

Date: 9.1.2 + 9.1.3: The Quadratic Formula

Quadratic formula: Given a quadratic equation in Standard Form: $ax^2 + bx + c = 0$

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

$$X = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

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

the discriminant: $b^2 - 4ac$

$b^2 - 4ac = 0$, there is one solution (one root/x-intercept), this is also the vertex.

$b^2 - 4ac = "-"$, there is no solution (no roots, x-intercepts) Vertex = $x = \frac{-b}{2a}, y = 0$

$b^2 - 4ac = "+"$, there are two roots (can't take the square root of a negative #)

9-13) $x^2 - 3x - 7 = 0$

a) $a = 1$
 $b = -3$
 $c = -7$

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

b)

$$X = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-7)}}{2(1)}$$

$$X = \frac{3 \pm \sqrt{9 + 28}}{2} = \frac{3 \pm \sqrt{37}}{2} = \frac{3 + \sqrt{37}}{2}, \frac{3 - \sqrt{37}}{2}$$

$$\approx 4.5 \text{ or } -1.5$$

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9-15) a - d

a) $3x^2 + 7x + 2 = 0$

$a=3$
 $b=7$
 $c=2$

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

$$x = \frac{-7 \pm \sqrt{7^2 - 4(3)(2)}}{2(3)}$$

$$x = \frac{-7 \pm \sqrt{49 - 24}}{6}$$

$$x = \frac{-7 \pm \sqrt{25}}{6}$$

$$\frac{-7+5}{6} = \frac{-2}{6} = \boxed{-\frac{1}{3}} \quad \frac{-7-5}{6} = \frac{-12}{6} = \boxed{-2}$$

b) $2x^2 - 9x - 35 = 0$

$a=2$
 $b=-9$
 $c=-35$

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

$$x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(2)(-35)}}{2(2)}$$

$$x = \frac{9 \pm \sqrt{81 + 280}}{4} = \frac{9 \pm \sqrt{361}}{4}$$

$$\frac{9+19}{4} \quad \text{or} \quad \frac{9-19}{4}$$

$$\frac{28}{4} = \boxed{7} \quad \text{or} \quad \frac{-10}{4} = \boxed{-2.5}$$

c+d) (on next page...)

9-24) $6x^2 + 11x - 10 = 0$

a) Zero product property

$$\begin{array}{r} 3x \quad -2 \\ 5 \quad +15x \quad -10 \\ 2x \quad 6x^2 \quad -4x \\ 3x \quad -2 \end{array} \quad \begin{array}{r} -60x^2 \\ +15x \quad -4x \\ 11x \end{array}$$

$$(3x-2)(2x+5) = 0$$

$$3x-2=0 \quad 2x+5=0$$

~~$$3x-2=0 \quad 2x+5=0$$~~

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

$$x = \frac{2}{3} \quad \text{or}$$

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

b) Quadratic formula:

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

$a=6$
 $b=11$
 $c=-10$

$$x = \frac{-11 \pm \sqrt{11^2 - 4(6)(-10)}}{2(6)}$$

$$x = \frac{-11 \pm \sqrt{121 + 240}}{12}$$

$$= \frac{-11 \pm \sqrt{361}}{12}$$

$$= \frac{-11+19}{12} \quad \text{or} \quad \frac{-11-19}{12}$$

$$= \frac{8}{12} = \frac{2}{3} \quad \text{or} \quad \frac{-30}{12} = \boxed{-2.5}$$

9-15)

$$c) 8x^2 + 10x + 3 = 0$$

$$a = 8$$

$$b = 10$$

$$c = 3$$

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

$$x = \frac{-10 \pm \sqrt{(10)^2 - 4(8)(3)}}{2(8)}$$

$$x = \frac{-10 \pm \sqrt{100 - 96}}{16}$$

$$x = \frac{-10 \pm \sqrt{4}}{16}$$

$$\begin{array}{cc} & 16 \\ & \swarrow \quad \searrow \\ \frac{-10+2}{16} & \quad \quad \quad \frac{-10-2}{16} \end{array}$$

$$\frac{-8}{16} = \boxed{\frac{-1}{2}} \quad \text{or} \quad \frac{-12}{16} = \boxed{\frac{-3}{4}}$$

$$d) x^2 - 5x + 9 = 0$$

$$a = 1$$

$$b = -5$$

$$c = 9$$

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

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(9)}}{2(1)}$$

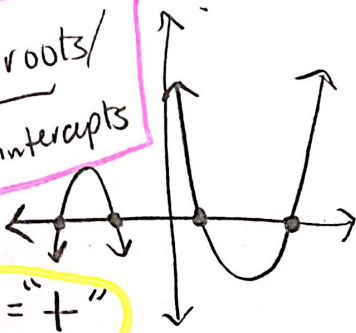
$$= \frac{5 \pm \sqrt{25 - 36}}{2}$$

$$= \frac{5 \pm \sqrt{-11}}{2}$$

no solution!

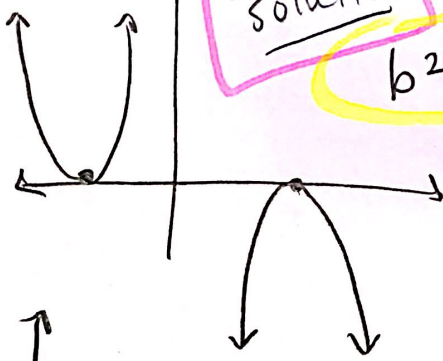
What the discriminant tells us:)

two roots/
x-intercepts



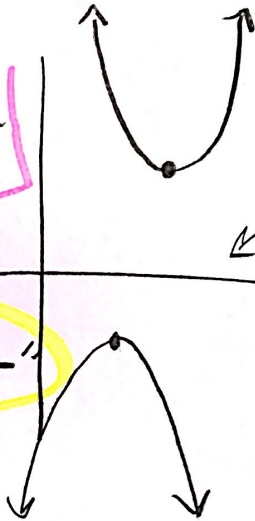
$$b^2 - 4ac = "+"$$

one-
solution



$$b^2 - 4ac = 0$$

no solution



no roots
or x-intercepts

$$b^2 - 4ac = "-"$$

