3x}{3} = \frac{30}{3} \\ x = 10 \end{array}$	<p>11) $11 + \frac{x}{3} = 7$</p> $\begin{array}{r} -11 \quad -11 \\ \hline \frac{x}{3} = -4(3) \\ \frac{x}{3} = -12 \\ x = -12 \end{array}$
<p>10) $4 + 2x = 12$</p> $\begin{array}{r} -4 \quad -4 \\ \hline 2x = 8 \\ \frac{2x}{2} = \frac{8}{2} \\ x = 4 \end{array}$	<p>12) $-6 + \frac{x}{7} = -2$</p> $\begin{array}{r} +6 \quad +6 \\ \hline \frac{x}{7} = 4(7) \\ \frac{x}{7} = 28 \\ x = 28 \end{array}$

Acceptable Answers

$$\begin{array}{r} -4k = 14 \\ -4 \quad -4 \\ \hline k = -\frac{14}{4} \\ k = \left(-\frac{7}{2}\right) = \left(-3\frac{1}{2}\right) = (-3.5) \end{array}$$

All answers must be fully reduced!
There is nothing improper about an improper fraction!

Solve.

<p>1) $\frac{x}{7} = \frac{16}{7}$</p> $\frac{x}{7} = \frac{16}{7} = 2\frac{2}{7}$	<p>3) $9 = -m$</p> $(-1)9 = -m(-1)$ $-9 = m$
<p>2) $\frac{k}{-2} = -8$</p> $(-2)\frac{k}{-2} = -8(-2)$ $k = 16$	<p>4) $\frac{-y}{4} = 7$</p> $(-4)\frac{-y}{4} = 7(-4)$ $y = -28$

Translate the following sentences into equations.

- 1) Twice the sum of a number n and 5 equals 18.

$$2(n + 5) = 18$$
- 2) The quotient of x and 2 added to 9 is equal to 13.

$$9 + x \div 2 = 13$$
- 3) Six less than 5 times a number x is 39.

$$5x - 6 = 39$$
- 4) Forty-two equals 5 subtracted from the product of 7 and x.

$$42 = 7x - 5$$

Match each sentence with its variable equation.

<p><u>b</u> 1) Twice the sum of 4 and x is 5.</p>	<p>a) $4(x - 2) = 5$</p>
<p><u>d</u> 2) Four more than the product of 2 and x is 5</p>	<p>b) $2(4 + x) = 5$</p>
<p><u>a</u> 3) Four times the difference of x and 2 is 5.</p>	<p>c) $4x - 2 = 5$</p>
<p><u>c</u> 4) Two subtracted from the product of x and 4 is 5.</p>	<p>d) $2x + 4 = 5$</p>
<p><u>e</u> 5) The product of two and x less 4 is 5.</p>	<p>e) $2x - 4 = 5$</p>

1) Five less than twice a number x is 31.
 Find the number.

1) Read Problem
 2) Define Unknown
 3) Write Equation
 4) Solve Equation
 5) Check Answer

Let x = the number

$$\begin{array}{r} 2x - 5 = 31 \\ +5 \quad +5 \\ \hline 2x = 36 \\ \frac{2x}{2} = \frac{36}{2} \\ x = 18 \end{array}$$

Lesson 1-9 (cont.)

2) A shirt cost \$28. This is \$5 more than twice the cost of a belt. Find the cost of the belt.

Let x = the cost of the belt

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- 2) Define Unknown
- 3) Write Equation

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$$\begin{array}{r} 28 = 2x + 5 \\ -5 \quad \quad -5 \\ \hline \end{array}$$

$$\frac{23}{2} = \frac{2x}{2}$$

$$11.5 = x$$

Belt = \$11.50

3) The largest pyramid in the world is Quetzalcóatl in Mexico. It's base covers an area of 45 acres. This is 6 acres more than 3 times that covered by the Great Pyramid of Khufu in Egypt. How many acres does the Egyptian pyramid cover?

Let y = the size of Khufu

- 1) Read Problem
- 2) Define Unknown
- 3) Write Equation

3) The largest pyramid in the world is Quetzalcóatl in Mexico. It's base covers an area of 45 acres. This is 6 acres more than 3 times that covered by the Great Pyramid of Khufu in Egypt. How many acres does the Egyptian pyramid cover?

Let y = the size of Khufu

- 1) Read Problem
- 2) Define Unknown
- 3) Write Equation
- 4) Solve Equation
- 5) Check Answer

$$\begin{array}{r} 45 = 3y + 6 \\ -6 \quad \quad -6 \\ \hline \end{array}$$

$$\frac{39}{3} = \frac{3y}{3}$$

$$13 = y$$

Khufu covers 13 acres