

Ch 5 Determining Zeros

(Solutions/roots/x-intercepts)

I. 4 words that mean the same thing →
"what is x when $y=0$?"

→ So, plug in $y=0$!

ex/ Determine the roots

$$f(x) = x^2 + 11x + 18$$

$$0 = x^2 + 11x + 18$$

... Now what?

II. 3 methods to solve this

Factoring Completing the square

↙ Don't always work ↘

Quadratic Formula
always works

A) Factoring

1) want $a=1$!

ex/ $f(x) = 2x^2 + 4x + 2$

2) Look for 2

$$\frac{0}{2} = \frac{2x^2}{2} + \frac{4x}{2} + \frac{2}{2}$$

#'s multiply to 1

& add to b

$$0 = x^2 + 2x + 1 \quad \text{yah tzee!}$$

3) Solutions are

ex/ $0 = (x+1)(x+1) \quad a=1$!

x 's that make 0

$$x+1=0 \text{ or } x+1=0$$

$$x = \{-1, -1\}$$

ex/ $f(x) = 3x^2 + 8x - 2$

1) divide out $a=3$

$$\frac{0}{3} = \frac{3x^2}{3} + \frac{8x}{3} - \frac{2}{3}$$

Stop that sucks
Don't do it.

$$\text{ex/ } f(x) = 3x^2 + 6x + 33$$

1) divide out $a=3$

$$2) \frac{0}{3} = \frac{3x^2}{3} + \frac{6x}{3} + \frac{33}{3}$$

$$0 = x^2 + 2x + 11$$

Factors!

umm can't

Stop!

B) Completing the Square (using magic step)

1) Divide out a (want $a=1$)

IF can't \div by $a \dots$ STOP!

2) Move c to other side

$$\text{ex/ } f(x) = x^2 + 11x - 3$$

$$x^2 + 11x - 3 = 0$$

3) Magic step ($\frac{a}{2}$ by 2)

$$\left(x + \frac{b}{2}\right)^2 = \# + \left(\frac{b}{2}\right)^2$$

$$\text{ex/ } (x+5)^2 = 3 + (5)^2$$

IF can't easily \div by 2 \rightarrow stop

4) Simplify right

5) Square root both sides

6) Solve for x

$$\text{ex/ } (x+5)^2 = 3 + 25$$

$$\sqrt{(x+5)^2} = \pm \sqrt{28} \leftarrow \sqrt{4} \sqrt{7}$$

$$x+5 = \pm 2\sqrt{7}$$

$$x = \{-5 \pm 2\sqrt{7}\}$$

c) Quadratic Formula

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

← Formula

Just plug it in!

ex/ $f(x) = 2x^2 - 3x + 5$

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

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(5)}}{2(2)}$$

$$x = \frac{3 \pm \sqrt{9 - 40}}{4}$$

$$x = \frac{3 \pm \sqrt{-31}}{4}$$

$$\left\{ \frac{3 \pm i\sqrt{31}}{4} \right\}$$

ex/ $f(x) = 3x^2 + 9x - 12$

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

$$x = \frac{-9 \pm \sqrt{9^2 - 4(3)(-12)}}{2(3)}$$

$$x = \frac{-9 \pm \sqrt{81 + 144}}{6}$$

$$x = \frac{-9 \pm 15}{6}$$

$$x = \frac{-9 \pm \sqrt{225}}{6}$$

$$\begin{aligned} \frac{-9 + 15}{6} &= \frac{6}{6} = 1 \\ \frac{-9 - 15}{6} &= \frac{-24}{6} = -4 \end{aligned}$$
$$x = \left\{ -4, 1 \right\}$$