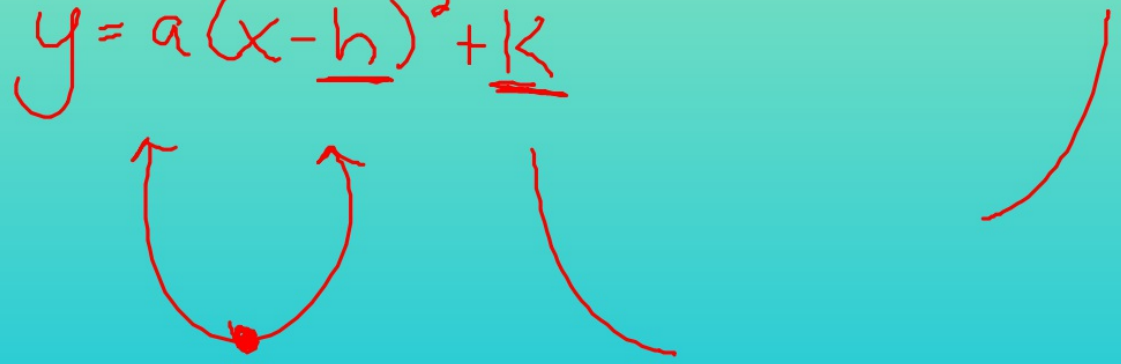
4.2 Standard Form of a Quadratic Function

Learning Targets for today

- To be able to graph quadratic functions of the form $y=ax^2 + c$ and $y = ax^2 + bx + c$.
- To be able to identify the vertex of each parabola (minimum / maximum).
- To be able to identify the axis of symmetry.
- To be able to identify the domain and range of each function.

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



Vocabulary

Standard Form of a Quadratic Formula – $y = ax^2 + bx + c$

Ex: $y = 4x^2$ / $y = x^2 + 9$ / $y = x^2 - x - 2$

Parabola – U-shaped curved line.

Axis of Symmetry - The fold or line that divides the parabola into two matching halves.

Vertex of a Parabola – The highest and lowest piont of a parabola, depending on whether the parabola opens up or down.

Parabola opens up → $y = ax^2 + bx + c$ (a is positive)
Vertex is lowest point!

Parabola opens down → $y = -ax^2 + bx + c$ (a is negative)
Vertex is highest point!

Find the Vertex of an Quadratic Equation $y = ax^2 + bx + c$

Example for you…	**Your turn to try…**
To find the x – coordinate of the vertex and the axis of symmetry line, set $x = \frac{-b}{2a}$.	*To find the x – coordinate of the vertex and the axis of symmetry line, set* $x = \frac{-b}{2a}$.
$y = ax^2 + bx + c$ 1. $y = x^2 + 6x - 4$	$a = -2 \quad b = 4 \quad c = -1$ 1. $y = -2x^2 + 4x - 1$
$x = \frac{-(6)}{2(1)} = \frac{-6}{2} = -3$	$x = \frac{-(4)}{2(-2)} = \frac{-4}{-4} = 1$
$y = (-3)^2 + 6(-3) - 4$ $y = -13$	$y = -2(1)^2 + 4(1) - 1$ $y = 1$

x	y
-1	
-2	
Vertex: -3	-13
-4	
-5	

x	y
Vertex: 1	1

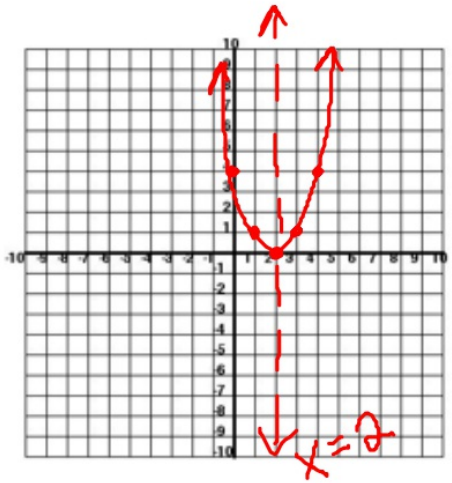
Graphing Quadratic Functions ($y = ax^2 + bx + c$) Finding the Vertex

Example for you…

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

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

x	y
4	4
3	1
2	0
1	1
0	4



a. State the vertex of the graph. Max or Min? (2,0) MIN.

b. State the axis of symmetry

$x=2$

c. State the domain of the function

$\mathbb{R}$

d. State the range of the function

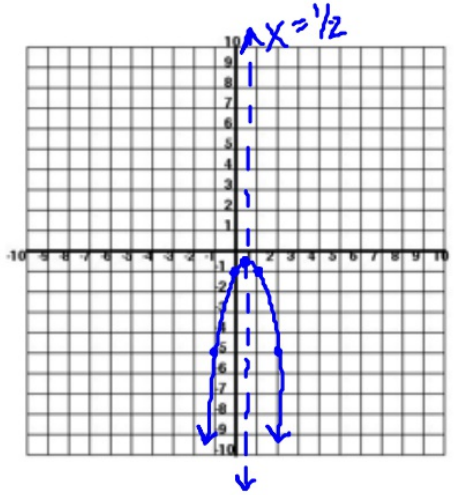
$\mathbb{R} \geq 0$

Your turn to try…

1. $y = -2x^2 + 2x - 1$

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

x	y
2	-5
1	-1
½	-½
0	-1
-1	-5



a. State the vertex of the graph. Max or Min? (½, -½) MAX

b. State the axis of symmetry

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

c. State the domain of the function

$\mathbb{R}$

d. State the range of the function

$\mathbb{R} \leq -\frac{1}{2}$

Converting Standard Form to Vertex Form $y = a(x - h)^2 + k$

Example for you…	**Your turn to try…**
Find the vertex of the quadratic, then write it in vertex form. ($y=a(x-h)^2+k$) 1. $y = x^2 + 2x + 5$ ($a=1$, $b=2$) $x = \frac{-b}{2a} = \frac{-(2)}{2(1)} = \frac{-2}{2} = -1$ $(-1, 4)$ = vertex $y=a(x-h)^2+k$ $y=(x+1)^2+4$	Find the vertex of the quadratic, then write it in vertex form. 1. $y = -x^2 + 4x - 5$ ($a=-1$, $b=4$) $x = \frac{-b}{2a} = \frac{-(4)}{2(-1)} = \frac{-4}{-2} = 2$ $(2, -1)$ = vertex ✓ $y=a(x-h)^2+k$ $y=-(x-2)^2-1$