

Functions 11U

Unit 3 – Quadratic Functions

3.6 Zeros of Quadratic Functions (pt 5)

Learning Goal - We are learning how to determine the number and values of zeros of a quadratic function

Example 3.6.4

Using the quadratic formula, determine the zeros of the quadratic:

In case you've forgotten, the quadratic formula is

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

← completing the square on

$$f(x) = ax^2 + bx + c$$

a) $f(x) = 2x^2 + 3x - 7$

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

b) $g(x) = 3x^2 - 2x + 4$

$a=3$ $b=-2$ $c=4$

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

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

$$= \frac{-3 \pm \sqrt{65}}{4}$$

∴ The zeros are

$$x = \frac{-3 + \sqrt{65}}{4} \text{ or } x = \frac{-3 - \sqrt{65}}{4}$$

$$\approx 1.3$$

$$\approx -2.8$$

⇒ approximate

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

$$\begin{aligned} -2^2 &= -4 \\ (-2)^2 &= +4 \end{aligned}$$

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

$$= \frac{2 \pm \sqrt{4 - 48}}{6}$$

$$= \frac{2 \pm \sqrt{-44}}{6}$$

∴ No zeros!

can't square root ∵ negative

The Discriminant

The Discriminant of the quadratic formula is called the **DISCRIMINANT** because *it discriminates between 2, 1, 0 zeros for a quadratic*

The Discriminant is $b^2 - 4ac$

1) If $b^2 - 4ac > 0 \Rightarrow 2$ zeros

2) If $b^2 - 4ac = 0 \Rightarrow 1$ zero $\left(x = \frac{-b}{2a}\right)$

3) If $b^2 - 4ac < 0 \Rightarrow 0$ zeros

Example 3.6.5

Determine the number of zeros using the discriminant:

a) $f(x) = 2x^2 + 3x - 2$
 $a=2 \quad b=3 \quad c=-2$

$$\begin{aligned} b^2 - 4ac &= (3)^2 - 4(2)(-2) \\ &= 9 + 16 \\ &= +25 > 0 \quad \therefore 2 \text{ zeros} \end{aligned}$$

c) $h(x) = 3x^2 + 5x + 6$
 $a=3 \quad b=5 \quad c=6$

$$\begin{aligned} b^2 - 4ac &= (5)^2 - 4(3)(6) \\ &= 25 - 72 < 0 \quad \therefore 0 \text{ zeros} \end{aligned}$$

$a=-1 \quad b=4 \quad c=-4$
b) $g(x) = -x^2 + 4x - 4$

$$\begin{aligned} b^2 - 4ac &= (4)^2 - 4(-1)(-4) \\ &= 16 - 16 \\ &= 0 \\ &\Rightarrow 1 \text{ zero} \end{aligned}$$

Success Criteria:

- I can recognize that a quadratic function may have 0, 1, or 2 zeros
- I can use the discriminant of the quadratic formula to determine the number of zeros