

Math 418

Warm Up: Sketch $f(x) = 2x^2 - x + 4$

- ① Find and Plot Vertex
- ② Determine \cup or \cap and Sketch.

① $2x^2 - x + 4$ Vertex: $(\frac{1}{4}, \frac{31}{8})$
 $a=2$
 $b=-1$

$$\frac{-b}{2a} = \frac{-(-1)}{2(2)} = \frac{1}{4}$$

8.4.1 $f(\frac{1}{4}) = 2(\frac{1}{4})^2 - (\frac{1}{4}) + 4$

$$= 2 \cdot \frac{1}{16} - \frac{1}{4} + 4$$

LCM(8,4,1)
= 8

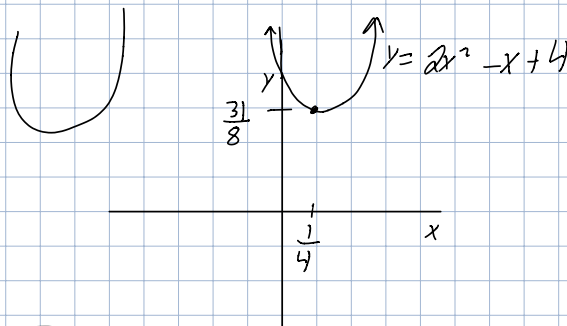
$$= \frac{2}{16} - \frac{1}{4} + 4 = \frac{1}{8} - \frac{1}{4} + \frac{4}{1} =$$

$$= \frac{1}{8} - \frac{2}{8} + \frac{4 \cdot 8}{1 \cdot 8}$$

$$= \frac{1}{8} - \frac{2}{8} + \frac{32}{8} = \frac{-1}{8} + \frac{32}{8} = \frac{31}{8}$$

Vertex: $(\frac{1}{4}, \frac{31}{8})$

② $a=2 > 0$



Vertex: $(\frac{1}{4}, \frac{31}{8})$

$a=2$

$$y = 2(x - \frac{1}{4})^2 + \frac{31}{8}$$

To Do:

① Write $y = 3x^2 + 2x - 7$ in Standard Form and Sketch it.

② Write $y = 2(x+8)^2 - 3$ in General Form $ax^2 + bx + c$

③ Write $f(x) = 2(x+3)(x-4)$ in Standard Form and Sketch it.

Fact: $(\frac{a}{b})^2 = \frac{a^2}{b^2}$

$(\frac{a}{b})^n = \frac{a^n}{b^n}$

Least Common Multiple

5 and 3
 $5 \cdot 3 = 15$
 $5 \cdot 3 \cdot 3 = 45$
 $5 \cdot 3 \cdot 4 = 60$
 $(5 \cdot 3) \cdot 10 = 150$

Common Multiples of 3 and 5

LCM(5,3) = 15

Quadratic Equations / Hidden Quadratics

① Factoring

① $x^2 - a^2 = (x-a)(x+a)$

Ex: $(x^2 - 25) = (x-5)(x+5)$
 $x^2 - 3 = (x-\sqrt{3})(x+\sqrt{3})$

② $x^2 + vx + w = (x+a)(x+b)$

Find 2 #'s a and b
So that $a+b = v$
 $ab = w$

Ex: $x^2 + 5x + 4 = (x+4)(x+1)$

$x^2 + 3x - 18 = (x+6)(x-3)$

$-18 = \begin{matrix} -1 \cdot 18 \\ 1 \cdot -18 \\ 2 \cdot -9 \\ -2 \cdot 9 \\ 6 \cdot -3 \\ -6 \cdot 3 \end{matrix}$

Factor: ① $x^2 + 22x + 120$
Factor and solve ② $x^2 + 2x - 15 = 0$

$x^2 + 1^2 = x^2 + 0x + 1$ Doesn't factor nicely

$x^2 + \pi x + \sqrt{2}$

$\sqrt{5}x^2 + \sqrt{7}x + \sqrt{3} = 0$

$\sqrt{2}x^2 - 6x - 140 = 0$

$2(x^2 - 3x - 70) = 0$

$x^2 - 3x - 70 = 0$

$(x-10)(x+7) = 0$

$x-10 = 0 \quad \begin{cases} x+7 = 0 \end{cases}$

$x=10$

$x=-7$

-1, 70

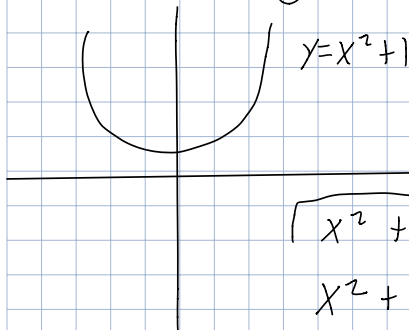
Doesn't factor Nicely?

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

$$x^2 + 10x + 1 = 0$$

$$\begin{aligned} a &= 1 \\ b &= 10 \\ c &= 1 \end{aligned}$$

$$x = \frac{-10 \pm \sqrt{100 - 4(1)(1)}}{2(1)} = \frac{-10 \pm \sqrt{96}}{2}$$



$$x^2 + 1 = 0$$

$$x^2 + 0x + 1$$

$$\begin{aligned} a &= 1 \\ b &= 0 \\ c &= 1 \end{aligned}$$

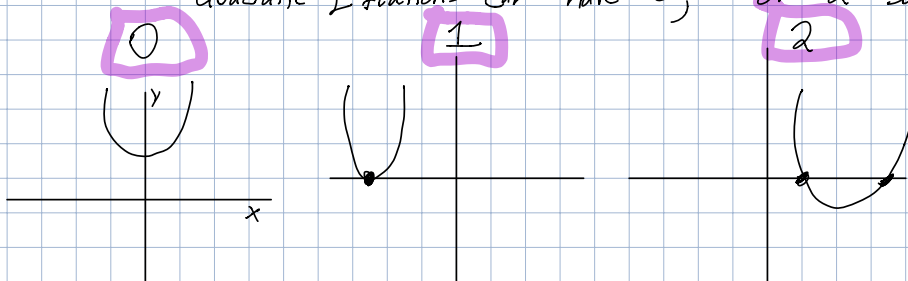
$$x = \frac{-0 \pm \sqrt{0 - 4(1)(1)}}{2(1)} = \frac{\pm \sqrt{-4}}{2}$$

No Sol'n!

Solve: $\begin{cases} \textcircled{1} & x^2 + 7x + 12 = 0 \\ \textcircled{2} & x^2 - 11x + 3 = 0 \end{cases} \quad \textcircled{3} \quad x^2 - 2x + 1 = 0$

Fact: Parabolas can have 0, 1 or 2 x-intercepts

Quadratic Equations can have 0, 1 or 2 solutions



Hidden Quadratics

Solve: $t^6 + 5t^3 + 6 = 0$

let $w = t^3$ $w^2 = (t^3)^2 = t^6$

Fact: $(a^b)^c = a^{bc}$

$$(t^3)^2 = t^6$$

$$W^2 + 5W + 6 = 0$$

$$(W+3)(W+2) = 0$$

$$W+3=0 \quad \vee \quad W+2=0$$

$$W = -3$$

$$W = -2$$

$$t^3 = -3$$

$$t^3 = -2$$

$$t = \sqrt[3]{-3}$$

$$t = \sqrt[3]{-2}$$

Solve:

$$x^{10} + 3x^5 + 2 = 0$$

$$x^6 + \boxed{x^5} + x^3 + 2 = 0$$

CAUTION

$$t^4 + 2t^2 + 1 = 0$$

$$\text{let } W = t^2, \quad W^2 = t^4$$

$$W^2 + 2W + 1 = 0$$

$$(W+1)(W+1) = 0$$

$$W+1=0$$

$$W = -1$$

$$t^2 = -1$$

$$t = \sqrt{-1}$$

No Sol'n

$$W-3=0$$

$$W = 3$$

$$t^2 = 3$$

$$t = \pm\sqrt{3}$$