Warm Up 9/18

1. Complete the square: $f(x) = -x^2 + x + 2$

2. Find the vertex by using any method: $5x^2 - 30x + 49$

$$\left(\frac{b}{2}\right)^2 = \left(\frac{-1}{2}\right)^2 = 1/4$$

Warm Up Solutions

1. Complete the square: $\frac{f(x)}{-1} = \frac{-x^2}{-1} + \frac{x}{-1} + \frac{2}{-1}$

$$\Rightarrow -f(x) = x^2 - x - 2 \quad \Rightarrow -f(x) + 1/4 = (x^2 - x + 1/4) - 2$$

$$\Rightarrow \frac{-f(x)}{-1} + 1/4 - 1/4 = (x - 1/2)^2 - 2 - 1/4 = \frac{(x-1/2)^2 - 9/4}{-1}$$

$$\Rightarrow \boxed{f(x) = -(x-1/2)^2 + 9/4}$$

$$f(x) = (x+1/2)^2 + 3/4$$

Warm Up Solutions

2. Find the vertex by using any method: $5x^2 - 30x + 49$

Vertex: $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$

$= \left(\frac{30}{10}, f\left(\frac{30}{10}\right)\right)$

$= \boxed{(3, 4)}$

Lesson 2-5 Part II

Quadratic Function: Maxima and Minima

Objective

Students will…

- Be able to find x and y-intercepts, via factoring, quadratic formula, and completing the square.
- Be able to graph quadratic functions by plotting vertex and the intercepts.

Standard form of a Quadratic Function

Recall that the standard form of a quadratic function is:

ex.

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

$= 3x^2 - 3x + 6$

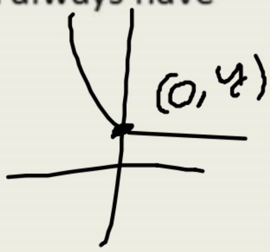
$$f(x) = ax^2 + bx + c,$$

where *a, b,* and *c* are real numbers and $a \neq 0$.

Also, remember that the parabola opens up ("smiley") if $a > 0$, while it opens down ("frowny") if $a < 0$.

Y-intercept

Remember that y-intercept is where the function crosses the y-axis, i.e. when $x = 0$. So, to find the y-intercept simply plug in zero for x and solve. It's good to keep in mind that a parabola will always have exactly one y-intercept.



Ex. $f(x) = x^2 - 6x + 8$

$$f(0) = 0^2 - 6(0) + 8$$
$$= 0 - 0 + 8 = 8$$

y-int: (0,8)

X-intercept

$\cancel{x^2-6x+8=1}$
$\cancel{(x-4)(x-2)=1}$
$\cancel{x-4=1 \quad x-2=1}$
$\cancel{x=5 \quad x=3}$

In contrast, the x-intercepts are where the function crosses the x-axis, i.e. when $y = 0$. So, one must make y, or f(x) in this case, zero and then solve for *x*. This can be done either by factoring, using the quadratic formula, or completing the square.

X

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

Ex.

$f(x) = x^2 - 6x + 8$

$0 = x^2 - 6x + 8$

zero prod. prop.

$0 = (x-4)(x-2)$

$x - 4 = 0$ or $x - 2 = 0$

$\boxed{x = 4 \quad x = 2}$

$f(x) = 2x^2 - 12x + 11$

$0 = 2x^2 - 12x + 11$

$x = \boxed{\frac{12 \pm \sqrt{56}}{4}}$

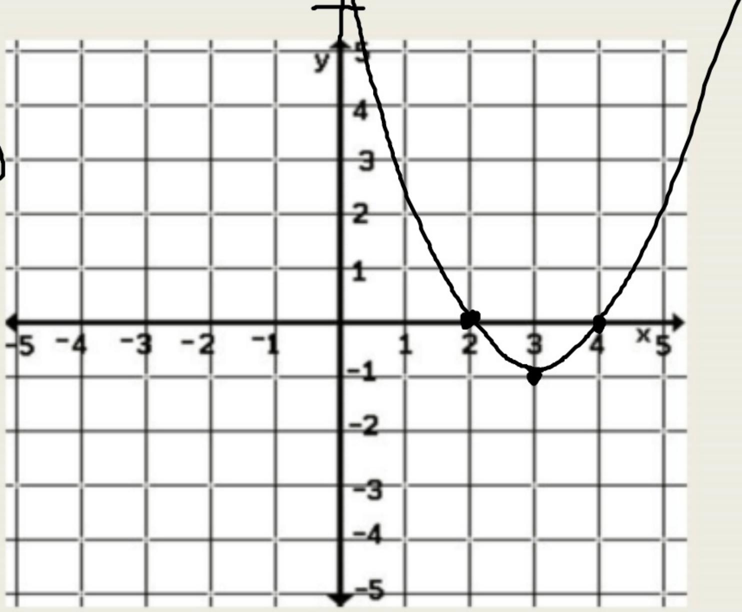
$= \boxed{3 \pm \frac{1}{2}\sqrt{14}}$

Graphing the quadratics

So, once you have the vertex and the x and y-intercepts, you can graph the parabola.

Ex. $f(x) = x^2 - 6x + 8$

x-int: (4, 0), (2, 0)
y-int: (0, 8)
Vertex: (3, -1)



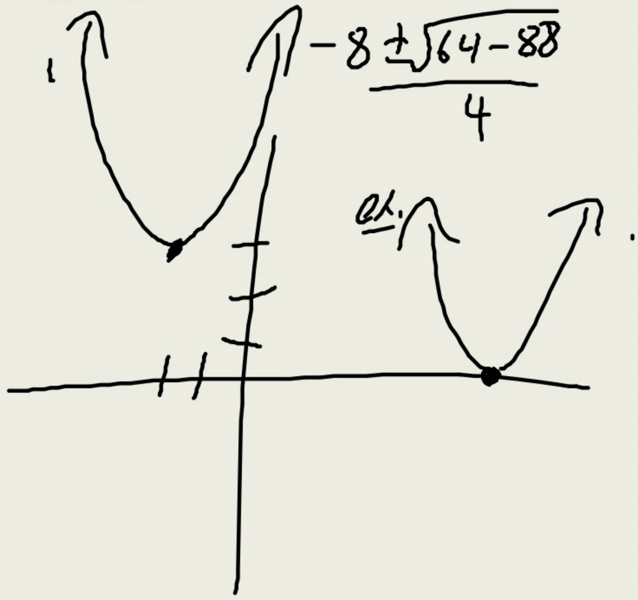
Try a few more…

Graph the following functions

1. $f(x) = 2x^2 + 8x + 11$

y-int: $(0, 11)$
Vertex: $(-2, 3)$
X-int: None

$$\frac{-8 \pm \sqrt{64-88}}{4}$$



Try a few more...

2. $f(x) = -x^2 + x + 2$

y-int: $(0, 2)$.

Vertex: $\left(\underset{0.5}{\tfrac{1}{2}}, \underset{2.25}{\tfrac{9}{4}}\right)$

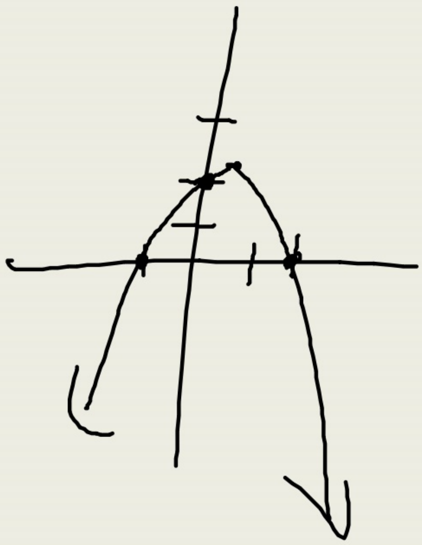
X-int: $-(x^2 - x - 2) = 0$

$$\frac{\cancel{-1}(x-2)(x+1)}{\cancel{-1}} = \frac{0}{-1}$$

$$(x-2)(x+1) = 0$$

$$x = 2, -1$$

$(2, 0)\ (-1, 0)$



3. $f(x) = 3x^2 + 6x - 1$

Homework 9/18

TB pg. 200-201 #1-17 (E.O.O)

Do all of the parts (a, b, and c).

Remember, you should already have the vertex from previous night.