Algebra 2 Chapter 4 Calendar

Howel

Name: Key (Afuhaamao

	Date	Assignment (Due the next class meeting)
Monday Tuesday	9/30/19 (A) 10/01/19 (B)	4.1 Worksheet *Graphing quadratics in (h,k) form*
Wednesday Thursday	10/02/19 (A) 10/03/19 (B)	4.2 Worksheet *Rewriting Quadratic Functions into vertex (h,k) form*
Friday	10/04/19 (A)	4.3 Worksheet *Solving from (h,k) form using square roots*
M-F	**10/7/19-10/11/19**	**FALL BREAK**
Monday	10/14/19 (B)	4.3 Worksheet *Solving from (h,k) form using square roots*
Tuesday Wednesday	10/15/19 (A) 10/16/19 (B)	4.4 Worksheet *More graphing - identify key features of quadratics*
Thursday Friday	10/17/19 (A) 10/18/19 (B)	Ch 4 Review and Foldable *Converting to standard, vertex, and intercept form*
Monday Tuesday	10/21/19 (A) 10/22/19 (B)	Ch 4 Practice Test
Wednesday Thursday	10/23/19 (A) 10/24/19 (B)	**Ch 4 Test** 5.1 Worksheet *Adding/Subtracting Polynomials*

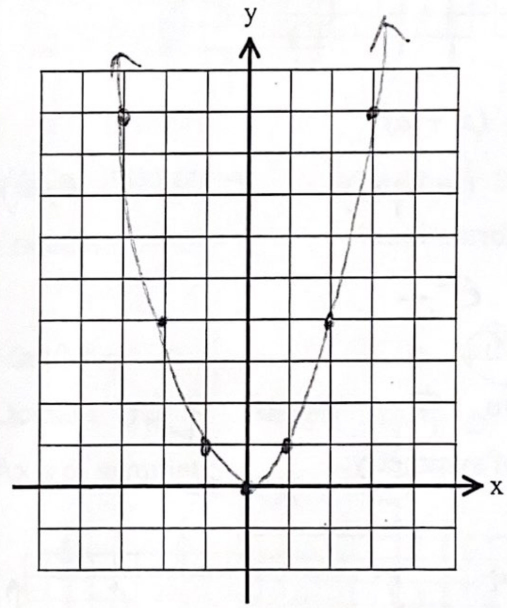
- Be prepared for daily quizzes.
- Every student is expected to do every assignment for the entire unit.
- Try www.khanacademy.org if you need help outside of school hours.
- Students who complete 100% of their homework for the semester will receive a 2% bonus!

4.1: Graphing in *(h,k) form* or *vertex form*

The Parent Function of the Quadratic:

$$y = x^2$$

x	$y = x^2$
-2	$(-2)^2 = 4$
-1	$(-1)^2 = 1$
0	$0^2 = 0$
1	$1^2 = 1$
2	$2^2 = 4$



$$\boxed{y = a(x-h)^2 + k}$$

This is called *vertex form* or *(h, k) form* or *graphing form*!

$y=(0+2)^2-5$
$y=-1$

Examples:

1. $y=(x+2)^2-5$

Vertex: $(-2,-5)$ y-intercept: $(0,-1)$

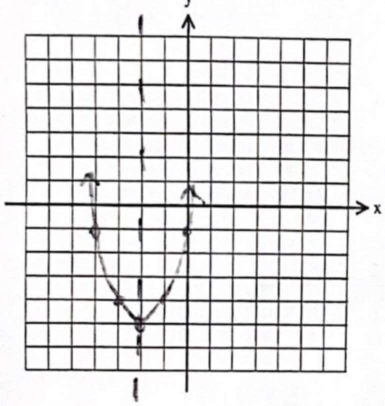
Transformations?

$\leftarrow 2 \downarrow 5$

Max/Min: -5 lowest y-value (from vertex)

Domain: $\{x \mid x \in \mathbb{R}\}$ Range: $\{y \mid y \geq -5\}$

Axis of symmetry: $x=-2$



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

Vertex: $(3,6)$ y-intercept: $(0,-$

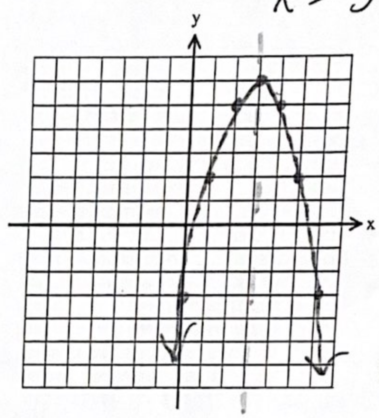
Transformations?

$\rightarrow 3 \uparrow 6$ Reflected $(a=-1)$

Max/Min: 6

Domain: $\mathbb{R}$ Range: $y \leq 6$

Axis of symmetry: $x=3$



3. $y=(x+2)^2$

Vertex: $(-2,0)$ y-intercept: $(0,4)$

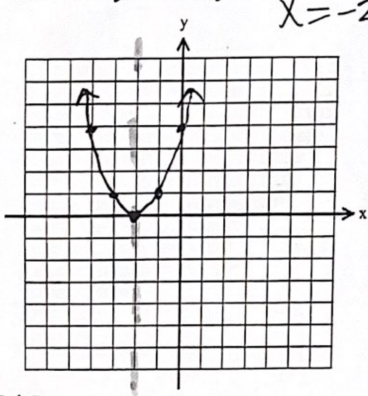
Transformations?

$\leftarrow 2$

Max/Min: 0

Domain: $\mathbb{R}$ Range: $y \geq 0$

Axis of symmetry: $x=-2$



4. $y=-x^2+6$

Vertex: $(0,6)$ y-intercept: $(0,6)$

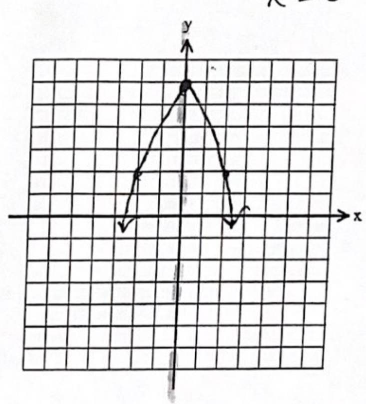
Transformations?

$\uparrow 6$ reflect

Max/Min: 6

Domain: $\mathbb{R}$ Range: $y \leq 6$

Axis of symmetry: $x=0$



You try!!!

a) $y = (x+4)^2 - 4$

$y = (0+4)^2 - 4$
$y = 4^2 - 4$
$y = 12$

Vertex: $(-4, -4)$ y-intercept: $(0, 12)$

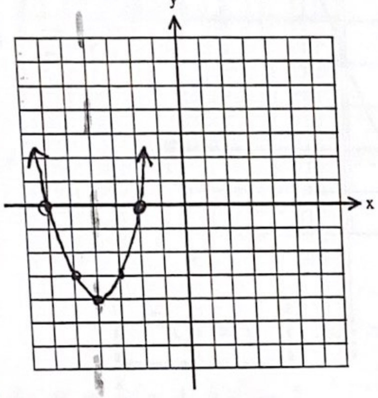
Transformations?

← 4 ↓ 4

Max/Min: -4

Domain: $\mathbb{R}$ Range: $y \geq -4$

Axis of symmetry: $x = -4$



b) $y = -(x-2)^2 + 1$

$y = -(0-2)^2 + 1$
$= -4 + 1 = -3$

Vertex: $(2, 1)$ y-intercept: $(0, -3)$

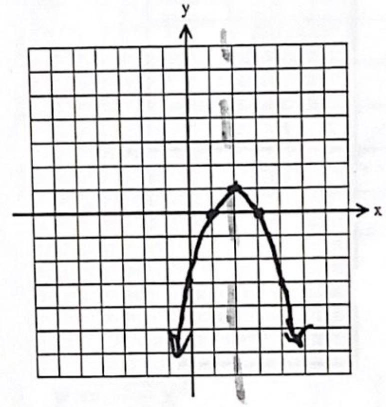
Transformations?

→2 ↑1 Reflect

Max/Min: 1

Domain: $\mathbb{R}$ Range: $y \leq 1$

Axis of symmetry: $x = 2$



c) $y = -x^2 - 2$

Vertex: $(0, -2)$ y-intercept: $(0, -2)$

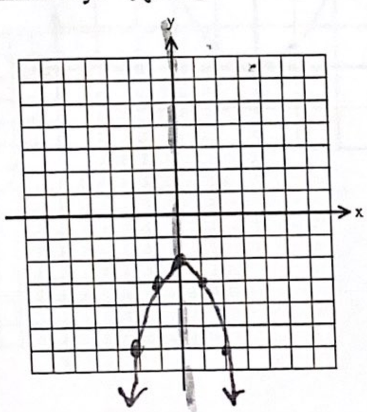
Transformations?

↓2 Reflect

Max/Min: -2

Domain: $\mathbb{R}$ Range: $y \leq -2$

Axis of symmetry: $x = 0$



d) $y = (x+5)^2$

Vertex: $(-5, 0)$ y-intercept: $(0, 25)$

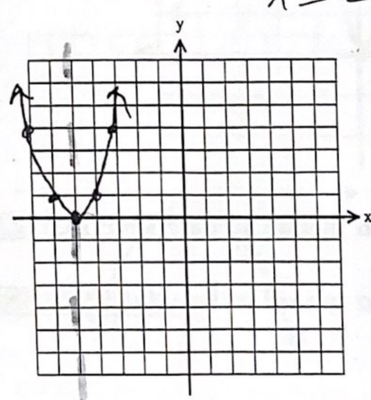
Transformations?

← 5

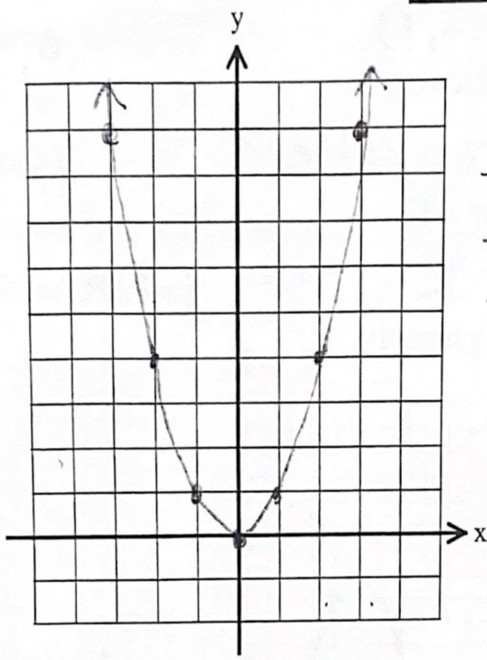
Max/Min: 0

Domain: $\mathbb{R}$ Range: $y \geq 0$

Axis of symmetry: $x = -5$

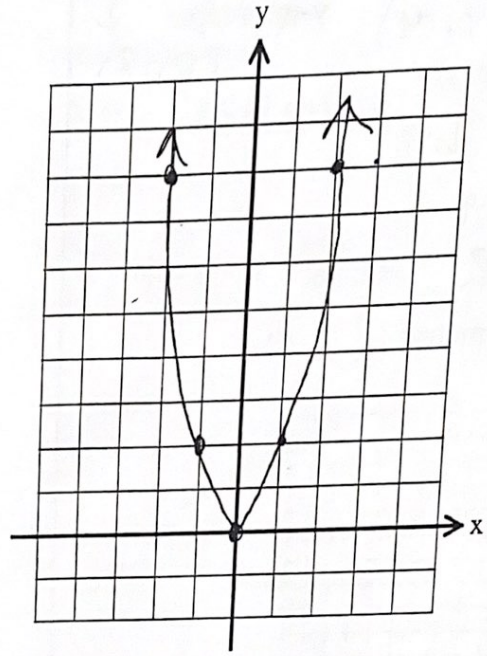


When $a = 1$ *or* $a = -1$, there's no stretch or compression.... $\boxed{y = x^2}$



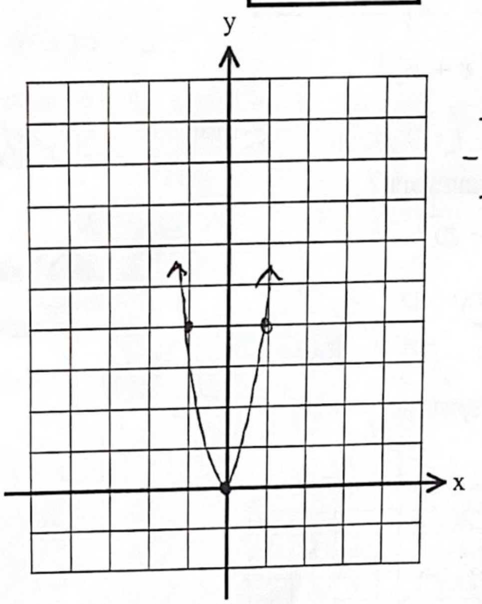
x	y
-2	4
-1	1
0	0
1	1
2	4

When $a = 2$... $\boxed{y = 2x^2}$



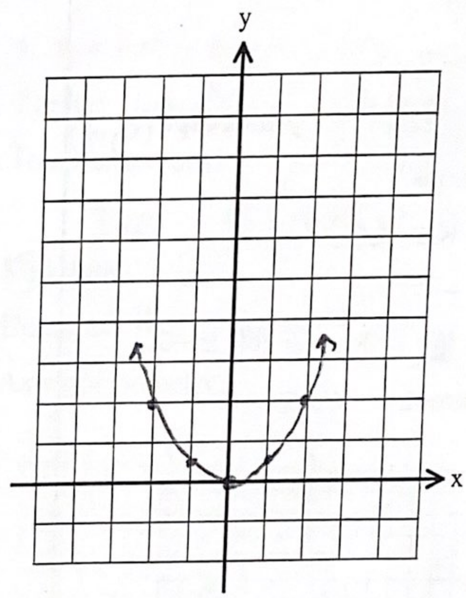
x	y
-2	8
-1	2
0	0
1	2
2	8

When $a = 4$... $\boxed{y = 4x^2}$



x	y
-2	16
-1	4
0	0
1	4
2	16

When $a = \frac{1}{2}$... $\boxed{y = \frac{1}{2}x^2}$



x	y
-2	2
-1	1/2
0	0
1	1/2
2	2

When $|a| > 1$, a is said to be <u>STRETCHED</u>.

When $|a| < 1$, a is said to be <u>COMPRESSED</u>.

xamples:

. $y = 3(x+2)^2 - 5$

/ertex: $(-2,-5)$ y-intercept: $(0,7)$

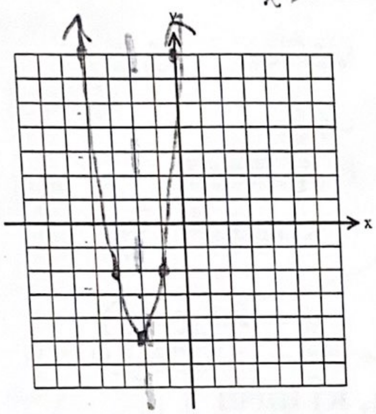
Transformations?

$\leftarrow 2$ $\downarrow 5$ stretch 3

Max/Min: -5

Domain: $\mathbb{R}$ Range: $y \geq -5$

Axis of symmetry: $x = -2$



2. $y = -4(x-3)^2 + 6$

Vertex: $(3,6)$ y-intercept: $(0,-30)$

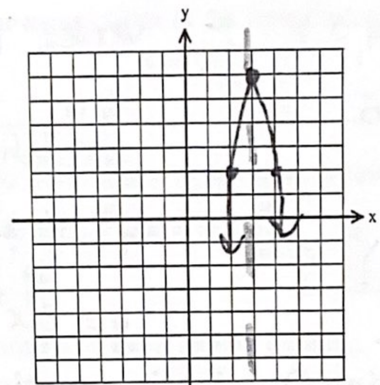
Transformations?

$\rightarrow 3$ $\uparrow 6$ Reflect stretch 4

Max/Min: 6

Domain: $\mathbb{R}$ Range: $y \leq 6$

Axis of symmetry: $x = 3$



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

Vertex: $(-4,-1)$ y-intercept: $(0,7)$

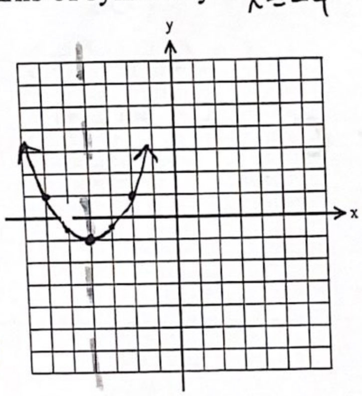
Transformations?

$\leftarrow 4$ $\downarrow 1$

Max/Min: 1

Domain: $\mathbb{R}$ Range: $y \geq 1$

Axis of symmetry: $x = -4$



4. $y = -\frac{1}{3}x^2$

Vertex: $(0,0)$ y-intercept: $(0,0)$

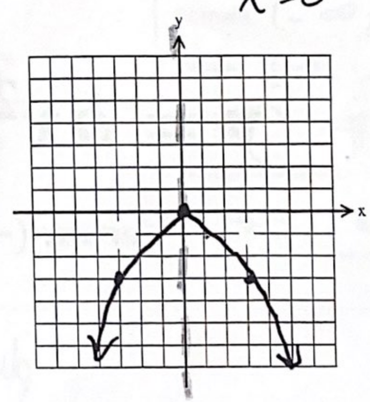
Transformations?

Reflect compress $\frac{1}{3}$

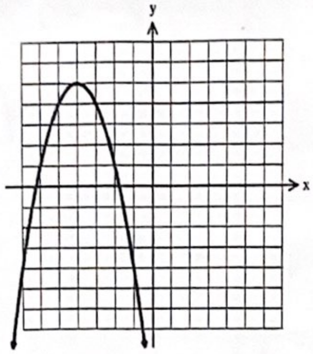
Max/Min: 0

Domain: $\mathbb{R}$ Range: $y \leq 0$

Axis of symmetry: $x = 0$



5. Describe the transformations on the functions shown below from the parent function $f(x) = x^2$ and write the equation for each parabola.

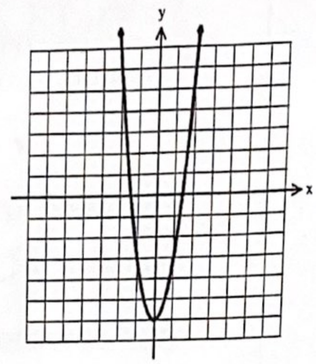


vertex $(-4, 5)$

$\leftarrow 4$ $\uparrow 5$

Reflect

$y = -(x+4)^2 - 5$



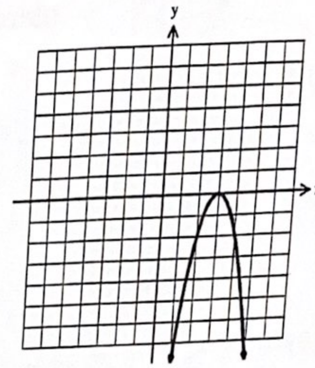
vertex: $(0, -6)$

$\downarrow 6$

stretch 3

$y = 3(x-0)^2 - 6$

$y = 3x^2 - 6$



vertex: $(3, 0)$

$\rightarrow 3$

reflect

stretch 2

$y = 2(x-3)^2$

4.2: Rewriting Quadratic equations into vertex (h, k) form

ESQ: Can you rewrite a quadratic equation in vertex form?

Vertex Form:

$$y = a(x-h)^2 + k$$

Vertex: (h, k)

Standard Form:

$$y = ax^2 + bx + c$$

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

plug in to get y

xample 3: Rewrite the equation in vertex orm.

$y = 4x^2 - 24x + 31$

$a = 4$
$b = -24$
$c = 31$

$x = \frac{-b}{2a}$

$x = \frac{-(-24)}{2(4)}$

$x = \frac{24}{8}$

$x = 3$

vertex: $(3, -5)$

$y = 4(3)^2 - 24(3) + 31$
$= 36 - 72 + 31$
$= -5$

$y = a(x-h)^2 + k$

$y = 4(x-3)^2 - 5$

Steps to writing an equation in vertex form:
1) Put the equation in Standard form. $y = ax^2 + bx + c$
2) Identify a, b, and c.
3) Find the x-coordinate of the vertex using the equation $h = -\frac{b}{2a}$
4) Find the y-coordinate of the vertex by evaluating $k = f(-\frac{b}{2a})$ plug in h for x to get y (k)
5) Substitute a, h, and k into the equation. $y = a(x-h)^2 + k$

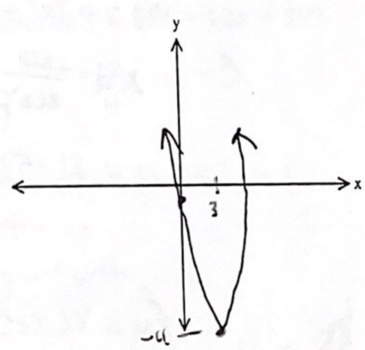
Example 4: Write the following equations in (h, k) form, then write the vertex and draw a sketch.

a.) $y = x^2 - 6x - 2$

y - int = c

$x = \frac{-(-6)}{2(1)} = \frac{6}{2} = 3$

$y = (3)^2 - 6(3) - 2$
$= 9 - 18 - 2$
$= -11$



Vertex: $(3, -11)$

y-intercept: -2

Domain: $(-\infty, \infty)$

Range: $[-11, \infty)$

Max/Min: -11

Transformations:

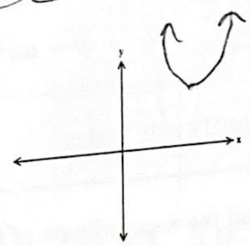
→3 ↓11

b.) $y = x^2 - 8x + 25$

$x = \frac{-(-8)}{2(1)} = 4$

$y = (x-4)^2 + 9$

$y = (4)^2 - 8(4) + 25$
$= 16 - 32 + 25$
$= 9$



vertex: $(4, 9)$

What is the range in example b? $[9, \infty)$

What are the transformations in example b?
$\rightarrow 4 \uparrow 9$

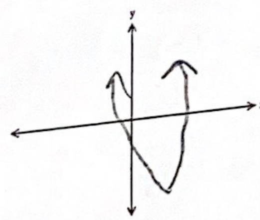
c.) $y = 3x^2 - 6x - 2$

$x = \frac{-(-6)}{2(3)} = \frac{6}{6} = 1$

$y = 3(x-1)^2 - 5$

$y = 3(1)^2 - 6(1) - 2$
$= 3 - 6 - 2$
$= -5$

vertex:
$(1, -5)$



What is the max/min in example c? -5

What is the y-intercept in example c? -2

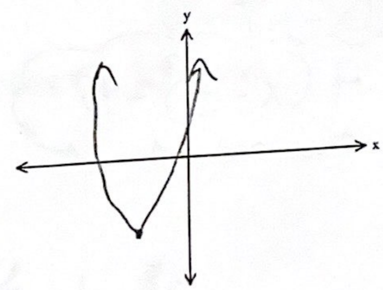
You try!!!

d.) $y = x^2 + 8x + 12$

$x = \frac{-8}{2} = -4$

$y = (-4)^2 + 8(-4) + 12$
$= 16 - 32 + 12$
$= -4$

$y = (x+4)^2 - 4$



vertex: $(-4, -4)$

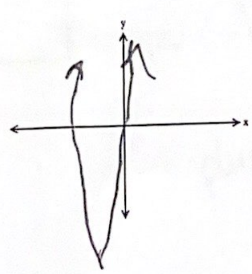
Example 5: Write the following equations in (h, k) form, then write the vertex and draw a sketch.

a.) $y = x^2 + 18x + 4$

$x = \frac{-18}{2} = -9$

$y = (-9)^2 + 18(-9) + 4$
$= -77$

$y = (x+9)^2 - 77$



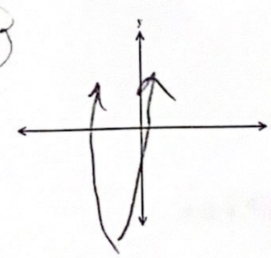
y-int $= 4$

b.) $y = 2x^2 + 20x + 6$ $\quad a = 2$

$x = \frac{-20}{2(2)} = \frac{-20}{4} = -5$

$y = 2(-5)^2 + 20(-5) + 6$
$= -44$

$y = 2(x+5)^2 - 44$



c.) $y = -2x^2 - 8x + 5$ $a = -2$

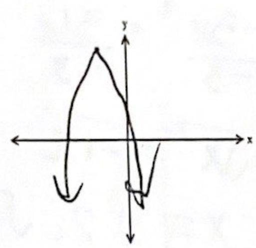
$x = \frac{-(-8)}{2(-2)} = \frac{8}{-4} = -2$

$y = -2(-2)^2 - 8(-2) + 5$

$= 13$

vertex $(-2, 13)$

$= -2(x+2)^2 + 13$



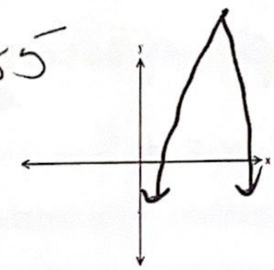
d.) $y = -x^2 + 18x + 4$ $a = -1$

$x = \frac{-18}{2(-1)} = 9$

$y = -(9)^2 + 18(9) + 4 = 85$

vertex: $(9, 85)$

$y = -(x-9)^2 + 85$



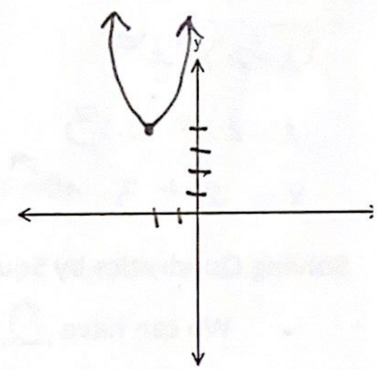
You try!!!

a.) $y = 2x^2 + 8x + 12$ $a = 2$

$x = \frac{-8}{4} = -2$

$y = 2(-2)^2 + 8(-2) + 12 = 4$

$y = 2(x+2)^2 + 4$



Example 6:
What are the transformations on the function $y = 2x^2 + 12x + 19$?

$x = \frac{-12}{2(2)} = \frac{-12}{4} = -3$ $a = 2$

$y = 2(-3)^2 + 12(-3) + 19 = 1$

vertex: $(-3, 1)$

$y = 2(x+3)^2 + 1$

$\leftarrow 3$ $\uparrow 1$

stretch 2

4.3: Solving Quadratics Using Square Roots

Can you solve an equation by completing the square? Can you graph a function includin the vertex AND the x-intercepts?

Work with a partner to solve the following quadratics by Square Rooting. If needed, write answers in terms of *i*, and simplify radical answers.

1) $x^2 + 25 = 0$

$\sqrt{x^2} = \sqrt{-25}$

$x = \pm 5i$

2) $-3x^2 - 30 = 6$

$\frac{-3x^2}{-3} = \frac{36}{-3}$

$\sqrt{x^2} = \sqrt{-12}$

$x = \pm 2i\sqrt{3}$

3) $(x-2)^2 - 9 = 0$

$\sqrt{(x-2)^2} = \sqrt{9}$

$x - 2 = \pm 3$

$x = 2 \pm 3$ → 5, → −1

4) $\frac{1}{4}(y-6)^2 = 8$

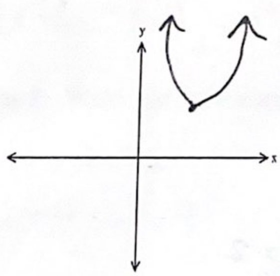
$\sqrt{(y-6)^2} = \sqrt{32}$

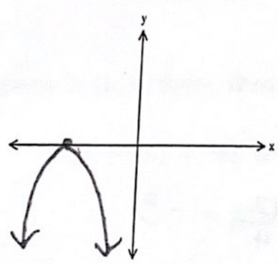
$y - 6 = \pm 4\sqrt{2}$

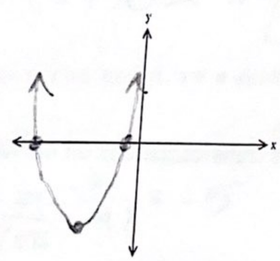
$y = 6 \pm 4\sqrt{2}$

Solving Quadratics by Square Rooting

- We can have 0 real solution, 1 real solution (0), or 2 real solutions.







w that we can change a quadratic function from standard form to rtex form t we can easily find the **vertex**. order to find the **solutions** (roots, x-intercepts, zeros), all we need) do is solve by using **square roots**.

Steps to solving by completing the square:
1) Rewrite the equation in vertex form.
2) Graph the vertex
3) Set y = 0 and solve by using square roots.
4) graph x-intercepts (solutions)

xample 1) Solve $y = x^2 - 8x - 33$ by rewriting in vertex form and graph completely.

$x = \frac{8}{2} = 4$

$y = (4)^2 - 8(4) - 33 = -49$

vertex $(4, -49)$

$y = (x-4)^2 - 49$

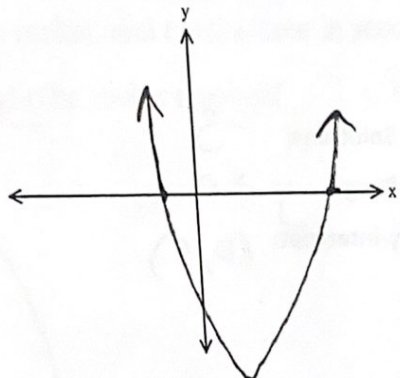
set $y = 0$

$0 = (x-4)^2 - 49$

$49 = (x-4)^2$

$\pm 7 = x - 4$

4 ± 7 → 11, → −3



Example 2) Solve $y = -x^2 - 2x + 3$ by rewriting in vertex form and graph completely.

$a = -1$

vertex $(-1, 4)$

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

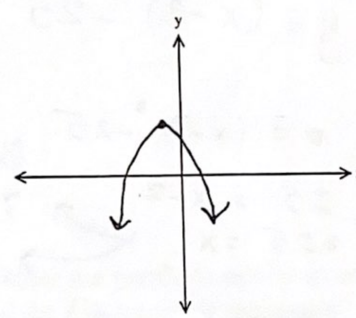
$y = -(-1)^2 - 2(-1) + 3 = 4$

$y = -(x+1)^2 + 4$

$0 = -(x+1)^2 + 4$

$\pm 2 = x + 1$ → 1, → −3

-1 ± 2



Vertex: $(-1, 4)$

Domain: $\mathbb{R}$

Max/Min: 4

Solutions: 1 & −3

Range: $y \le 4$

y-intercept: $(0, 3)$

Example 3) Solve $y = x^2 + 6x + 9$ by rewriting in vertex form and graph completely.

$x = \frac{-6}{2} = -3$

$y = (-3)^2 + 6(-3) + 9 = 0$

vertex: $(-3, 0)$

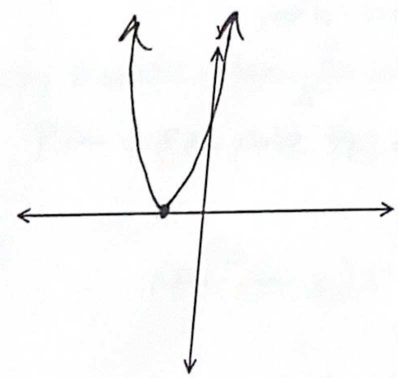
$y = (x+3)^2$

x-int

$0 = (x+3)^2$

$0 = x + 3$

$x = -3$



Vertex: $(-3, 0)$

Domain: $\mathbb{R}$

Max/Min: 0

Solutions: -3

Range: $y \geq 0$

y-intercept: $(0, 9)$

You try!!!

a) $y = x^2 - 4x - 21$

$x = \frac{4}{2} = 2$

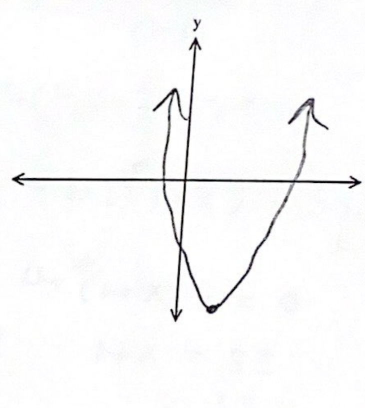
$y = 2^2 - 4(2) - 21 = -25$

$y = (x-2)^2 - 25$

$0 = (x-2)^2 - 25$

$\pm 5 = x - 2$

$2 \pm 5 = x$ → 7, → -3



Vertex: $(2, -25)$

Domain: $\mathbb{R}$

Max/Min: -25

Solutions: 7 & -3

Range: $y \geq -25$

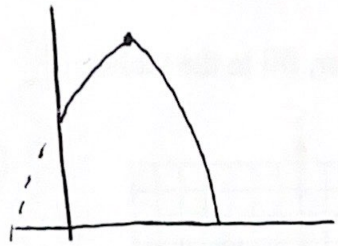
y-intercept: $(0, -21)$

nple 4) A football is kicked in the air, and its path can be modeled by the equation $= -16(x-5)^2 + 21$, where x is the horizontal distance (in feet) and f(x) is the height. What e maximum height of the football?

vertex: $(5, 21)$

↑

max height

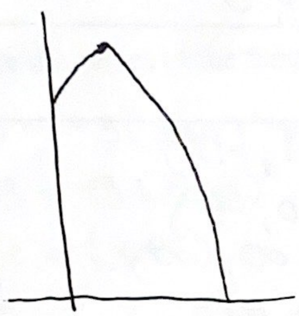


ample 5) A rocket is launched off a platform with an initial velocity of 19.6 meters per cond. The path of the rocket can be modeled by the equation $h = -4.9(t-2)^2 + 78.4$ here h is the height of the rocket, and t is the time in seconds.

Vhat is the maximum height the rocket reaches? vertex: $(2, 78.4)$

↑

max height



After how many seconds will the rocket hit the ground? height $= 0$ find x-int

$$-4.9(t-2)^2 + 78.4 = 0$$

$$\frac{-4.9(t-2)^2}{-4.9} = \frac{-78.4}{-4.9}$$

$$\sqrt{(t-2)^2} = \sqrt{16}$$

$$t - 2 = \pm 4$$

$$+2 \qquad +2$$

6 seconds

$\cancel{-2}$

Example 6) Given the function $f(x) = x^2 + 2x + 7$, state whether the parabola opens up or down and the maximum or minimum. What do you need to find the maximum or minimum?

$x = \frac{-2}{2} = -1$ vertex

opens up

$y = (-1)^2 + 2(-1) + 7 = 6$

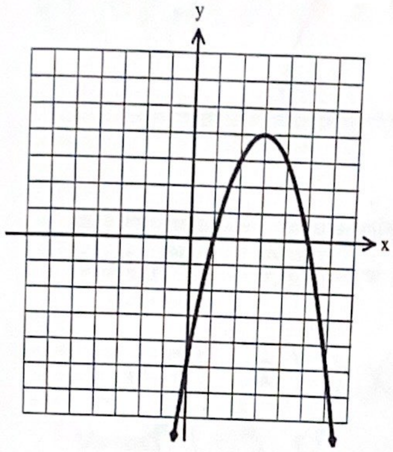
min @ 6

$y = (x+1)^2 + 6$

4.4: More Graphing - Key Features of Quadratics

Can you identify key features of a quadratic and analyze....

With a partner, fill in the tables…



Vertex: $(3,4)$

y-intercept: $(0,-5)$

Domain: $(-\infty,\infty)$

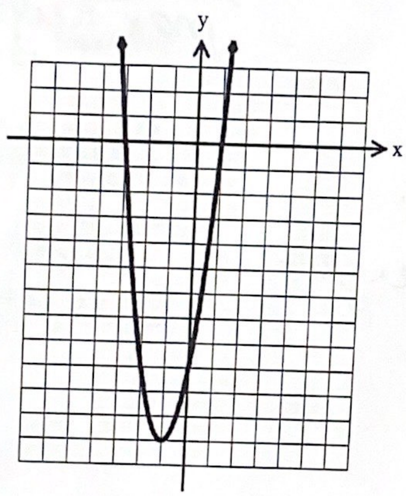
Range: $(-\infty,4]$

Max/Min: 4

Transformations:

$\rightarrow 3$ $\uparrow 4$ reflect

Roots: 1 & 5



Vertex: $(-1,-12)$

y-intercept: $(0,-9)$

Domain: $(-\infty,\infty)$

Range: $[-12,\infty)$

Max/Min: -12

Transformations:

$\leftarrow 1$ $\downarrow 12$ stretch 3

Roots: -3 & 1

1.) If $(x+3)(x-1) = (x-h)^2 + k$, then what is the value of k?

FOIL

x^2+2x-3

vertex $(-1, -4)$

$\uparrow$

K

$x = -\frac{2}{2} = -1$

$y = (-1)^2 + 2(-1) - 3 = -4$

) Find the vertex from #1

$(-1, -4)$

.) What is the vertex of the function $y = 3.2(x+4)^2 - 5.1$?

$(-4, -5.1)$

4.) What is the y-intercept of the function $f(x) = -2(x-3)^2 + 10$?

plug in 0 for x

$y = -2(0-3)^2 + 10$

$= -18 + 10$

$= -8$

5.) What are the zeroes of the function $h(x) = -3(x+4)^2 + 3$?

plug in 0 for y & solve

$0 = -3(x+4)^2 + 3$

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

$1 = (x+4)^2$

$\pm 1 = x + 4$

$x = -4 \pm 1$

$-3 \quad -5$

6.) What are the x-intercepts of the function $y = x^2 + 6x - 27$?

plug in 0 for y & factor

$0 = x^2 + 6x - 27$

$0 = (x+9)(x-3)$

$-9 \quad 3$

7.) A parabola has a vertex of $(\overset{h}{-1}, \overset{k}{-5})$ and passes through the point $(\overset{x}{3}, \overset{y}{-37})$. In the $y = a(x-h)^2 + k$ form of the parabola, what is the value of a?

$y = a(x+1)^2 - 5$

$-37 = a(3+1)^2 - 5$

$-32 = a(4)^2$

$-32 = 16a$

$-2 = a$

8.) A parabola has a vertex of $(5, 2)$ and passes through the point $(6, 3)$. In the $y = a(x-h)^2 + k$ form of the parabola, what is the value of a ?

$y = a(x-5)^2 + 2$

$3 = a(6-5)^2 + 2$

$3 = a + 2$

$a = 1$

You try!

9.) A parabola has a vertex of $(-4, 3)$ and passes through the point $(-2, 19)$. In the $y = a(x-h)^2 + k$ form of the parabola, what is the value of a ?

$19 = a(-2+4)^2 + 3$

$19 = 4a + 3$ $\quad a = 4$

$16 = 4a$

10.) If $g(x) = -x^2 + 10x - 21 = a(x-h)^2 + k$, then what is the value of k?

$a = -1$ $\quad y = -(x-5)^2 + 4$

$x = \frac{-10}{2(-1)} = 5$ $\quad$ K

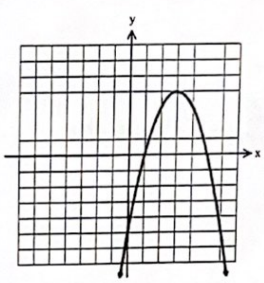
$y = -1(5)^2 + 10(5) - 21 = 4$

11.) Which of the following functions have the range $[4, \infty)$?

A) $y = 2(x+3)^2 + 4$

C) $y = (x+2)^2$

B)



D) $f(x) = 2x^2 + 6x + 4$

$2(x + 3/2)^2 - 1/2$

12.) The graph $f(x) = x^2$ has a vertical stretch by a factor of 5 and is reflected vertically. What is the equation of the function after the transformation?

$f(x) = -5x^2$

13.) Describe in words how the graph of $g(x) = \frac{1}{2}(x+4)^2 - 3$ would be transformed from the parent function $f(x) = x^2$.

$\leftarrow 4 \quad \downarrow 3$ compress $\frac{1}{2}$

14.) The graph $f(x) = x^2$ is compressed by a factor of $\frac{2}{3}$, shifted 3 units to the left, and 6 units up. What is the equation of the function after the transformation?

$f(x) = \frac{2}{3}(x+3)^2 + 6$

15.) When evaluating the function $f(x) = -2(x+1)^2 + 3$ for any real number x, what must be true about the value of f(x) ?

$(-1, 3)$ $\frown$ max @ 3

f(x) must be in the range

$\{y \mid y \leq 3\}$ / $(-\infty, 3]$

Example 16: The storage building shown can be modeled by the graph of the function $y = -x^2 + 24x - 44$ where x is the horizontal distance and y is the height (in cm). What is the maximum height of the building?

$a = 1$

$x = \frac{-24}{2(-1)} = 12$

$y = -(12)^2 + 24(12) - 44 = 100$

max height 100 cm

What is the width of the building at the base?

find x-int

$-1(x-12)^2 + 100 = 0$

$(x-12)^2 = 100$

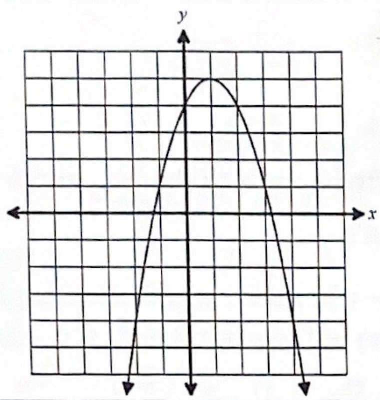
$x - 12 = \pm 10$

$x = 12 \pm 10$ → 22, 2

width = 22 - 2

20 cm

17.) Compare the two functions represented below. Determine which of the following statements is true.

Function $f(x)$	Function $g(x)$
	Roots: $(x-1)^2+6=0$ $(x-1)^2=-6 \to$ imaginary y-int: $g(0)=(0-1)^2+6=7$ $g(x)=(x-1)^2+6$ vertex: 1,6 $x=1$ axis of sym

~~I.~~ $f(x)$ and $g(x)$ have the same y-intercept.

~~II.~~ $f(x)$ and $g(x)$ have the same roots.

III. $f(x)$ and $g(x)$ have the same axis of symmetry. $x=1$

~~IV.~~ $f(x)$ and $g(x)$ have the same range.

18.) 

Find the key features of the function $y=-0.5x^2-3x+4$

Vertex: $(-3, 8.5)$

y-intercept: 4

Domain: $(-\infty, \infty)$

Range: $(-\infty, 8.5]$

Max/Min: 8.5

Transformations:

$\leftarrow 3$ $\uparrow 8.5$ reflect compress.

Roots: -7.12 & 1.12

19.) 

Find the key features of the function $y=2.5(x+10.2)^2-5$

Vertex: $(-10.2, -5)$

y-intercept: 255.1

Domain: $(-\infty, \infty)$

Range: $[-5, \infty)$

Max/Min: -5

Transformations:

$\leftarrow 10.2$ $\downarrow 5$ stretch 2.5

Roots: -11.6 & -8.8