Section 6.4: Vertex Form of a Quadratic Function

↳ $y = a(x - h)^2 + k$

Investigate

A. The Effect of Parameter ***a*** in $y = ax^2$ on the graph of $y = x^2$

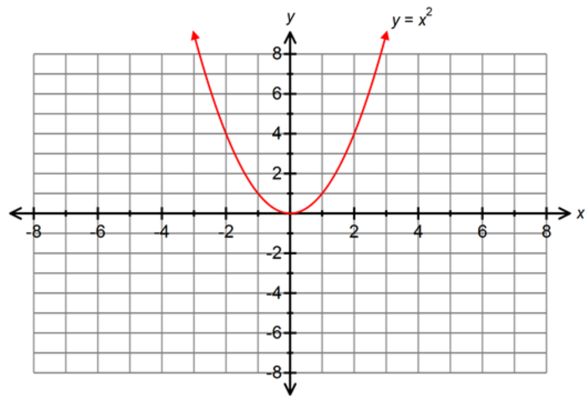
B. The effect of parameter **k** in $y = x^2 + k$ on the graph of $y = x^2$

C. The Effect of Parameter **h** in $y = (x - h)^2$ on the graph of $y = x^2$

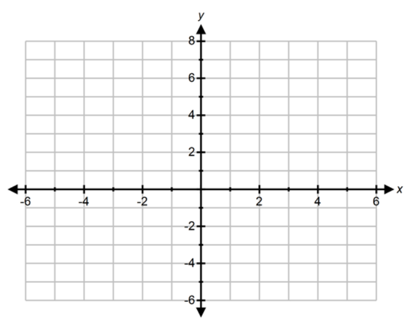
The effect of parameter h in $y = (x-h)^2$ on the graph of $y = x^2$

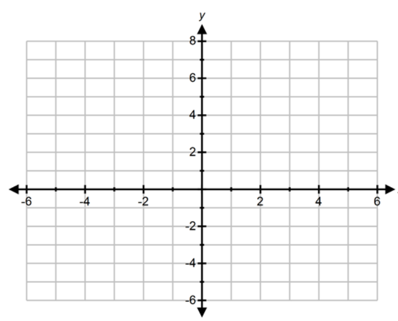
$y = x^2$

x	y
-2	4
-1	1
0	0
1	1
2	4
3	9



$y = (x+3)^2$	$y = (x-1)^2$
vertex=	vertex=
shift =	shift =
HT=	HT=



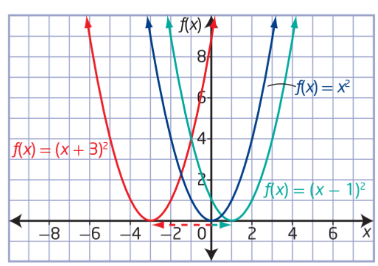


What is the effect of h?

> translates the parabola ***horizontally (left/right)***

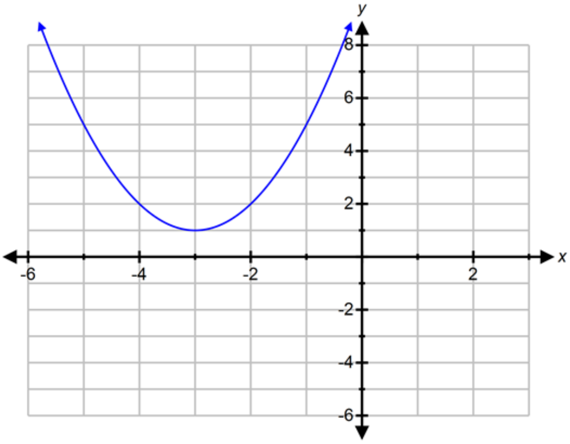
> h = *x*-coordinate of vertex

> the equation of the axis of symmetry is $x = \text{h}$



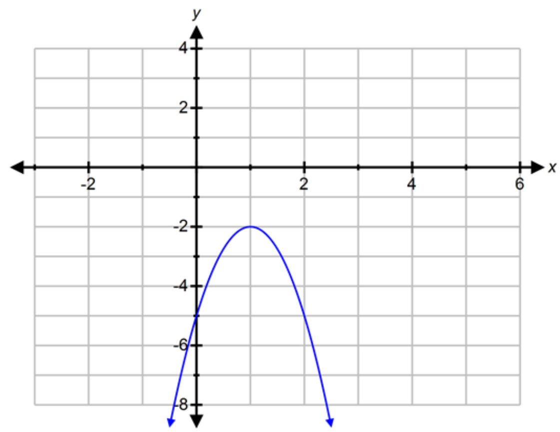
Example: State the transformations and the coordinates of the vertex for each quadratic function.

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



Vertex:______________

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



Vertex:______________

Example:

Without the aid of a graph, determine the coordinates of the vertex for:

(i) $y = (x+7)^2 - 2$

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

Vertex:________________

Vertex:________________

Summary

A quadratic function is in vertex form when it is written in the form

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

☆ **where**

- ***a*** **indicates direction of opening and width of graph**
- **coordinates of the vertex (h, k)**
- **equation of axis of symmetry x = h**

Example: **Sketch the graph of a quadratic function in vertex form.**

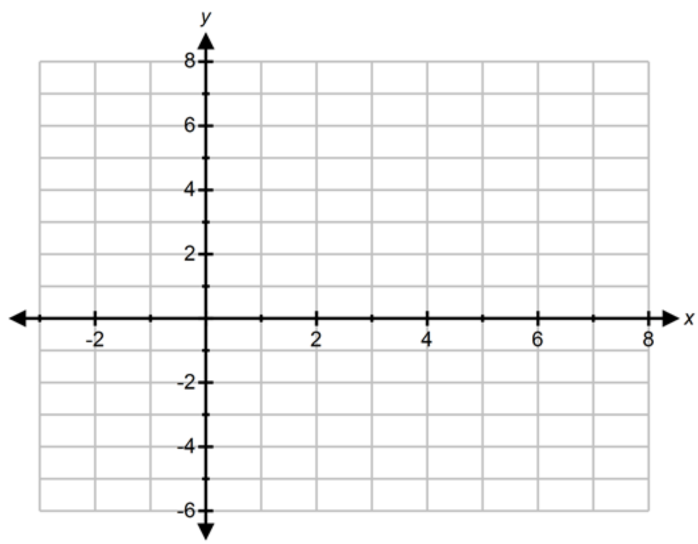
$$f(x) = -\frac{1}{2}(x-4)^2 + 3$$

(a) state the direction of opening__________

(b) state the coordinates of the vertex__________

(c) state the equation of axis of symmetry__________

(d) determine the y – intercept__________



(e) sketch the graph

(f) state the domain and range

Domain:_______________

Range:________________

Predicting the number of zeros of a quadratic function.

For each quadratic function:

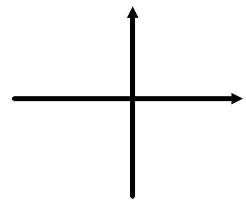
- •state the direction
- •the vertex
- •sketch the graph
- •state the number of x – intercepts

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

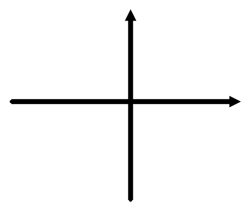
Direction:_____

Vertex:_______

Number of x – intercepts:____



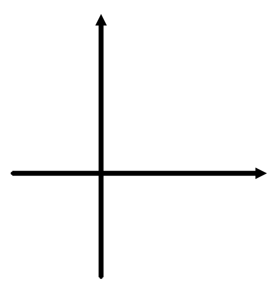
(b) $y = (x - 4)^2$



Direction:_____

Vertex:_______

Number of x – intercepts:____



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

Direction:_____

Vertex:_______

Number of x – intercepts:____

Example: Predict the number of x – intercepts (or zeros) for:

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

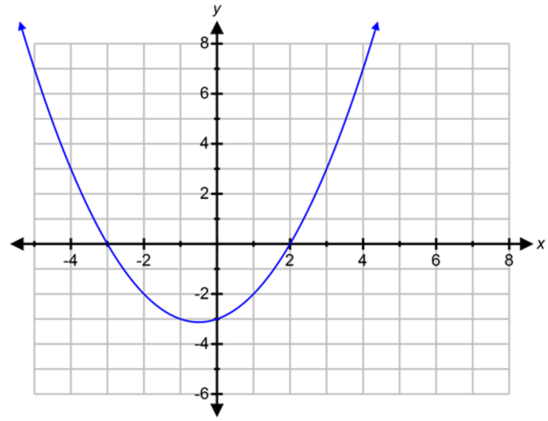
(ii) $f(x) = \frac{1}{2}(x+3)^2 - 4$

(iii) $g(x) = -(x + 2)^2$

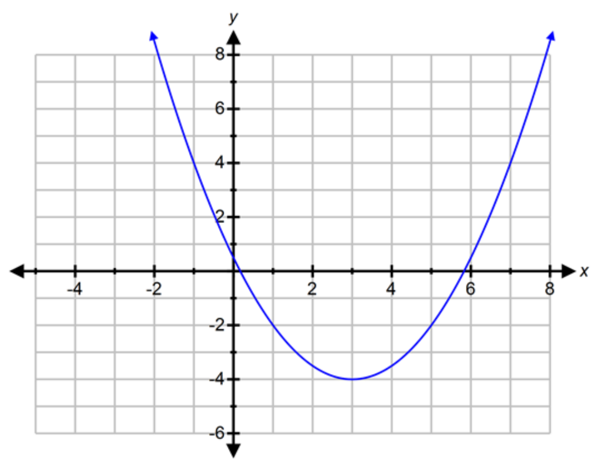
Work Sample 6.4: pg.363 #s 1 bce, 2a-c, 3, 4, 5a)b), 11a, 12a-d

6.5: Solving Problems Using Quadratic Models.
Determining the equation of a parabola from a graph.

Review: Determine the equation using x-intercepts



Example: Determine the equation using the vertex



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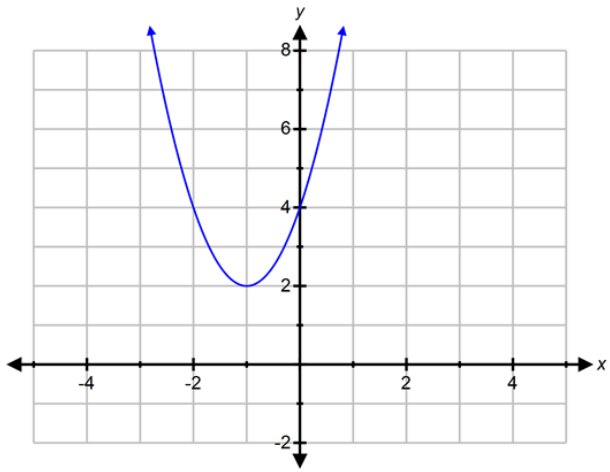
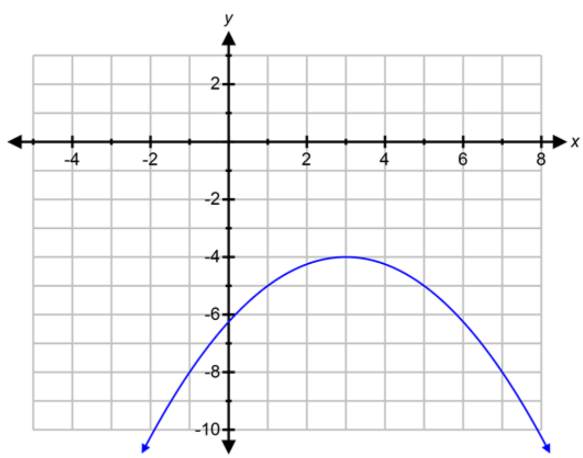
Example: Determine the equation of the quadratic in vertex form.

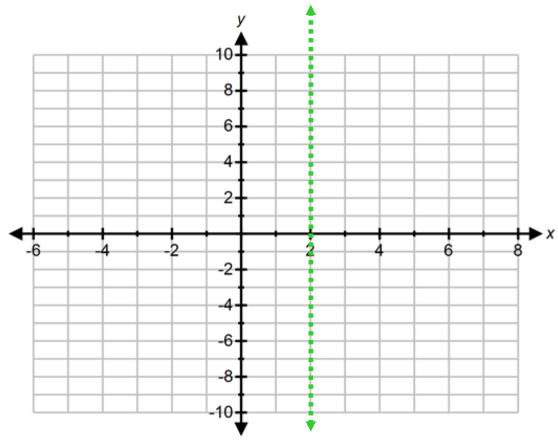
(i)



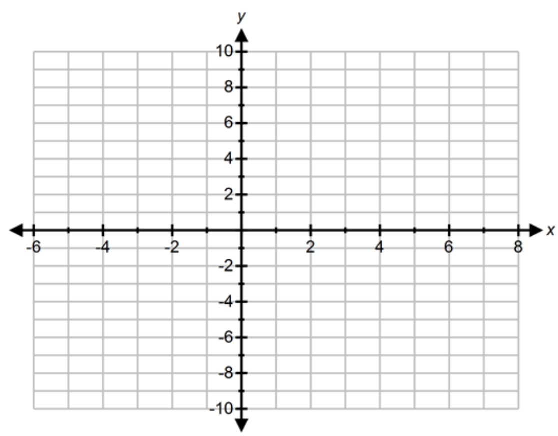
(ii)



(iii) A parabola has vertex at (2, –6) and passes through the point (4, 8), determine the function. Determine the equation of the quadratic and state the range.

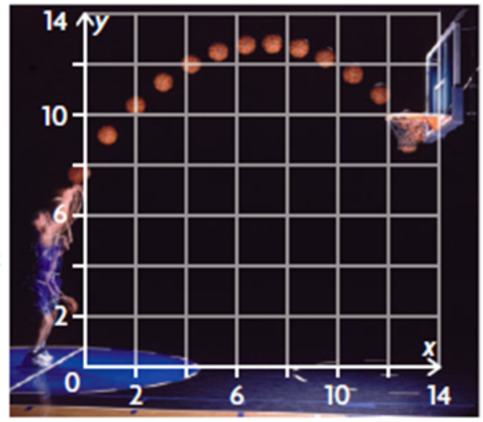


(iv) A parabola intercepts the x – axis at –4 and 6 and has a maximum value of 5. Determine the function that models the parabola and state the range.



(v)

A basketball player taking a free throw releases the ball at a height of 8 feet while standing on the free throw line. At 7 feet from the free throw line the ball attains a maximum height of 13 ft.



(a) Determine the quadratic function that models the path of the basketball.

(b) Determine the height of the ball when it is 3 feet from the free throw line.

(vi)

A quarterback throws the ball from an initial height of 6 feet. It is caught by the receiver 50 feet away, at a height of 6 feet. The ball reaches a maximum height of 20 feet during its flight. Determine the quadratic function which models this situation and state the domain and range.

Work Sample 6.5: pg. 377#s 7 a)b), 9 a)b), 10 a)b), 12, 16a-c