Math 7. Solving Simple Quadratic Equations. Factoring to solve Quadratic Equations.

Standard Form of a Quadratic Equation

A quadratic equation is an equation that can be written in the form $ax^2 + bx + c = 0$, where $a \neq 0$. This form is called the **standard form** of a quadratic equation.

You can solve equations of the form $x^2 = k$ by finding the square roots of each side. For example, the solutions of $x^2 = 81$ are $\pm\sqrt{81}$, or ± 9.

Example 1. What are the solutions of $3x^2 - 75 = 0$?

$$3x^2 - 75 = 0$$
$$3x^2 = 75$$
$$x^2 = 25$$
$$x = \pm\sqrt{25}$$
$$x = \pm 5$$

Practice.

1. Solve Each equation below

$x^2 - 9 = 0$	$x^2 + 7 = 0$	$n^2 = 81$	$a^2 = 324$
$3x^2 = 0$	$3x^2 - 12 = 0$	$k^2 - 196 = 0$	$r^2 + 49 = 49$
$x^2 + 4 = 0$	$\frac{1}{3}x^2 - 3 = 0$	$w^2 - 36 = -64$	$4g^2 = 25$
$\frac{1}{2}x^2 + 1 = 0$	$x^2 + 5 = 5$	$64b^2 = 16$	$5q^2 - 20 = 0$
$\frac{1}{4}x^2 - 1 = 0$	$x^2 + 25 = 0$	$144 - p^2 = 0$	$2r^2 - 32 = 0$
$x^2 - 10 = -10$	$2x^2 - 18 = 0$	$3a^2 + 12 = 0$	$5z^2 - 45 = 0$

2. Write and solve an equation in the form $ax^2 + c = 0$, where $a \neq 0$, that satisfies the given condition:
   a) The equation has no solution
   b) The equation has exactly one solution
   c) The equation has two solutions

3. Solve the equation $(x - 7)^2 = 0$

Solving by Factoring

Firs, lets recall that if $ab = a$, the $a = 0$, or $b = 0$.

For example, if $(x + 5)(x - 7) = 0$, then $(x + 5) = 0$, or $(x - 7) = 0$, which will lead to the fact that $x = -5$, or $x = 7$.

Example 2. What are the solutions of the equation $3y^2 - 17y + 24 = 0$?

By factoring the quadratic expression, we will get $(3x - 8)(x - 3) = 0$, which means that $(3x - 8) = 0$, or $(x - 3) = 0$, thus $x = 8/3$, or $x = 3$.

Practice.

4. Solve by factoring

$x^2 + 11x + 10 = 0$	$x^2 + 13x = -42$
$g^2 + 4g - 32 = 0$	$p^2 - 4p = 21$
$s^2 - 14s + 45 = 0$	$c^2 = 5c$
$2z^2 - 21z - 36 = 0$	$2w^2 - 11w = -12$
$3q^2 + q - 14 = 0$	$3h^2 + 17h = -10$
$4m^2 - 27m - 40 = 0$	$9b^2 = 16$

5. A box shaped like a rectangular prism has a volume of 280 in^3 . Its dimensions are 4 in. by $(n + 2)$ in. by $(n + s)$ in. Find n.

6. You are knitting a blanket. You want the area of the blanket to be 24 ft^2. You want the length of the blanket to be 2 ft longer than its width. What should the dimensions of the blanket be?

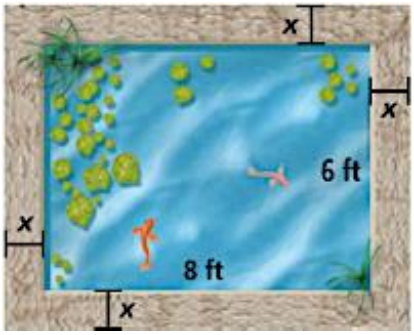
7. You are building a rectangular deck. The area of the deck should be 250 ft^2. You want the length of the deck to be 5 ft longer than twice its width. What the dimensions of the deck should be?

8. Write each equation in the standard form. Then solve.

$7n^2 + 16n + 15 = 2n^2 + 3$

$4q^2 + 3q = 3q^2 - 4q + 18$

9. You have a rectangular koi pond that measures 6 ft by 8 ft. You have enough concrete to cover 72 ft^2 for a walkway, as shown in the diagram. What should the width of the walkway be?



- How can you write the outer dimensions of the walkway?
- How can you represent the total area of the walkway and pond in two ways?

10. How many solutions does an equation of the form $x^2 - k^2 = 0$ have? Explain.

11. You throw a softball into the air with an initial upward velocity of 38 ft/s and an initial height of 5 ft.

a) Use the vertical motion model to write an equation that gives the ball's height h, in feet, at time t, in seconds.

b) The ball's height is Oft when it is on the ground. Solve the equation you wrote in part (a) for h = 0 to find when the ball lands.

12. Solve each cubic equation.

$x^3 - 10x^2 + 24x = 0$

$x^3 - 5x^2 + 4x = 0$

$3x^3 - 9x^2 = 0$

13. Find an equation that has the given numbers as solutions. For example, 4 and -3 are solutions of $x^2 - x - 12 = 0$.

a) -5, 8
b) 3, -2
c) 1/2, -10
d) 2/3, -5/7

14. Solve (factor by grouping).

$x^3 + 5x^2 - x - 5 = 0$

$x^3 + x^2 - 4x - 4 = 0$

$x^3 + 2x^2 - 9x - 18 = 0$