

Solve each equation.

$6x = 18$ $x = 3$	$\frac{4s}{4} = \frac{24}{4}$ $s = 6$	$\frac{5x}{5} = \frac{30}{5}$ $x = 6$	$\frac{9b}{9} = \frac{72}{9}$ $b = 8$
$\frac{4y}{4} = \frac{8}{4}$ $y = 2$	$\frac{5x}{5} = \frac{25}{5}$ $x = 5$	$\frac{3x}{3} = \frac{-12}{3}$ $x = -4$	$\frac{5s}{5} = \frac{0}{5}$ $s = 0$
$\frac{6t}{6} = \frac{6}{6}$ $t = 1$	$\frac{-4n}{-4} = \frac{-20}{-4}$ $n = 5$	$\frac{8c}{8} = \frac{-8}{8}$ $c = -1$	$\frac{-10e}{-10} = \frac{-30}{-10}$ $e = 3$
$\frac{-7x}{-7} = \frac{-21}{-7}$ $x = 3$	$\frac{-2x}{-2} = \frac{10}{-2}$ $x = -5$	$\frac{20x}{20} = \frac{80}{20}$ $x = 4$	$\frac{-7m}{-7} = \frac{7}{-7}$ $m = -1$

Robin multiplied 8 times a number. The answer was 48. What was Robin's number?

Equation: $\frac{8x}{8} = \frac{48}{8}$

Solution: $x = 6$

Jerry thought of a number. Then he multiplied it by 5. The answer came out to be 45. What was Jerry's number?

Equation: $\frac{5x}{5} = \frac{45}{5}$

Solution: $x = 9$

Jennifer started out with 8 dollars. Then she got some more money for her birthday. She ended up with 15 dollars. How much did she get for her birthday?

Equation: $\frac{-8}{-8} + x = \frac{15}{-8}$

Solution: $x = 7$

7 times some number is 28. What is the number?

Equation: $\frac{7x}{7} = \frac{28}{7}$

Solution: $x = 4$

Here are some equations for you to solve. Each problem takes two steps.
First simplify the equation by combining like terms. Then find the solution.

$5x + 2x = -21$ $\frac{7x}{7} = \frac{-21}{7}$ $x = -3$	$2x + 3x = 30$ $\frac{5x}{5} = \frac{30}{5}$ $x = 6$	$3x + 3x = -24$ $\frac{6x}{6} = \frac{-24}{6}$ $x = -4$	$5x + 5x = -70$ $\frac{10x}{10} = \frac{-70}{10}$ $x = -7$
$4x + 5x = 18$ $\frac{9x}{9} = \frac{18}{9}$ $x = 2$	$7x - 3x = -12$ $\frac{4x}{4} = \frac{-12}{4}$ $x = -3$	$8x - 14x = 60$ $\frac{-6x}{-6} = \frac{60}{-6}$ $x = -10$	$3x + x = 36$ $\frac{4x}{4} = \frac{36}{4}$ $x = 9$
$5x = 13 + 7$ $\frac{5x}{5} = \frac{20}{5}$ $x = 4$	$3x = 10 + 2$ $\frac{3x}{3} = \frac{12}{3}$ $x = 4$	$-4x = 19 + 9$ $\frac{-4x}{-4} = \frac{28}{-4}$ $x = -7$	$7x = 30 + 40$ $\frac{7x}{7} = \frac{70}{7}$ $x = 10$
$6x = 5 - 17$ $\frac{6x}{6} = \frac{-12}{6}$ $x = -2$	$8x = 30 - 6$ $\frac{8x}{8} = \frac{24}{8}$ $x = 3$	$2x = 23 - 23$ $\frac{2x}{2} = \frac{0}{2}$ $x = 0$	$3x = 11 + 22$ $\frac{3x}{3} = \frac{33}{3}$ $x = 11$
$56 = 2x - 9x$ $\frac{56}{-7} = \frac{-7x}{-7}$ $x = -8$	$77 = 6t + 5t$ $\frac{77}{11} = \frac{11t}{11}$ $t = 7$	$49 - 9 = 5a$ $\frac{40}{5} = \frac{5a}{5}$ $a = 8$	$17 + 3 = 4x$ $\frac{20}{4} = \frac{4x}{4}$ $5 = x$
$18 = 7s + 2s$ $\frac{18}{9} = \frac{9s}{9}$ $s = 2$	$15 = 3m - 8m$ $\frac{15}{-5} = \frac{-5m}{-5}$ $m = -3$	$20 - 44 = 8x$ $\frac{-24}{8} = \frac{8x}{8}$ $x = -3$	$37 - 30 = 7x$ $\frac{7}{7} = \frac{7x}{7}$ $x = 1$
$20 = 7y - 12y$ $\frac{20}{-5} = \frac{-5y}{-5}$ $-4 = y$	$18 = 9t - 3t$ $\frac{18}{6} = \frac{6t}{6}$ $t = 3$	$5 + 13 = -9w$ $\frac{18}{-9} = \frac{-9w}{-9}$ $w = -2$	$48 + 16 = 32y$ $\frac{64}{32} = \frac{32y}{32}$ $y = 2$

Solve each equation.

$5x + 3x = 19 + 5$ $8x = 24$ $x = 3$	$6x + 4x = 15 + 5$ $\frac{10x}{10} = \frac{20}{10}$ $x = 2$	$2x - 7x = 23 + 12$ $\frac{-5x}{-5} = \frac{35}{-5}$ $x = -7$
$10x - 17x = 8 - 50$ $\frac{-7x}{-7} = \frac{-42}{-7}$ $x = 6$	$2x + x = 9 + 9$ $\frac{3x}{3} = \frac{18}{3}$ $x = 6$	$5x - 3x + 6x = 56$ $\frac{8x}{8} = \frac{56}{8}$ $x = 7$
$4x + 7x - 4x = 56$ $\frac{7x}{7} = \frac{56}{7}$ $x = 8$	$5x + 2x + 2x = 45$ $\frac{9x}{9} = \frac{45}{9}$ $x = 5$	$6x - 14x + 3x = 40$ $\frac{-5x}{-5} = \frac{40}{-5}$ $x = -8$
$10 + 4 = 2a + 5a$ $\frac{14}{7} = \frac{7a}{7}$ $a = 2$	$3 + 15 = 12b - 3b$ $\frac{18}{9} = \frac{9b}{9}$ $b = 2$	$* 9 = 10r - 16r + 5r$ $\frac{9}{-1} = \frac{-r}{-1}$ $r = -9$
$12 + 36 = 13y - 7y$ $\frac{48}{6} = \frac{6y}{6}$ $y = 8$	$-7 = 4x + 2x + x$ $\frac{-7}{7} = \frac{7x}{7}$ $x = -1$	$27 = 6a + 5a - 2a$ $\frac{27}{9} = \frac{9a}{9}$ $a = 3$
$9x - 4x - 8x = 15$ $\frac{-3x}{-3} = \frac{15}{-3}$ $x = -5$	$72 = 4c + 7c - 2c$ $\frac{72}{9} = \frac{9c}{9}$ $c = 8$	$15z - 6z = 20 + 16$ $\frac{9z}{9} = \frac{36}{9}$ $z = 4$
$37 + 35 = 9s + 3s$ $\frac{72}{12} = \frac{12s}{12}$ $s = 6$	$6x - 10x = 28$ $\frac{-4x}{-4} = \frac{28}{-4}$ $x = -7$	$6 = 11y - 4y - 5y$ $\frac{6}{2} = \frac{2y}{2}$ $y = 3$

Use the Finger Method to solve each equation.

$$\begin{array}{l} \text{5x} + 2 = 37 \\ \text{5x} = 35 \\ x = 7 \end{array}$$

$$\begin{array}{l} 4x + 7 = 15 \\ -7 \quad -7 \\ 4x = 8 \\ \frac{4x}{4} = \frac{8}{4} \\ x = 2 \end{array}$$

$$\begin{array}{l} 3x + 8 = 29 \\ -8 \quad -8 \\ 3x = 21 \\ \frac{3x}{3} = \frac{21}{3} \\ x = 7 \end{array}$$

$$\begin{array}{l} 5x + 6 = 26 \\ -6 \quad -6 \\ 5x = 20 \\ \frac{5x}{5} = \frac{20}{5} \\ x = 4 \end{array}$$

$$\begin{array}{l} 2x + 10 = 16 \\ -10 \quad -10 \\ 2x = 6 \\ \frac{2x}{2} = \frac{6}{2} \\ x = 3 \end{array}$$

$$\begin{array}{l} 6x + 7 = 19 \\ -7 \quad -7 \\ 6x = 12 \\ \frac{6x}{6} = \frac{12}{6} \\ x = 2 \end{array}$$

$$\begin{array}{l} 11 + 4x = 15 \\ 4x = 4 \\ x = 1 \end{array}$$

$$\begin{array}{l} 7 + 3x = 7 \\ -7 \quad -7 \\ 3x = 0 \\ \frac{3x}{3} = \frac{0}{3} \\ x = 0 \end{array}$$


$$\begin{array}{l} 3 + 8x = 35 \\ -3 \quad -3 \\ 8x = 32 \\ \frac{8x}{8} = \frac{32}{8} \\ x = 4 \end{array}$$

$$\begin{array}{l} 12 = x + 5 \\ -5 \quad -5 \\ x = 7 \end{array}$$

$$\begin{array}{l} 4 = 3x + 10 \\ -10 \quad -10 \\ -6 = 3x \\ \frac{-6}{3} = \frac{3x}{3} \\ x = -2 \end{array}$$

$$\begin{array}{l} 87 = 10x + 7 \\ -7 \quad -7 \\ 80 = 10x \\ \frac{80}{10} = \frac{10x}{10} \\ x = 8 \end{array}$$

Here are some more equations to solve using the Finger Method.

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$$8x - 3 = 37$$

$$8x = 40$$

$$x = 5$$~~

$$6x - 11 = 13$$

$$+ 11 \quad + 11$$

$$\frac{6x}{6} = \frac{24}{6}$$

$$x = 4$$

$$5x - 14 = 6$$

$$+ 14 \quad + 14$$

$$\frac{5x}{5} = \frac{20}{5}$$


$$x = 4$$

$$20 = 3x - 7$$

$$+ 7 \quad + 7$$

$$\frac{27}{3} = \frac{3x}{3}$$

$$x = 9$$

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$$-2x + 10 = 24$$

$$-2x = 14$$

$$x =$$~~

$$-7x + 9 = 79$$


$$- 9 \quad - 9$$

$$\frac{-7x}{-7} = \frac{70}{-7}$$

$$x = -10$$

~~$$10 = 18 - 2x$$

$$2x = 8$$

$$x = 4$$
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$$6 = 46 - 8x$$

$$- 46 \quad - 46$$

$$\frac{-40}{-8} = \frac{-8x}{-8}$$

$$x = 5$$

$$35 = -4x + 15$$

$$- 15 \quad - 15$$

$$\frac{20}{-4} = \frac{-4x}{-4}$$

$$x = -5$$

$$15 = 35 - 4x$$

$$- 35 \quad - 35$$

$$\frac{-20}{-4} = \frac{-4x}{-4}$$

$$x = 5$$

You will have to think a little harder to solve these using the Finger Method.

16 is greater than 4 so the number added to 16 must be negative.

$$\begin{aligned} 2x + 16 &= 4 \\ 2x &= -12 \\ x &= -6 \end{aligned}$$

$$\begin{aligned} 5x + 50 &= 20 \\ -50 & \quad -50 \\ 5x &= -30 \\ \frac{5x}{5} &= \frac{-30}{5} \\ x &= -6 \end{aligned}$$

$$\begin{aligned} 7x + 60 &= 4 \\ -60 & \quad -60 \\ 7x &= -56 \\ \frac{7x}{7} &= \frac{-56}{7} \\ x &= -8 \end{aligned}$$

$$\begin{aligned} 19 + 12x &= 7 \\ -19 & \quad -19 \\ 12x &= -12 \\ \frac{12x}{12} &= \frac{-12}{12} \\ x &= -1 \end{aligned}$$

$$\begin{aligned} 16 &= 24 + 2x \\ -24 & \quad -24 \\ -8 &= 2x \\ \frac{-8}{2} &= \frac{2x}{2} \\ x &= -4 \end{aligned}$$

$$\begin{aligned} 45 &= x + 48 \\ -48 & \quad -48 \\ x &= -3 \end{aligned}$$

$$\begin{aligned} -5x + 13 &= -12 \\ -13 & \quad -13 \\ -5x &= -25 \\ \frac{-5x}{-5} &= \frac{-25}{-5} \\ x &= 5 \end{aligned}$$

$$\begin{aligned} -7x - 1 &= -22 \\ +1 & \quad +1 \\ -7x &= -21 \\ \frac{-7x}{-7} &= \frac{-21}{-7} \\ x &= 3 \end{aligned}$$

Did you solve the last two equations? Don't worry if you didn't. The Finger Method is just one way to solve equations. You can keep on using it if you like it. In the next section you will find out about another method which will make it easier to solve equations like the last two.

Solve each equation by using the Addition Principle.

We want to find out what $8x$ equals, so we need to get rid of the -4 . That's why we add $+4$ to each side.

$$8x - 4 = 20$$

$$+4 \quad +4$$

$$8x = 24$$

$$x = 3$$

$$4x - 3 = 21$$

$$+3 \quad +3$$

$$\frac{4x}{4} = \frac{24}{4}$$

$$x = 6$$

$$7x - 3 = 11$$

$$+3 \quad +3$$

$$\frac{7x}{7} = \frac{14}{7}$$

$$x = 2$$

$$5x - 31 = 4$$

$$+31 \quad +31$$

$$\frac{5x}{5} = \frac{35}{5}$$

$$x = 7$$

$$2x - 9 = 33$$

$$+9 \quad +9$$

$$\frac{2x}{2} = \frac{42}{2}$$

$$x = 21$$

$$10x - 73 = 7$$

$$+73 \quad +73$$

$$\frac{10x}{10} = \frac{80}{10}$$

$$x = 8$$

$$11x - 9 = 35$$

$$+9 \quad +9$$

$$\frac{11x}{11} = \frac{44}{11}$$

$$x = 4$$

$$13 = 3x - 23$$

$$+23 \quad +23$$

$$\frac{36}{3} = \frac{3x}{3}$$

$$x = 12$$

$$26 = x - 8$$

$$+8 \quad +8$$

$$x = 34$$

$$45 = 6x - 9$$

$$+9 \quad +9$$

$$\frac{54}{6} = \frac{6x}{6}$$

$$x = 9$$

We want to find out what $5x$ equals, so we need to get rid of the $+3$. That's why we add -3 to each side.

$$5x + 3 = 23$$

$$-3 \quad -3$$

$$5x = 20$$

$$x = 4$$

$$10x + 3 = 63$$

$$-3 \quad -3$$

$$\frac{10x}{10} = \frac{60}{10}$$

$$x = 6$$

$$6x + 8 = 38$$

$$-8 \quad -8$$

$$\frac{6x}{6} = \frac{30}{6}$$

$$x = 5$$

$$3x + 7 = 25$$

$$-7 \quad -7$$

$$\frac{3x}{3} = \frac{18}{3}$$

$$x = 6$$

$$2x + 9 = 9$$

$$-9 \quad -9$$

$$2x = 0$$

$$x = 0$$

$$7x + 16 = 16$$

$$-16 \quad -16$$

$$\frac{7x}{7} = \frac{0}{7}$$

$$x = 0$$

$$34 = 4x + 34$$

$$-34 \quad -34$$

$$0 = 4x$$

$$\frac{0}{4} = \frac{4x}{4}$$

$$x = 0$$

The problems on this page have been mixed up. Stop and think about what number you want to get rid of. Then add the opposite of that number to both sides.

$4x - 17 = 7$ $+17 \quad +17$ $\cancel{4x} = \frac{24}{4}$ $x = 6$	$6x + 5 = 59$ $\cancel{-5} \quad -5$ $\cancel{6x} = \frac{54}{6}$ $x = 9$	$5y - 7 = 13$ $\cancel{+7} \quad +7$ $\cancel{5y} = \frac{20}{5}$ $y = 4$
$2x + 1 = 51$ $\cancel{-1} \quad -1$ $\cancel{2x} = \frac{50}{2}$ $x = 25$	$3x - 2 = 4$ $\cancel{+2} \quad +2$ $\cancel{3x} = \frac{6}{3}$ $x = 2$	$10s + 9 = 49$ $\cancel{-9} \quad -9$ $\cancel{10s} = \frac{40}{10}$ $s = 4$
$9x + 8 = 89$ $\cancel{-8} \quad -8$ $\cancel{9x} = \frac{81}{9}$ $x = 9$	$5a - 5 = 5$ $\cancel{+5} \quad +5$ $\cancel{5a} = \frac{10}{5}$ $a = 2$	$6x + 5 = 5$ $\cancel{-5} \quad -5$ $\cancel{6x} = \frac{0}{6}$ $x = 0$
$32^{+17} = 7m - 17^{+17}$ $49 = 7m$ $m = 7$	$50^{-10} = 20x + 10^{-10}$ $40 = 20x$ $x = 2$	$35 = 3x + 20$ $\cancel{-20} \quad -20$ $\frac{15}{3} = \frac{3x}{3}$ $x = 5$
$22 = 9x - 23$ $\cancel{+23} \quad +23$ $\frac{45}{9} = \frac{9x}{9}$ $x = 5$	$3 = 58 + 5x$ $\cancel{-58} \quad -58$ $\frac{-55}{5} = \frac{5x}{5}$ $x = -11$	$4 = 12x + 40$ $\cancel{-40} \quad -40$ $\frac{-36}{12} = \frac{12x}{12}$ $x = -3$
$18 = 4z - 10$ $\cancel{+10} \quad +10$ $\frac{28}{4} = \frac{4z}{4}$ $z = 7$	$38 = 4x + 10$ $\cancel{-10} \quad -10$ $\frac{28}{4} = \frac{4x}{4}$ $x = 7$	$34 = 4x + 10$ $\cancel{-10} \quad -10$ $\frac{24}{4} = \frac{4x}{4}$ $x = 6$
$2 = 4x - 10$ $\cancel{+10} \quad +10$ $\frac{12}{4} = \frac{4x}{4}$ $x = 3$	$10 = 4x + 10$ $\cancel{-10} \quad -10$ $\frac{0}{4} = \frac{4x}{4}$ $x = 0$	$2 = 4x + 10$ $\cancel{-10} \quad -10$ $\frac{-8}{4} = \frac{4x}{4}$ $x = -2$

Now look at the last two problems on page 12 again. It is easy to solve these using the Addition Principle.

$$\begin{aligned} -5x + \cancel{3}^{-3} &= -12^{-13} \\ -5x &= -25 \\ x &= 5 \end{aligned}$$

$$\begin{aligned} -7x - \cancel{x}^{+1} &= -22^{+1} \\ -7x &= -21 \\ x &= 3 \end{aligned}$$

Here are some more equations to solve using the Addition Principle:

$\begin{aligned} -3x + \cancel{17}^{-17} &= 2 \\ -3x &= -15 \\ \frac{-3x}{-3} &= \frac{-15}{-3} \\ x &= 5 \end{aligned}$	$\begin{aligned} -4x + \cancel{6}^{-6} &= -10 \\ -4x &= -16 \\ \frac{-4x}{-4} &= \frac{-16}{-4} \\ x &= 4 \end{aligned}$	$\begin{aligned} -5x - \cancel{18}^{+18} &= -3 \\ -5x &= 15 \\ \frac{-5x}{-5} &= \frac{15}{-5} \\ x &= -3 \end{aligned}$
$\begin{aligned} -\cancel{9}^{+9} + 2x &= -21 \\ 2x &= -12 \\ \frac{2x}{2} &= \frac{-12}{2} \\ x &= -6 \end{aligned}$	$\begin{aligned} -7x + \cancel{42}^{-42} &= 0 \\ -7x &= -42 \\ \frac{-7x}{-7} &= \frac{-42}{-7} \\ x &= 6 \end{aligned}$	$\begin{aligned} \cancel{12}^{-12} + 9x &= -60 \\ 9x &= -72 \\ \frac{9x}{9} &= \frac{-72}{9} \\ x &= -8 \end{aligned}$
$\begin{aligned} -\cancel{70}^{+70} + 5x &= -20 \\ 5x &= 50 \\ \frac{5x}{5} &= \frac{50}{5} \\ x &= 10 \end{aligned}$	$\begin{aligned} -2x - \cancel{98}^{+98} &= 2 \\ -2x &= 100 \\ \frac{-2x}{-2} &= \frac{100}{-2} \\ x &= -50 \end{aligned}$	$\begin{aligned} 36 &= -4x + \cancel{56}^{-56} \\ -20 &= -4x \\ \frac{-20}{-4} &= \frac{-4x}{-4} \\ x &= 5 \end{aligned}$
$\begin{aligned} 6x + \cancel{12}^{-12} &= 0 \\ 6x &= -12 \\ \frac{6x}{6} &= \frac{-12}{6} \\ x &= -2 \end{aligned}$	$\begin{aligned} 29 &= \cancel{38}^{-38} + x \\ x &= -9 \end{aligned}$	$\begin{aligned} 0 &= 12p - \cancel{48}^{+48} \\ 48 &= 12p \\ \frac{48}{12} &= \frac{12p}{12} \\ p &= 4 \end{aligned}$
$\begin{aligned} \cancel{18}^{-18} + -8p &= -30 \\ -8p &= -48 \\ \frac{-8p}{-8} &= \frac{-48}{-8} \\ p &= 6 \end{aligned}$	$\begin{aligned} 0 &= -6x - \cancel{66}^{+66} \\ 66 &= -6x \\ \frac{66}{-6} &= \frac{-6x}{-6} \\ x &= -11 \end{aligned}$	$\begin{aligned} -\cancel{14}^{+14} + -3x &= -2 \\ -3x &= 12 \\ \frac{-3x}{-3} &= \frac{12}{-3} \\ x &= -4 \end{aligned}$

These equations have an extra step. First simplify each side by combining like terms. Then use the Addition Principle.

$\begin{aligned} 2x + 5x + 11 &= 53 \\ 7x + 11 &= 53 \\ 7x &= 42 \\ x &= 6 \end{aligned}$	$\begin{aligned} 3 + 4x + 5x &= 21 \\ -3 + 9x &= 21 \\ 9x &= 18 \\ x &= 2 \end{aligned}$	$\begin{aligned} 5x + 8 - 2x &= 26 \\ 3x + 8 &= 26 \\ 3x &= 18 \\ x &= 6 \end{aligned}$
$\begin{aligned} 16x - 8 - 9x &= 27 \\ 7x - 8 &= 27 \\ 7x &= 35 \\ x &= 5 \end{aligned}$	$\begin{aligned} x - 3x + 9 &= 27 \\ -2x + 9 &= 27 \\ -2x &= 18 \\ x &= -9 \end{aligned}$	$\begin{aligned} 2x + 7 + 2x &= 23 \\ 4x + 7 &= 23 \\ 4x &= 16 \\ x &= 4 \end{aligned}$
$\begin{aligned} 4x + 9x + 8 &= 47 \\ 13x + 8 &= 47 \\ 13x &= 39 \\ x &= 3 \end{aligned}$	$\begin{aligned} 55 - 3x - 2x &= 10 \\ 55 - 5x &= 10 \\ -5x &= -45 \\ x &= 9 \end{aligned}$	$\begin{aligned} 8x + 7 + 2x &= 7 \\ 10x + 7 &= 7 \\ 10x &= 0 \\ x &= 0 \end{aligned}$
$\begin{aligned} 61 &= 6 - 8x - 3x \\ 61 &= 6 - 11x \\ -6 &= -11x \\ 55 &= -11x \\ x &= -5 \end{aligned}$	$\begin{aligned} x + 6 + x &= 28 \\ 2x + 6 &= 28 \\ -6 &= 22 \\ 2x &= 22 \\ x &= 11 \end{aligned}$	$\begin{aligned} 4x - 3 + 2x &= 15 \\ 6x - 3 &= 15 \\ +3 &= 18 \\ 6x &= 18 \\ x &= 3 \end{aligned}$
$\begin{aligned} 6x + 14 + x &= 56 \\ 7x + 14 &= 56 \\ -14 &= 42 \\ 7x &= 42 \\ x &= 6 \end{aligned}$	$\begin{aligned} 0 &= 3x - 20 + 2 \\ 0 &= 3x - 18 \\ +18 &= 3x \\ 18 &= 3x \\ x &= 6 \end{aligned}$	$\begin{aligned} 2x + 5 - 10x + 11 &= 0 \\ -8x + 16 &= 0 \\ -16 &= -16 \\ -8x &= -16 \\ x &= 2 \end{aligned}$

On these problems you can use the Addition Principle to get rid of the extra x -terms so that you'll have an x -term on one side and a number term on the other side.

$5x - 2x = 2x - 2x - 12$ $3x = -12$ $x = -4$	$9x = 5x + 8$ $-5x \quad -5x$ $\frac{4x}{4} = \frac{8}{4}$ $x = 2$	$8x = 16 + 6x$ $-6x \quad -6x$ $\frac{2x}{2} = \frac{16}{2}$ $x = 8$	$4x = 7 + 3x$ $-3x \quad -3x$ $x = 7$
$10x = 3x - 42$ $-3x \quad -3x$ $\frac{7x}{7} = \frac{-42}{7}$ $x = -6$	$7x = 36 + 4x$ $-4x \quad -4x$ $\frac{3x}{3} = \frac{36}{3}$ $x = 12$	$3x = 11x + 24$ $-11x \quad -11x$ $\frac{-8x}{-8} = \frac{24}{-8}$ $x = -3$	$9x = 15 + 6x$ $-6x \quad -6x$ $\frac{3x}{3} = \frac{15}{3}$ $x = 5$
$2x + 3x = 45 - 3x + 3x$ $5x = 45$ $x = 9$	$4x = 63 - 3x$ $+3x \quad +3x$ $\frac{7x}{7} = \frac{63}{7}$ $x = 9$	$4x = 30 - x$ $+x \quad +x$ $\frac{5x}{5} = \frac{30}{5}$ $x = 6$	$2x = 36 - 2x$ $+2x \quad +2x$ $\frac{4x}{4} = \frac{36}{4}$ $x = 9$
$x = 16 - x$ $+x \quad +x$ $\frac{2x}{2} = \frac{16}{2}$ $x = 8$	$3x = 48 - 5x$ $+5x \quad +5x$ $\frac{8x}{8} = \frac{48}{8}$ $x = 6$	$10x = 60 - 5x$ $+5x \quad +5x$ $\frac{15x}{15} = \frac{60}{15}$ $x = 4$	$0 = 35 - 7x$ $+7x \quad +7x$ $\frac{7x}{7} = \frac{35}{7}$ $x = 5$

Be careful on these. First look at the equation and decide what term you need to get rid of. Then use the Addition Principle to get rid of it.

$6x + 5 = 35$ $-5 \quad -5$ $\frac{6x}{6} = \frac{30}{6}$ $x = 5$	$7x = 27 - 2x$ $+2x \quad +2x$ $\frac{9x}{9} = \frac{27}{9}$ $x = 3$	$10t - 3 = 57$ $+3 \quad +3$ $\frac{10t}{10} = \frac{60}{10}$ $t = 6$	$7x = 3x + 20$ $-3x \quad -3x$ $\frac{4x}{4} = \frac{20}{4}$ $x = 5$
$9x = 2x + 42$ $-2x \quad -2x$ $\frac{7x}{7} = \frac{42}{7}$ $x = 6$	$w + 16 = 7$ $-16 \quad -16$ $w = -9$	$48 - 2x = 4x$ $+2x \quad +2x$ $\frac{48}{6} = \frac{6x}{6}$ $x = 8$	$3k - 10 = 5k$ $-3k \quad -3k$ $\frac{-10}{2} = \frac{2k}{2}$ $k = -5$

Be sure to simplify each side before you use the Addition Principle.

$3x + 5x = 6x + 28 - 2x$ $\cancel{8x} = \cancel{4x} + 28$ $4x = 28$ $x = 7$	$6x + 5x = 3x + 2x - 54$ $\cancel{11x} = \cancel{5x} - 54$ $\begin{array}{r} -5x \\ -5x \\ \hline 6x = -54 \\ \frac{6x}{6} = \frac{-54}{6} \\ x = -9 \end{array}$	$7x - 3x = 6x + 14 - 4x$ $\cancel{4x} = \cancel{2x} + 14$ $\begin{array}{r} -2x \\ -2x \\ \hline 2x = 14 \\ \frac{2x}{2} = \frac{14}{2} \\ x = 7 \end{array}$
$3x + x = 4x + 24 - 6x$ $\begin{array}{r} 4x = -2x + 24 \\ +2x \quad +2x \\ \hline 6x = 24 \\ \frac{6x}{6} = \frac{24}{6} \\ x = 4 \end{array}$	$5x + 7x = 3x + 6x - 36$ $\begin{array}{r} 12x = 9x - 36 \\ -9x \quad -9x \\ \hline 3x = -36 \\ \frac{3x}{3} = \frac{-36}{3} \\ x = -12 \end{array}$	$14x - 10x = 3x + 16$ $\begin{array}{r} 4x = 3x + 16 \\ -3x \quad -3x \\ \hline x = 16 \end{array}$
$3x - 5x + 8x = 4x + 18$ $\begin{array}{r} 6x = 4x + 18 \\ -4x \quad -4x \\ \hline 2x = 18 \\ \frac{2x}{2} = \frac{18}{2} \\ x = 9 \end{array}$	$2x + 12x = 3x - 5x$ $\begin{array}{r} 14x = -2x \\ +2x \quad +2x \\ \hline 16x = 0 \\ \frac{16x}{16} = \frac{0}{16} \\ x = 0 \end{array}$	$5x = 3x + 6x + 28$ $\begin{array}{r} 5x = 9x + 28 \\ -9x \quad -9x \\ \hline -4x = 28 \\ \frac{-4x}{-4} = \frac{28}{-4} \\ x = -7 \end{array}$
$26 + 2x + 6 = 8x - 2x$ $32 + \cancel{2x} = \cancel{6x}$ $32 = 4x$ $x = 8$	$x + x + 48 = 3x + 5x$ $\begin{array}{r} \cancel{2x} + 48 = \cancel{8x} \\ -2x \quad -2x \\ \hline 48 = 6x \\ \frac{48}{6} = \frac{6x}{6} \\ x = 8 \end{array}$	$9x - 6x + 36 = 7x - 2x$ $\begin{array}{r} 3x + 36 = 5x \\ -3x \quad -3x \\ \hline 36 = 2x \\ \frac{36}{2} = \frac{2x}{2} \\ x = 18 \end{array}$
$8x - x - 40 = 10x + x$ $\begin{array}{r} 7x - 40 = 11x \\ -7x \quad -7x \\ \hline -40 = 4x \\ \frac{-40}{4} = \frac{4x}{4} \\ x = -10 \end{array}$	$3x + 3x + 3 = 3x$ $\begin{array}{r} 6x + 3 = 3x \\ -6x \quad -6x \\ \hline 3 = -3x \\ \frac{3}{-3} = \frac{-3x}{-3} \\ x = -1 \end{array}$	$6x + 8x - 36 = 3x + 5x$ $\begin{array}{r} 14x - 36 = 8x \\ -14x \quad -14x \\ \hline -36 = -6x \\ \frac{-36}{-6} = \frac{-6x}{-6} \\ x = 6 \end{array}$

On some equations you have to use the Addition Principle *twice* to get the x -terms on one side and the numbers on the other.

$$5x^{-2x} + 6 = 2x^{-2x} + 24$$

If I add $-2x$ to both sides I'll have just 24 on the right.

$$3x + 6^{-6} = 24^{-6}$$

Now I can get rid of the 6 by adding -6 .

$$3x = 18$$

$$x = 6$$

$$10x + 5 = 6x + 49$$

$$\begin{array}{r} -6x \\ 4x + 5 = 49 \\ -5 \quad -5 \\ \hline 4x = 44 \\ \frac{4x}{4} = \frac{44}{4} \end{array}$$

$$x = 11$$

$$7x + 10 = 2x + 25$$

$$\begin{array}{r} -2x \\ 5x + 10 = 25 \\ -10 \quad -10 \\ \hline 5x = 15 \\ \frac{5x}{5} = \frac{15}{5} \end{array}$$

$$x = 3$$

$$6x + 16 = 3x + 7$$

$$\begin{array}{r} -3x \\ 3x + 16 = 7 \\ -16 \quad -16 \\ \hline 3x = -9 \\ \frac{3x}{3} = \frac{-9}{3} \end{array}$$

$$x = -3$$

$$13x + 41 = 4x + 5$$

$$\begin{array}{r} -4x \\ 9x + 41 = 5 \\ -41 \quad -41 \\ \hline 9x = -36 \\ \frac{9x}{9} = \frac{-36}{9} \end{array}$$

$$x = -4$$

$$6x + 15 = 2x + 7$$

$$\begin{array}{r} -2x \\ 4x + 15 = 7 \\ -15 \quad -15 \\ \hline 4x = -8 \\ \frac{4x}{4} = \frac{-8}{4} \end{array}$$

$$x = -2$$

$$4x + 8 = 3x + 17$$

$$\begin{array}{r} -3x \\ x + 8 = 17 \\ -8 \quad -8 \\ \hline x = 9 \end{array}$$

$$x = 9$$

$$9x + 40 = 3x + 40$$

$$\begin{array}{r} -3x \\ 6x + 40 = 40 \\ -40 \quad -40 \\ \hline 6x = 0 \\ \frac{6x}{6} = \frac{0}{6} \end{array}$$

$$x = 0$$

$$2a + 8 = 12 - 3a$$

$$5a - 8 = 12$$

$$5a = 20$$

$$a = 4$$

$$8m - 15 = 7 - 3m$$

$$\begin{array}{r} +3m \\ 11m - 15 = 7 \\ +15 \quad +15 \\ \hline 11m = 22 \\ \frac{11m}{11} = \frac{22}{11} \end{array}$$

$$m = 2$$

$$4y - 10 = 5 - y$$

$$\begin{array}{r} +y \\ 5y - 10 = 5 \\ +10 \quad +10 \\ \hline 5y = 15 \\ \frac{5y}{5} = \frac{15}{5} \end{array}$$

$$y = 3$$

$$4t - 7 = 14 - 3t$$

$$\begin{array}{r} +3t \\ 7t - 7 = 14 \\ +7 \quad +7 \\ \hline 7t = 21 \\ \frac{7t}{7} = \frac{21}{7} \end{array}$$

$$t = 3$$

$$4m - 7 = 18 - m$$

$$\begin{array}{r} +m \\ 5m - 7 = 18 \\ +7 \quad +7 \\ \hline 5m = 25 \\ \frac{5m}{5} = \frac{25}{5} \end{array}$$

$$m = 5$$

$$8y - 9 = 2 - 3y$$

$$\begin{array}{r} +3y \\ 11y - 9 = 2 + 9 \\ +9 \quad +9 \\ \hline 11y = 11 \\ \frac{11y}{11} = \frac{11}{11} \end{array}$$

$$y = 1$$

Remember to simplify each side before you use the Addition Principle.

$$8x + 7 - 3x = 6x + 19 - 4x$$

$$5x + 7 = 2x + 19$$

$$3x + 7 = 19$$

$$3x = 12$$

$$x = 4$$

$$5x - 3x + 8 = 4 + 4x - 6$$

$$2x + 8 = -2 + 4x$$

$$8 = -2 + 2x$$

$$\frac{10}{2} = \frac{2x}{2} \quad \boxed{x=5}$$

$$9x + 3x - 9x = 6 + 8x - 11$$

$$3x = -5 + 8x$$

$$\frac{-5x}{-5} = \frac{-5}{-5}$$

$$\boxed{x=1}$$

$$4x + 3x - 7 = 60 - 2x - 13$$

$$7x - 7 = 47 - 2x$$

$$9x - 7 = 47$$

$$\frac{54}{9} = \frac{54}{9} \quad \boxed{x=6}$$

$$6x - 8 + 2x - 5 = 7 - 2x$$

$$8x - 13 = 7 - 2x$$

$$10x - 13 = 7 + 13$$

$$\frac{20x}{10} = \frac{20}{10} \quad \boxed{x=2}$$

$$x + 2 + x + x = 6 - x$$

$$3x + 2 = 6 - x$$

$$4x + 2 = 6$$

$$\frac{4x}{4} = \frac{4}{4} \quad \boxed{x=1}$$

$$8x + 5x - 7x + 3 - x = 48$$

$$5x + 3 = 48$$

$$\frac{5x}{5} = \frac{45}{5}$$

$$\boxed{x=9}$$

$$4 + 3x = 6x - 8 + 3x - 12$$

$$4 + 3x = 9x - 20$$

$$4 = 6x - 20$$

$$\frac{24}{6} = \frac{6x}{6} \quad \boxed{x=4}$$

$$3x + 3x + 3x + 3 = 3 + 5x$$

$$9x + 3 = 3 + 5x$$

$$4x + 3 = 3$$

$$\frac{4x}{4} = \frac{0}{4} \quad \boxed{x=0}$$

$$7 - 4x + 3 = x - 16 - 3x$$

$$10 - 4x = -2x - 16$$

$$10 = 2x - 16$$

$$\frac{26}{2} = \frac{2x}{2} \quad \boxed{x=13}$$

Here are some equations with parentheses for you to solve. First simplify each side of the equation. Then the rest will be easy.

$$3(5x - 3x) + 5 = 47$$

$$3(2x) + 5 = 47$$

$$6x + 5 = 47$$

$$6x = 42$$

$$x = 7$$

$$2(7x - 3x) + 4 = 28$$

$$14x - 6x + 4 = 28$$

$$8x + 4 = 28$$

$$\frac{8x}{8} = \frac{24}{8}$$

$$x = 3$$

$$3(2x + 2x) = 35 + 5x$$

$$6x + 6x = 35 + 5x$$

$$12x = 35 + 5x$$

$$\frac{7x}{7} = \frac{35}{7}$$

$$x = 5$$

$$16(x - 1) = 12x + 36$$

$$16x - 16 = 12x + 36$$

$$4x - 16 = 36$$

$$\frac{4x}{4} = \frac{52}{4}$$

$$x = 13$$

$$6x + 2(x + 7) = 46$$

$$6x + 2x + 14 = 46$$

$$8x + 14 = 46$$

$$\frac{8x}{8} = \frac{32}{8}$$

$$x = 4$$

$$4x + 18 = 7(x + 3)$$

$$4x + 18 = 7x + 21$$

$$18 = 3x + 21$$

$$\frac{-3}{-3} = \frac{3x}{-3}$$

$$x = -1$$

$$3x + 3(5x - 7x) = 12 - x$$

$$3x + 15x - 21x = 12 - x$$

$$-3x = 12 - x$$

$$\frac{-2x}{-2} = \frac{12}{-2}$$

$$x = -6$$

$$9 - 4(7x - 8x) = x - 3$$

$$9 - 28x + 32x = x - 3$$

$$9 + 4x = x - 3$$

$$9 + 3x = -3$$

$$\frac{3x}{3} = \frac{-12}{3}$$

$$x = -4$$

$$3(2x - 3) - 9x - 4 = 2x + 12$$

$$6x - 9 - 9x - 4 = 2x + 12$$

$$-3x - 13 = 2x + 12$$

$$-13 = 5x + 12$$

$$\frac{-25}{5} = \frac{5x}{5}$$

$$x = -5$$

$$-2x - 18 = 6(1 - 2x) + 4x$$

$$-2x - 18 = 6 - 12x + 4x$$

$$-2x - 18 = 6 - 8x$$

$$-18 = 6 - 6x$$

$$\frac{-24}{-6} = \frac{-6x}{-6}$$

$$4(3x + x) + 7 - 5x = 8 + (-5)(5x - 6x) + 23$$

$$12x + 4x + 7 - 5x = 8 - 25x + 30x + 23$$

$$11x + 7 = 5x + 31$$

$$6x + 7 = 31$$

$$6x = 24$$

$$\frac{6x}{6} = \frac{24}{6}$$

$$x = 4$$

Using Equations to Solve Problems

Make up an equation for each problem. Then solve the equation to get the answer.

"I'm thinking of a number. If you multiply it by 6 and then add 7, you will get 55. What is my number?"

$$\begin{aligned} \text{Equation: } 6x + 7 &= 55 \\ 6x &= 48 \\ x &= 8 \end{aligned}$$

Answer: 8

"I'm thinking of a number. If you multiply it by 4 and then add 13, you will get 37. What is my number?"

$$\begin{aligned} \text{Equation: } 4x + 13 &= 37 \\ -13 \quad -13 & \\ \hline 4x &= 24 \\ \frac{4x}{4} &= \frac{24}{4} \end{aligned}$$

Answer:

$$x = 6$$

"I'm thinking of a number. If you multiply it by 8 and then add 17, you will get 33. What is my number?"

$$\begin{aligned} \text{Equation: } 8x + 17 &= 33 \\ -17 \quad -17 & \\ \hline 8x &= 16 \\ \frac{8x}{8} &= \frac{16}{8} \end{aligned}$$

Answer:

$$x = 2$$

"I'm thinking of a number. If you multiply it by 5 and then take away 7, you will get 53. What is my number?"

$$\begin{aligned} \text{Equation: } 5x - 7 &= 53 \\ +7 \quad +7 & \\ \hline 5x &= 60 \\ \frac{5x}{5} &= \frac{60}{5} \end{aligned}$$

Answer:

$$x = 12$$

"I'm thinking of a number. If you multiply it by 8 and then subtract 13, you will get 43. What is my number?"

$$\begin{aligned} \text{Equation: } 8x - 13 &= 43 \\ +13 \quad +13 & \\ \hline 8x &= 56 \\ \frac{8x}{8} &= \frac{56}{8} \end{aligned}$$

Answer:

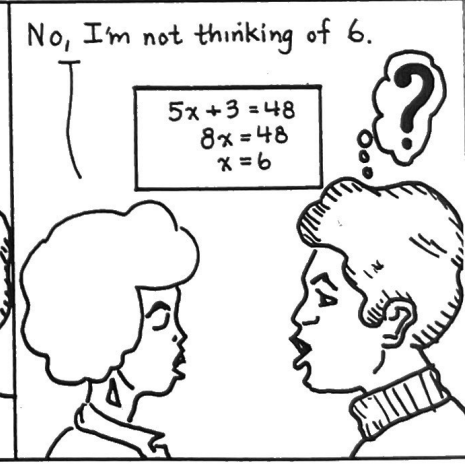
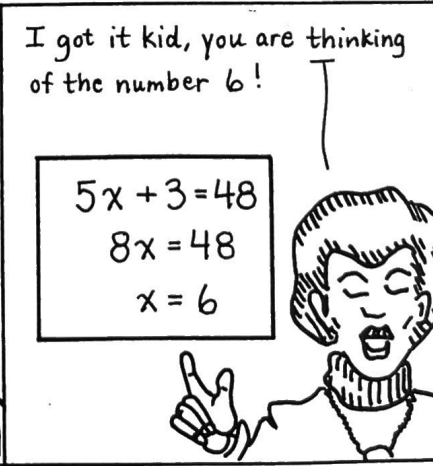
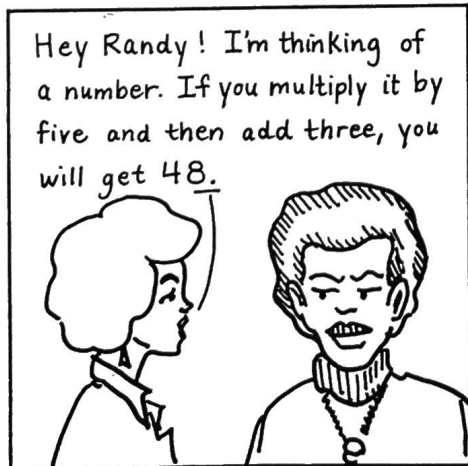
$$x = 7$$

"I'm thinking of a number. If you multiply it by 5 and then subtract 24, you will get the number I am thinking of. What is my number?"

$$\begin{aligned} \text{Equation: } 5x - 24 &= x \\ -5x \quad -5x & \\ \hline -24 &= -4x \\ \frac{-24}{-4} &= \frac{-4x}{-4} \end{aligned}$$

Answer:

$$x = 6$$



Do you know what number Debra was thinking of? Can you prove it?

For each problem, first write an equation. Then solve the equation and use the solution to find the answer.

A 48-cm piece of wire is to be cut into two parts. One piece must be 10 cm longer than the other. How long should the pieces be?

$$\begin{array}{r} x \quad , \quad x+10 \\ \hline 48 \end{array}$$

Equation: $x + x + 10 = 48$

$$2x + 10 = 48$$

$$2x = 38$$

$$x = 19$$

Answer: 19cm and 29cm

How can \$500 be divided between two people so that one person gets \$50 more than the other?

$x = \$$ person 1 gets
 $x+50 = \$$ person 2 gets

Equation: $500 = x + x + 50$

$$500 = 2x + 50$$

$$\begin{array}{r} 500 \\ -50 \\ \hline 450 = \frac{2x}{2} \end{array}$$

$\$225$
 $\$275$

Answer: $x = 225$

A 16-ft. board is to be cut into three pieces. Two of the pieces must be 4 feet shorter than the third piece. How long should each piece be?

$x = 3^{\text{rd}}$ piece
 $x-4 = 1^{\text{st}}/2^{\text{nd}}$ piece

Equation: $16 = x + 2(x-4)$

$$16 = x + 2x - 8$$

$$16 = 3x - 8$$

$$\begin{array}{r} 16 \\ +8 \\ \hline 24 = 3x \end{array}$$

8 ft
 4 ft
 4 ft

Answer: $\frac{24}{3} = \frac{3x}{3} \quad x = 8$

The band leader wants to line up the 92 band members in 4 rows so that each row has two more members than the row before. How many members should be in the shortest row?

$x = 1^{\text{st}}$ row
 $x+2 = 2^{\text{nd}}$ row
 $x+4 = 3^{\text{rd}}$ row
 $x+6 = 4^{\text{th}}$ row

Equation: $92 = x + x + 2 + x + 4 + x + 6$

$$92 = 4x + 12$$

$$\begin{array}{r} 92 \\ -12 \\ \hline 80 = \frac{4x}{4} \end{array}$$

20 students

Answer: $\frac{80}{4} = \frac{4x}{4} \quad x = 20$

Raoul has to finish a 473-page book in a week. He decides to read the same number of pages each weekday and 30 extra pages on Saturday and on Sunday. How many pages will he have to read on Wednesday?

$x = \#$ pgs. on weekday

Equation: $473 = 5x + 2(x+30)$

$$473 = 5x + 2x + 60$$

$$473 = 7x + 60$$

$$\begin{array}{r} 473 \\ -60 \\ \hline 413 = \frac{7x}{7} \end{array}$$

Answer: $\frac{413}{7} = \frac{7x}{7}$

A store owner sells two pairs of running shoes for each pair of high tops. He plans to order 144 pairs of shoes. How many pairs should be high tops?

$x = \text{high tops}$
 $2x = \text{running shoes}$

Equation: $x + 2x = 144$

$$3x = 144$$

$$\frac{3x}{3} = \frac{144}{3}$$

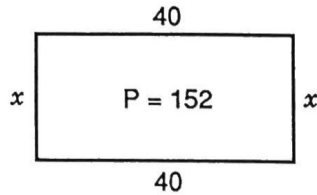
48
 high tops

Answer: $x = 48$

$x = 59$ 59 pgs

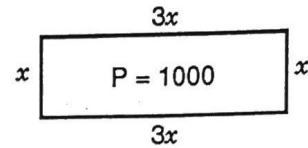
Perimeter Problems

In each problem, first write an equation for the perimeter of the rectangle or triangle. Then solve the equation and use your solution to find the lengths of all the sides.



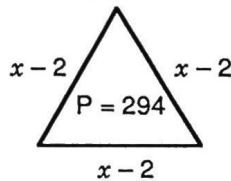
$$\begin{aligned} \text{Equation: } x + 40 + x + 40 &= 152 \\ 2x + 80 &= 152 \\ 2x &= 72 \\ x &= 36 \end{aligned}$$

Lengths: 36, 40, 36, 40



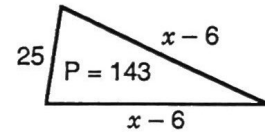
$$\begin{aligned} \text{Equation: } x + 3x + x + 3x &= 1000 \\ 8x &= 1000 \\ \frac{8x}{8} &= \frac{1000}{8} \\ x &= 125 \end{aligned}$$

Lengths: 125, 375, 125, 375



$$\begin{aligned} \text{Equation: } x - 2 + x - 2 + x - 2 &= 294 \\ 3x - 6 &= 294 \\ +6 \quad +6 & \\ 3x &= 300 \\ \frac{3x}{3} &= \frac{300}{3} \\ x &= 100 \end{aligned}$$

94 ← Lengths: 98, 98, 98



$$\begin{aligned} \text{Equation: } 25 + x - 6 + x - 6 &= 143 \\ 2x + 13 &= 143 \\ -13 & \\ 2x &= 130 \\ \frac{2x}{2} &= \frac{130}{2} \\ x &= 65 \end{aligned}$$

Lengths: 25, 59, 59

You need to make your own sketches for these problems.

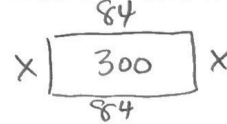
The perimeter of a rectangle is 234 meters. The rectangle is twice as long as it is wide. What are its length and width?



$$\begin{aligned} \text{Equation: } 2x + x + 2x + x &= 234 \\ 6x &= 234 \\ \frac{6x}{6} &= \frac{234}{6} \\ x &= 39 \end{aligned}$$

Answer: 39, 78, 39, 78

Zelda has a 300-inch roll of binding for a quilt. The quilt must be 84 inches long. How wide can she make it?



$$\begin{aligned} \text{Equation: } 84 + x + 84 + x &= 300 \\ 168 + 2x &= 300 \\ -168 & \\ 2x &= 132 \\ \frac{2x}{2} &= \frac{132}{2} \\ x &= 66 \end{aligned}$$

Answer: 66 in.

Use the Addition and Division Principles to solve each equation.

$$5x - 120 = 60$$

$$\begin{array}{r} 5x = 180 \\ \underline{5} \quad \underline{5} \\ x = 36 \end{array}$$

$$3x - 18 = 45$$

$$\begin{array}{r} 3x = 63 \\ \underline{3} \quad \underline{3} \\ x = 21 \end{array}$$

$$6x + 42 = 300$$

$$\begin{array}{r} 6x = 258 \\ \underline{6} \quad \underline{6} \\ x = 43 \end{array}$$

$$10 - 4x = 102$$

$$\begin{array}{r} -10 \quad -10 \\ -4x = 92 \\ \underline{-4} \quad \underline{-4} \\ x = -23 \end{array}$$

$$100 - 9x = 451$$

$$\begin{array}{r} -100 \quad -100 \\ -9x = 351 \\ \underline{-9} \quad \underline{-9} \\ x = -39 \end{array}$$

$$5x - 17 = 123$$

$$\begin{array}{r} +17 \quad +17 \\ 5x = 140 \\ \underline{5} \quad \underline{5} \\ x = 28 \end{array}$$

$$14x + 25 = 193$$

$$\begin{array}{r} -25 \quad -25 \\ 14x = 168 \\ \underline{14} \quad \underline{14} \\ x = 12 \end{array}$$

$$32x - 77 = 115$$

$$\begin{array}{r} +77 \quad +77 \\ 32x = 192 \\ \underline{32} \quad \underline{32} \\ x = 6 \end{array}$$

$$18x + 25 = -65$$

$$\begin{array}{r} -25 \quad -25 \\ 18x = -90 \\ \underline{18} \quad \underline{18} \\ x = -5 \end{array}$$

$$3(x - 2) = 99$$

$$\begin{array}{r} 3x - 2 = 33 \\ \underline{3} \quad \underline{3} \\ x = 35 \end{array}$$

OR

$$3(x - 2) = 99$$

$$3x - 6 = 99 + 6$$

$$\begin{array}{r} 3x = 105 \\ \underline{3} \quad \underline{3} \\ x = 35 \end{array}$$

$$7(x - 5) = 252$$

$$\begin{array}{r} 7x - 35 = 252 \\ +35 \quad +35 \\ 7x = 287 \\ \underline{7} \quad \underline{7} \\ x = 41 \end{array}$$

$$5(x + 6) = 400$$

$$\begin{array}{r} 5x + 6 = 80 \\ \underline{-6} \quad \underline{-6} \\ x = 74 \end{array}$$

$$-12(x + 4) = 240$$

$$\begin{array}{r} -12x + 4 = -20 \\ \underline{-4} \quad \underline{-4} \\ x = -24 \end{array}$$

$$6(2x + 1) = -138$$

$$\begin{array}{r} 2x + 1 = -23 \\ -1 \quad -1 \\ 2x = -24 \\ \underline{2} \quad \underline{2} \\ x = -12 \end{array}$$

$$196 + 14x = 0$$

$$\begin{array}{r} -196 \quad -196 \\ 14x = -196 \\ \underline{14} \quad \underline{14} \\ x = -14 \end{array}$$

$$2x - 55 = 11x - 280$$

$$\begin{array}{r} -2x \quad -2x \\ -55 = 9x - 280 \\ +280 \quad +280 \\ 225 = 9x \\ \underline{9} \quad \underline{9} \\ x = 25 \end{array}$$

$$50 + 4(x - 2) = 210$$

$$\begin{array}{r} -50 \quad -50 \\ 4(x - 2) = 160 \\ \underline{4} \quad \underline{4} \\ x - 2 = 40 \\ +2 \quad +2 \\ x = 42 \end{array}$$

The Multiplication Principle for Equations

In some equations the variable is already divided by a number.

$$\frac{x}{5} = 14$$

$$\frac{x}{25} = -18$$

We can use the Multiplication Principle to solve these equations. The Multiplication Principle says that if you multiply both sides of an equation by the same number (except 0), the new equation you get will be equivalent to the equation you started with.

$$\begin{aligned} \frac{x}{5} &= 14 \\ 5 \cdot \frac{x}{5} &= 14 \cdot 5 \\ x &= 70 \end{aligned}$$

$$\begin{aligned} \frac{x}{25} &= -18 \\ 25 \cdot \frac{x}{25} &= -18 \cdot 25 \\ x &= -450 \end{aligned}$$

$$\begin{array}{r} 18 \\ \times 25 \\ \hline 90 \\ 36 \\ \hline 450 \end{array}$$

Solve each equation using the Multiplication Principle.

$\begin{aligned} 6 \cdot \frac{x}{6} &= 5 \cdot 6 \\ x &= 30 \end{aligned}$	$\begin{aligned} -2 \cdot \frac{x}{-2} &= 12 \cdot -2 \\ x &= -24 \end{aligned}$	$\begin{aligned} 4 \cdot \frac{x}{4} &= 10 \cdot 4 \\ x &= 40 \end{aligned}$	$\begin{aligned} 9 \cdot \frac{x}{9} &= -8 \cdot 9 \\ x &= -72 \end{aligned}$
$\begin{aligned} 10 \cdot \frac{x}{10} &= 42 \cdot 10 \\ x &= 420 \end{aligned}$	$\begin{aligned} -2 \cdot \frac{x}{-2} &= -8 \cdot -2 \\ x &= 16 \end{aligned}$	$\begin{aligned} -8 \cdot \frac{x}{-8} &= -2 \cdot -8 \\ x &= 16 \end{aligned}$	$\begin{aligned} 6 \cdot \frac{x}{6} &= 8 \cdot 6 \\ x &= 48 \end{aligned}$
$\begin{aligned} 11 \cdot \frac{x}{11} &= 2 \cdot 11 \\ x &= 22 \end{aligned}$	$\begin{aligned} 27 \cdot \frac{x}{27} &= -1 \cdot 27 \\ x &= -27 \end{aligned}$	$\begin{aligned} -10 \cdot \frac{x}{-10} &= -10 \cdot -10 \\ x &= 100 \end{aligned}$	$\begin{aligned} 15 \cdot \frac{x}{15} &= 0 \cdot 15 \\ x &= 0 \end{aligned}$
$\begin{aligned} 9 \cdot 9 &= \frac{x}{9} \cdot 9 \\ 81 &= x \end{aligned}$	$\begin{aligned} 24 \cdot 1 &= \frac{x}{24} \cdot 24 \\ x &= 24 \end{aligned}$	$\begin{aligned} -3 \cdot 13 &= \frac{x}{-3} \cdot -3 \\ x &= -39 \end{aligned}$	$\begin{aligned} 980 \cdot 11 &= \frac{x}{80} \cdot 80 \\ x &= 880 \end{aligned}$
$\begin{aligned} 22 \cdot \frac{x}{22} &= 15 \cdot 22 \\ x &= 330 \end{aligned}$	$\begin{aligned} -16 \cdot \frac{x}{-16} &= 18 \cdot -16 \\ x &= -288 \end{aligned}$	$\begin{aligned} 100 \cdot \frac{x}{100} &= 34 \cdot 100 \\ x &= 3400 \end{aligned}$	$\begin{aligned} 24 \cdot \frac{x}{24} &= -56 \cdot 24 \\ x &= -1344 \end{aligned}$

Use the Multiplication and Addition Principles to solve each equation.

$$\frac{x}{3} - 7 = 15$$

$$3 \cdot \frac{x}{3} = 22 \cdot 3$$

$$x = 66$$

$$\frac{y}{5} - 11 = 9$$

$$5 \cdot \frac{y}{5} = 20 \cdot 5$$

$$y = 100$$

$$\frac{n}{9} + 5 = 13$$

$$9 \cdot \frac{n}{9} = 8 \cdot 9$$

$$n = 72$$

$$\frac{r}{2} + 8 = 5$$

$$-2 \cdot \frac{r}{2} = -3 \cdot 2$$

$$r = -6$$

$$\frac{a}{6} - 15 = 15$$

$$6 \cdot \frac{a}{6} = 30 \cdot 6$$

$$a = 180$$

$$\frac{d}{10} + 15 = 15$$

$$10 \cdot \frac{d}{10} = 0 \cdot 10$$

$$d = 0$$

$$12 = 5 + \frac{x}{3}$$

$$3 \cdot 7 = \frac{x}{3} \cdot 3$$

$$21 = x$$

$$14 = \frac{k}{8} + 7$$

$$8 \cdot 7 = \frac{k}{8} \cdot 8$$

$$k = 56$$

$$12 + \frac{a}{32} = 22$$

$$32 \cdot \frac{a}{32} = 10 \cdot 32$$

$$a = 320$$

$$4 \cdot \frac{x-9}{4} = 20 \cdot 4$$

$$x - 9 = 80$$

$$x = 89$$

$$8 \cdot \frac{x-7}{8} = -3 \cdot 8$$

$$x - 7 = -24$$

$$x = -17$$

$$3 \cdot \frac{x+5}{3} = 9 \cdot 3$$

$$x + 5 = 27$$

$$x = 22$$

$$\frac{x}{5} + 11 = 73$$

$$5 \cdot \frac{x}{5} = 720 \cdot 5$$

$$x = 3600$$

$$33 \cdot \frac{x-8}{33} = 40 \cdot 33$$

$$x - 8 = 1320$$

$$x = 1328$$

$$12 = 18 + \frac{x}{6}$$

$$6 \cdot -6 = \frac{x}{6} \cdot 6$$

$$-36 = x$$

Solve each equation by using the Multiplication and Division Principles.

$$2 \cdot \frac{5x}{2} = 30 \cdot 2$$

$$\frac{5x}{\cancel{5}} = \frac{60}{5}$$

$$x = 12$$

$$9 \cdot \frac{10y}{9} = 100 \cdot 9$$

$$\frac{10y}{\cancel{10}} = \frac{900}{\cancel{10}}$$

$$y = 90$$

$$8 \cdot \frac{7x}{8} = 14 \cdot 8$$

$$\frac{7x}{\cancel{7}} = \frac{112}{\cancel{7}}$$

$$x = 16$$

$$3 \cdot \frac{2x}{3} = 120 \cdot 3$$

$$\frac{2x}{\cancel{2}} = \frac{360}{\cancel{2}}$$

$$x = 180$$

$$5 \cdot \frac{-6y}{5} = 18 \cdot 5$$

$$\frac{-6y}{\cancel{5}} = \frac{90}{\cancel{5}}$$

$$y = -15$$

$$14 \cdot \frac{-x}{14} = 2 \cdot 14$$

$$\frac{-x}{\cancel{14}} = \frac{28}{\cancel{14}}$$

$$x = -28$$

$$2 \cdot \frac{15x}{2} = -75 \cdot 2$$

$$\frac{15x}{\cancel{15}} = \frac{-150}{\cancel{15}}$$

$$x = -10$$

$$4 \cdot \frac{-3x}{4} = 24 \cdot 4$$

$$\frac{-3x}{\cancel{4}} = \frac{96}{\cancel{4}}$$

$$x = -32$$

$$12 \cdot \frac{11x}{12} = 55 \cdot 12$$

$$\frac{11x}{\cancel{11}} = \frac{660}{\cancel{11}}$$

$$x = 60$$

$$3 \cdot \frac{-50x}{3} = 1000 \cdot 3$$

$$\frac{-50x}{\cancel{3}} = \frac{3000}{\cancel{3}}$$

$$x = -60$$

$$9 \cdot \frac{5x}{9} = -40 \cdot 9$$

$$\frac{5x}{\cancel{9}} = \frac{-360}{\cancel{9}}$$

$$x = -72$$

$$-1 \cdot \frac{4x}{-1} = 64 \cdot -1$$

$$\frac{4x}{\cancel{-1}} = \frac{-64}{\cancel{-1}}$$

$$x = -16$$

$$5 \cdot 12 = \frac{6x}{5} \cdot 5$$

$$\frac{60}{\cancel{5}} = \frac{6x}{\cancel{5}}$$

$$x = 10$$

$$6 \cdot -20 = \frac{5x}{6} \cdot 6$$

$$\frac{-120}{\cancel{6}} = \frac{5x}{\cancel{6}}$$

$$x = -24$$

$$3 \cdot 0 = \frac{-2x}{3} \cdot 3$$

$$\frac{0}{\cancel{3}} = \frac{-2x}{\cancel{3}}$$

$$x = 0$$

$$2 \cdot \frac{3(x-5)}{2} = 9 \cdot 2$$

$$\frac{3(x-5)}{\cancel{2}} = \frac{18}{\cancel{2}}$$

$$x-5 = 6$$

$$\begin{array}{r} +5 \\ +5 \end{array}$$

$$x = 11$$

$$3 \cdot \frac{2(x+8)}{3} = 16 \cdot 3$$

$$\frac{2(x+8)}{\cancel{3}} = \frac{48}{\cancel{3}}$$

$$x+8 = 24$$

$$\begin{array}{r} -8 \\ -8 \end{array}$$

$$x = 3$$

$$7 \cdot \frac{3(2x-1)}{7} = 9 \cdot 7$$

$$\frac{3(2x-1)}{\cancel{7}} = \frac{63}{\cancel{7}}$$

$$2x-1 = 21$$

$$\begin{array}{r} +1 \\ +1 \end{array}$$

$$2x = 22$$

$$\frac{2x}{2} = \frac{22}{2}$$

$$x = 11$$

Here's how we could use algebra to solve the Shake Shack problem from page 1. Remember that a shake at the Shack costs 80¢ and the bill for three burgers and a shake was \$4.40. The question was "How much is a burger?"

First we pick a variable to stand for a number we want to find.

$$x = \text{cost of a burger}$$

Next we use that variable to write expressions for other numbers we will need.

$$3x = \text{cost of 3 burgers}$$

Then we find two things which are equal and write an equation.

$$3x + 80 = 440 \quad \text{(\$4.40 is 440¢)}$$

$$3x = 360$$

$$x = 120$$

Finally we solve the equation and use the solution to answer the question.

A burger costs \$1.20.

Follow the steps above to solve each problem.

At the Shake Shack two orders of fries and four shakes costs \$5.90. How much is an order of fries?

$x = \text{price of fries}$

Equation: $2x + 4(.80) = 5.90$

$$2x + 3.20 = 5.90$$

$$-3.20 \quad -3.20$$

$$\frac{2x}{2} = \frac{2.70}{2}$$

Answer:

$$x = \$1.35$$

Jed figures the prom will cost him \$160. He has saved \$46 and can earn \$6 an hour at his job. How many hours will he have to work?

Equation: $x = \# \text{ of hours he needs to work}$

$$6x + 46 = 160$$

$$-46 \quad -46$$

$$\frac{6x}{6} = \frac{114}{6}$$

Answer: $x = 19$

Matt wants to call his mother long distance. The rate is 80¢ for the first three minutes and 20¢ for each additional minute. How long can he talk for \$3.00?

Equation: $x = \# \text{ of minutes}$

$$(.80) + .2x = 3.00$$

$$-.2x = 2.20 \quad -80$$

$$\frac{.2x}{.2} = \frac{2.20}{.2}$$

Answer:

$$x = 11 + 3$$

$$14 \text{ min}$$

Anna is in a phone booth with \$1.35 in change. A call home costs 60¢ for the first five minutes and 15¢ for each additional minute. How long can she talk?

Equation: $x = \# \text{ of minutes}$

$$.6 + .15x = 1.35$$

$$.15x = .75 \quad -60$$

$$\frac{.15x}{.15} = \frac{.75}{.15}$$

Answer:

$$x = 5 + 5$$

$$10 \text{ mins}$$

Age Puzzles

Algebra makes it easy to solve certain kinds of puzzles. Here are some about age. Follow the same steps you followed on the last two pages.

Jason is 12 years older than Ted. Next year Jason will be 3 times as old as Ted. How old is Ted?

	<u>Ted</u>	<u>Jason</u>
This year:	x	$x+12$
Next year:	$3(x+1)$	$x+13$

Equation: $x+13 = 3(x+1)$

$$x+13 = 3x+3$$

$$13 = 2x+3$$

$$10 = 2x$$

$$x = 5$$

Answer: Ted is 5 years old.

Ellen is 11 years older than Maja. Last year Ellen was twice as old as Maja.

	<u>Ellen</u>	<u>Maja</u>
this year	$x+11$	x
last year	$x+10$	$x-1$

Equation:

$$x+10 = (x-1)2$$

$$x+10 = 2x-2$$

$$-x \quad -x$$

$$10 = x-2$$

$x = \text{Maja}$
this yr.

12 yrs old

Answer: $x = 12$

Pam is 14 and her dad is 37. In how many years will Pam's dad be twice as old as she will be?

	<u>Pam</u>	<u>Dad</u>
This year	14	37
Equation:	$14+x$	$37+x$

$$37+x = (14+x)2$$

$$37+x = 28+2x$$

$$-x \quad -x$$

$$37 = 28+x$$

$$-28 \quad -28$$

Answer: $x = 9$ 9 years

Sean is 20 and his brother is 12.

How many years ago was Sean three times as old as his brother? $x = \text{years}$

	<u>Sean</u>	<u>Brother</u>
Equation:	20	12

$$20-x = (12-x)3$$

$$20-x = 36-3x$$

$$+3x \quad +3x$$

$$20+2x = 36$$

$$-20 \quad -20$$

$$2x = 16$$

Answer: $\frac{2x}{2} = \frac{16}{2} \quad x = 8$

12/4

8 yrs ago

Minh is 16. His parents are both the same age. The three of them have lived a total of 100 years. How old are his parents?

	<u>Minh</u>	<u>Parents</u>
Equation:	16	x

$$2x+16 = 100$$

$$-16 \quad -16$$

$$2x = 84$$

$$\frac{2x}{2} = \frac{84}{2}$$

$$x = 42$$

Answer: 42 yrs old

Alex and Alicia are twins. Kevin is 5 years older than the twins. Their ages total 53.

	<u>Kevin</u>	<u>Twins</u>
Equation:	$x+5$	x

$$2x+x+5 = 53$$

$$3x+5 = 53$$

$$-5 \quad -5$$

$$3x = 48$$

$$\frac{3x}{3} = \frac{48}{3}$$

Answer: $x = 16$

The twins are 16 and Kevin is 21