

# Quadratic Formula

"Solve" means to find value/s for "x".

a)  $-x^2 + 4x = 4$

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

Bring all terms to left so you have "0" on right.

$a = -1$  (in front of "x<sup>2</sup>")  
 $b = 4$  (in front of "x")  
 $c = -4$  (alone, no variable with it)

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

$a = -1$   
 $b = 4$   
 $c = -4$

$$= \frac{-4 \pm \sqrt{4^2 - 4(-1)(-4)}}{2(-1)}$$

$$= \frac{-4 \pm \sqrt{16 - 16}}{-2}$$

$$= \frac{-4 \pm \sqrt{0}}{-2}$$

$$= \frac{-4 \pm 0}{-2} \rightarrow \frac{-4+0}{-2} = \frac{-4}{-2} = 2$$
 ~~$x = 2$~~

$$\rightarrow \frac{-4-0}{-2} = \frac{-4}{-2} = 2$$
 ~~$x = 2$~~



$x = 2$   
0 no zero

$$b) \quad 3x^2 - 6x = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \begin{array}{l} a = 3 \\ b = -6 \\ c = 0 \end{array}$$

$$= \frac{+6 \pm \sqrt{(-6)^2 - 4(3)(0)}}{2(3)} \quad \begin{array}{l} (-6)^2 = +36 \\ ( ) \end{array}$$

$$= \frac{6 \pm \sqrt{36 - 0}}{6}$$

{ 0, 2 }

$$= \frac{6 \pm \sqrt{36}}{6}$$

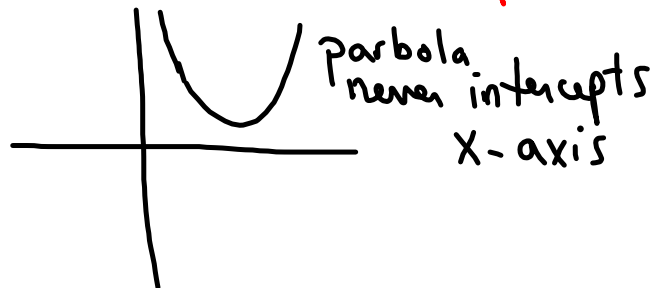
$$= \frac{6 \pm 6}{6} \begin{array}{l} \rightarrow \frac{6+6}{6} = \frac{12}{6} = 2 = x_1 \\ \rightarrow \frac{6-6}{6} = \frac{0}{6} = 0 = x_2 \end{array}$$

$$c) \quad \frac{1}{2}x^2 + x + \frac{7}{2} = 0$$

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

$$= \frac{-1 \pm \sqrt{1^2 - 4\left(\frac{1}{2}\right)\left(\frac{7}{2}\right)}}{2\left(\frac{1}{2}\right)}$$

$$= \frac{-1 \pm \sqrt{1-7}}{1} = \frac{-1 \pm \sqrt{-6}}{1}$$



$$a = \frac{1}{2} \text{ or } 0.5$$

$$b = 1$$

$$c = \frac{7}{2} \text{ or } 3.5$$

You can't  
# negative

$\therefore$  no solution

$$d) \quad \frac{1}{2}x^2 - 2x + 4 = 0$$

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

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

$$b = -2$$

$$c = 4$$

$$= \frac{2 \pm \sqrt{(-2)^2 - 4\left(\frac{1}{2}\right)(4)}}{2\left(\frac{1}{2}\right)}$$

$$= 2 \pm \sqrt{4 - 8}$$

→ No solution again!

$$e) \quad -x^2 + 10x = 16$$

$$-x^2 + 10x - 16 = 0$$

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

$$a = -1$$

$$b = 10$$

$$c = -16$$

$$= \frac{-10 \pm \sqrt{10^2 - 4(-1)(-16)}}{2(-1)}$$

$$= \frac{-10 \pm \sqrt{100 - 64}}{-2}$$

$$= \frac{-10 \pm \sqrt{36}}{-2}$$

$$e) \quad \{2, 8\}$$

$$= \frac{-10 \pm 6}{-2} \begin{cases} \rightarrow \frac{-10+6}{-2} = \frac{-4}{-2} = 2 = x_1 \\ \rightarrow \frac{-10-6}{-2} = \frac{-16}{-2} = 8 = x_2 \end{cases}$$

$$(2, 0) \text{ and } (8, 0)$$

$$f) \quad 2x^2 + 2x - \frac{9}{2} = 0$$

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

$$a = 2$$

$$b = 2$$

$$c = -\frac{9}{2} \text{ or}$$

$$-4.5$$

$$= \frac{-2 \pm \sqrt{2^2 - 4(2)\left(-\frac{9}{2}\right)}}{2(2)}$$

$$= \frac{-2 \pm \sqrt{4 + 36}}{4}$$

$$= \frac{-2 \pm \sqrt{40}}{4}$$

$$x_1 =$$

$$\frac{-2 + 6.325}{4} = 1.08$$

$$= \frac{-2 \pm 6.325}{4}$$

$$x_2 =$$

$$\frac{-2 - 6.325}{4} = -2.08$$

$$g) -x^2 + 6x = 9$$

$$-x^2 + 6x - 9 = 0$$

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

$$a = -1$$

$$b = 6$$

$$c = -9$$

$$= \frac{-6 \pm \sqrt{6^2 - 4(-1)(-9)}}{2(-1)}$$

$$= \frac{-6 \pm \sqrt{36 - 36}}{-2}$$

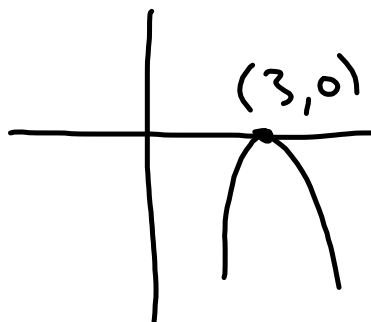
$$= \frac{-6 \pm \sqrt{0}}{-2} = \frac{-6 \pm 0}{-2}$$

g)

Only one  
solution  $x = 3$

$$\frac{-6+0}{-2} = 3$$

$$\frac{-6-0}{-2} = 3$$



$$h) \quad -9x^2 + 6x - 1 = 0$$

$$a = -9$$

$$b = 6$$

$$c = -1$$

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

$$= \frac{-6 \pm \sqrt{6^2 - 4(-9)(-1)}}{2(-9)}$$

$$= \frac{-6 \pm \sqrt{36 - 36}}{-18}$$

h) Only one solution!  
 $x = \frac{1}{3}$

$$= \frac{-6 \pm \sqrt{0}}{-18}$$

$$\frac{-6 + 0}{-18} = \frac{-6}{-18} = \frac{1}{3}$$

$$= \frac{-6 \pm 0}{-18}$$

$$\frac{-6 - 0}{-18} = \frac{-6}{-18} = \frac{1}{3}$$



$$i) \quad 3x^2 - 12 = 0$$

$$3x^2 + 0x - 12 = 0$$

↑  
b

$$a = 3$$

$$b = 0$$

$$c = -12$$

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

$$= \frac{-0 \pm \sqrt{0^2 - 4(3)(-12)}}{2(3)}$$

$$= \frac{0 \pm \sqrt{0 + 144}}{6}$$

$$= \frac{0 \pm \sqrt{144}}{6}$$

$$\frac{0 + 12}{6} = 2$$

$$\frac{0 - 12}{6} = -2$$

(i) Solution:

$$\{-2, 2\}$$

$$j) \quad 3x + 4 = x^2$$

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

$$a = -1$$

$$b = 3$$

$$c = 4$$

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

$$= \frac{-3 \pm \sqrt{3^2 - 4(-1)(4)}}{2(-1)}$$

$$= \frac{-3 \pm \sqrt{9 + 16}}{-2}$$

Solution:

$$\{-1, 4\}$$

$$= \frac{-3 \pm \sqrt{25}}{-2}$$

$$= \frac{-3 \pm 5}{-2}$$

$$\frac{-3 + 5}{-2} = \frac{2}{-2} = -1$$

$$\frac{-3 - 5}{-2} = \frac{-8}{-2} = 4$$