# Quadratic Formula

The solutions of $ax^2+bx+c=0$; $a\neq 0$ are given by the formula:

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

E.g. Solve the given equation and simplify the answer.

(a) $3x^2+2x=7$ (b) $x^2+5x+8=0$

Sol: (a) $3x^2+2x-7=0$; $a=3$; $b=2$; $c=-7$

$$x=\frac{-2\pm\sqrt{4-4\cdot 3\cdot(-7)}}{6}=\frac{-2\pm\sqrt{88}}{6}=\frac{-2\pm\sqrt{4\cdot 22}}{6}$$

$$x=\frac{-2\pm 2\sqrt{22}}{6}=\boxed{\frac{-1\pm\sqrt{22}}{3}}$$

(b) $x^2 + 5x + 8 = 0$

$$x = \frac{-5 \pm \sqrt{25 - 32}}{2} = \frac{-5 \pm \sqrt{-7}}{2} = \boxed{\frac{-5 \pm i\sqrt{7}}{2}}$$

## Discriminant

The quantity $b^2 - 4ac$ is called the discriminant of the equation

$$ax^2 + bx + c = 0$$

(1) $\boxed{b^2 - 4ac > 0}$ → The equation has 2 real solutions.

(2) $\boxed{b^2 - 4ac < 0}$ → The equation has 2 NON-real solutions

(3) $\boxed{b^2 - 4ac = 0}$ → The equation has 1 real solution.

$$x = -\frac{b}{2a}.$$

# An Application:

$$f(x) = 22.1x^2 - 72.2x + 371.9$$

This function is used to estimate the # of sales (in thousands) of new homes in the U.S. where $x$ is the # of years after the year 2009.

Q: In what year were the # of sales of new homes about 563400 or 563.4 thousands.

Set $22.1x^2 - 72.2x + 371.9 = 563.4$. Then solve for $x$.

$$\rightarrow \underbrace{22.1}_{a}x^2 \underbrace{- 72.2}_{b}x \underbrace{- 191.5}_{c} = 0$$

$$x = \frac{72.2 \pm \sqrt{(-72.2)^2 - 4 \cdot (22.1) \cdot (191.5)}}{44.2}$$

$x = 5$ or ~~$x = -1.733\ldots$~~

→ corresponds to the year: **2014**