

5.5 Solving Quadratic Equations

Standard Form of a Quadratic Equation $y = ax^2 + bx + c$

Zero-Product Property: If $ab = 0$, then $a = 0$ or $b = 0$.

Solve by Factoring:

1. Write in standard form
2. Factor the quadratic expression
3. Use the Zero-Product Property
4. Solve for x
5. These are the zeros of the parabola--where it crosses the x -axis

Solve by factoring.

$$x^2 + 7x = 18$$

$$x^2 + 7x - 18 = 0$$

$$(x+9)(x-2) = 0$$

$$x+9=0 \quad x-2=0$$

$$x = -9 \quad x = 2$$

$$2x^2 + 4x = 6$$

$$2x^2 + 4x - 6 = 0$$

$$2(x^2 + 2x - 3) = 0$$

$$2(x+3)(x-1) = 0$$

$$x = -3 \quad x = 1$$

$$16x^2 = 8x$$

$$16x^2 - 8x = 0$$

$$(8x)(2x-1) = 0$$

$$x = 0 \quad x = \frac{1}{2}$$

$$2x - 1 = 0$$

$$2x = 1$$

$$x = \frac{1}{2}$$

Solve by factoring and by finding square roots.

$$4x^2 - 25 = 0$$

$$(2x+5)(2x-5) = 0$$

$$x = \frac{-5}{2} \quad x = \frac{5}{2}$$

$$\frac{4x^2}{4} = \frac{25}{4}$$

$$\pm\sqrt{x^2} = \pm\sqrt{\frac{25}{4}}$$

$$x = \pm\frac{5}{2}$$

$$x^2 - \frac{1}{4} = 0$$

$$(x + \frac{1}{2})(x - \frac{1}{2}) = 0$$

$$x = -\frac{1}{2} \quad x = \frac{1}{2}$$

$$\pm\sqrt{x^2} = \pm\sqrt{\frac{1}{4}}$$

$$x = \pm\frac{1}{2}$$

$$6x^2 = 486$$

$$6x^2 - 486 = 0$$

$$6(x^2 - 81) = 0$$

$$6(x+9)(x-9) = 0$$

$$x = -9 \quad x = 9$$

$$\frac{6x^2}{6} = \frac{486}{6}$$

$$\pm\sqrt{x^2} = \pm\sqrt{81}$$

$$x = \pm 9$$

A smoke jumper jumps from 1400 ft. The function describing the height is $y = -16x^2 + 1400$, where y is the height in feet and x is time in seconds. Using factoring, find the time during which the jumper is in free fall if the parachute opens at 1000 ft. 5 seconds

$$1000 = -16x^2 + 1400$$

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$$0 = -16x^2 + 400$$

$$0 = -16(x^2 - 25)$$

$$0 = -16(x+5)(x-5)$$

$$x = \pm 5$$

$$\sqrt{\frac{-400}{-16}} = \sqrt{\frac{-16x^2}{-16}}$$

$$\pm\sqrt{25} = \pm\sqrt{x^2}$$

$$\pm 5 = x$$

Not every quadratic equation can be solved by factoring or by taking the square root. You can solve a quadratic equation by graphing its related quadratic function.

Where the quadratic function intersects the x-axis, the value of the function is zero, and each x-value is a zero of the function.

A zero of a function is a solution to the equation $y = ax^2 + bx + c$

Use the graphing calculator to solve each quadratic equation. When necessary, round your answer to the nearest hundredth.

$$0 = x^2 + 6x + 4 \quad x = -5.24 \quad x = -.76$$

$$3x^2 + 5x - 12 = 8$$

$$3x^2 + 5x - 20 = 0 \quad x = -3.55 \quad x = 1.88$$

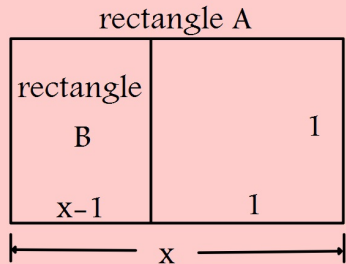
$$x^2 = -2x + 7 \quad x = -3.83 \quad x = 1.83$$

$$x^2 + 2x - 7 = 0 \quad \text{or} \quad -x^2 - 2x + 7 = 0$$

$$2x^2 + 7x - 1 = 0$$

$$x = -3.64 \quad x = 0.14$$

Artists use a golden rectangle in their work because forms based on it are visually pleasing. You can divide a golden rectangle into a square of side length 1 and a smaller rectangle that is similar to the original one. The ratio of the longer side to the shorter side of a golden rectangle is the golden ratio. Use the figure to find the golden ratio. *compare using \div*



long
short $X = 1.62$
ratio 1.62:1

$$\left(\frac{x}{1} = \frac{1}{x-1}\right) \times 1$$

$$x(x-1) = 1$$

$$x^2 - x = 1 \quad x^2 - x - 1 = 0 \quad \text{graph. find +x-int.}$$

homework:

page 266 # 20-30 even with GC + worksheet