W2 –Quadratics in Vertex Form Unit 4
MPM2D
Jensen

1) Complete the table of properties for each quadratic

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

Vertex	(4,0)
Axis of Symmetry	$x=4$
Direction of Opening	up
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \geq 0\}$

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

Vertex	(-2,-5)
Axis of Symmetry	$x=-2$
Direction of Opening	down
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \leq -5\}$

2) Write an equation for the parabola with vertex at (2,3), opening upward, and with no vertical stretch.

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

3) Write an equation for the parabola with vertex at $(-3,0)$, opening downward, and with a vertical stretch by a factor of 2.

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

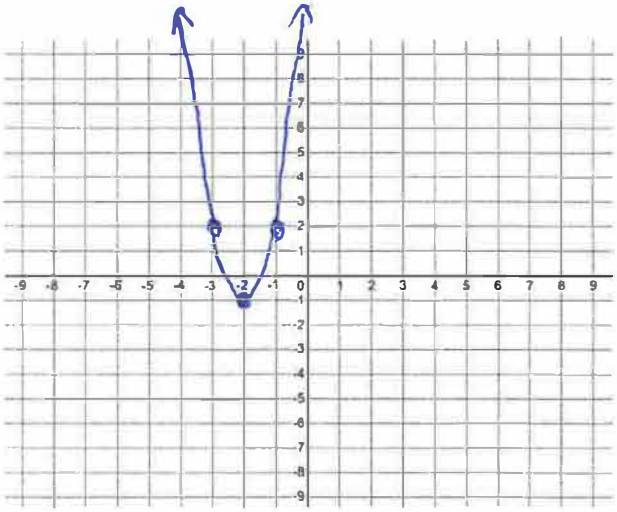
4) Write an equation for the parabola with vertex at $(4,-1)$, opening upward, and with a vertical compression by a factor of $\frac{1}{3}$.

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

5) The graph of $y = x^2$ is stretched vertically by a factor of 3 and then translated 2 units to the left and 1 unit down. Write the equation of the parabola and then sketch it using a table of values.

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

x	y
-4	11
-3	2
-2	-1
-1	2
0	11



6) For each of the following functions, **i)** describe the transformations compared to $y = x^2$, **ii)** complete the table of properties, **iii)** graph the function by making a table of values

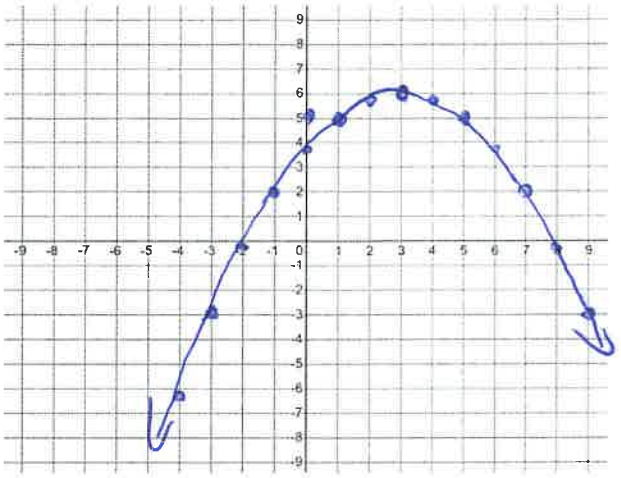
, $y = -\frac{1}{4}(x-3)^2 + 6$

Transformations:

- vertical compression by a factor of $\frac{1}{4}$
- vertical reflection in the x-axis
- shift right 3 units
- shift up 6 units

Vertex	(3,6)
Axis of Symmetry	$x=3$
Direction of Opening	Down
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \leq 6\}$

x	y
1	5
2	5.75
3	6
4	5.75
5	5



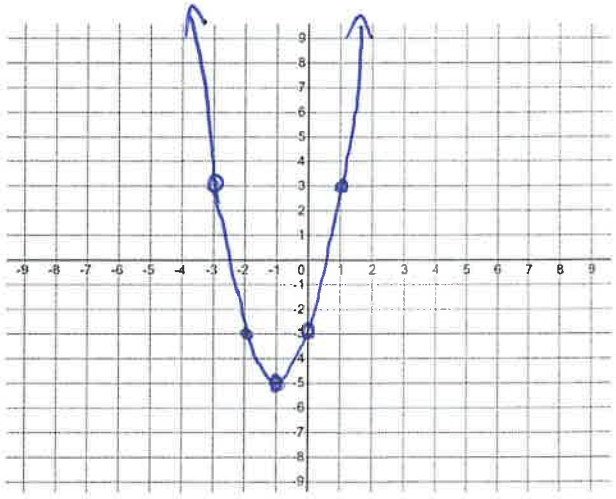
b) $y = 2(x+1)^2 - 5$

Transformations:

- vertical stretch by a factor of 2
- shift left 1 unit
- shift down 5 units.

Vertex	(-1,-5)
Axis of Symmetry	$x=-1$
Direction of Opening	up
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \geq -5\}$

x	y
-3	3
-2	-3
-1	-5
0	-3
1	3



7) The graph of $y = x^2$ is compressed vertically by a factor of $\frac{1}{2}$, reflected in the x-axis, and then translated 2 units up. Write the equation of the parabola.

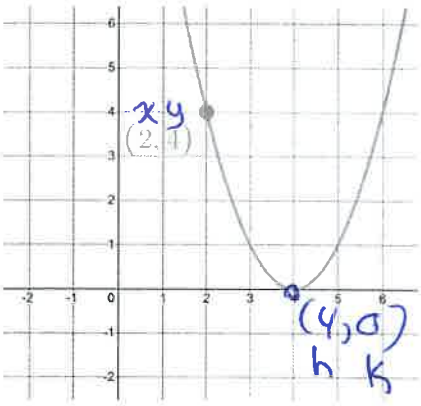
$$y = -\frac{1}{2}x^2 + 2$$

8) Describe the transformations from $y = x^2$ to $y = -5(x + 4)^2 + 7$

- vertical stretch by a factor of 5
- vertical reflection in the x-axis
- shift left 4 units
- shift up 7 units

9) Write an equation, in vertex form, for each parabola.

a)



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

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

$1 = a(-2)^2$

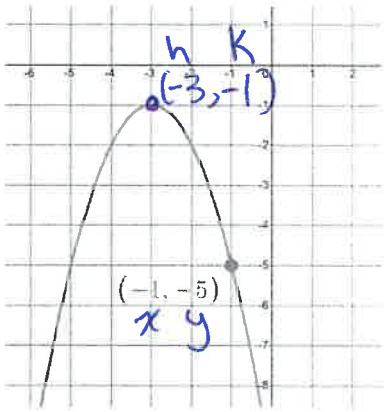
$1 = 4a$

$a = \frac{1}{4}$

$a = 1$

$y = (x-4)^2$

b)



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

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

$-5 = a(2)^2 - 1$

$-5 + 1 = 4a$

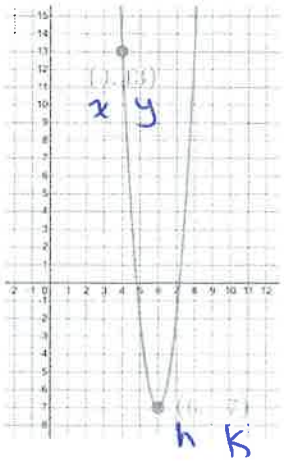
$-4 = 4a$

$a = \frac{-4}{4}$

$a = -1$

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

c)



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

$13 = a(4-6)^2 + (-7)$

$13 = a(-2)^2 - 7$

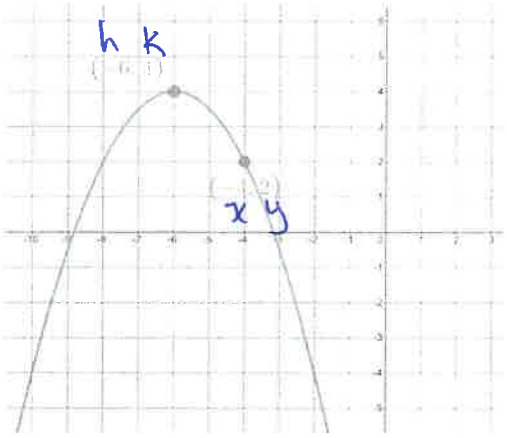
$20 = 4a$

$a = \frac{20}{4}$

$a = 5$

$y = 5(x-6)^2 - 7$

d)



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

$2 = a[-4-(-6)]^2 + 4$

$2 = a(2)^2 + 4$

$-2 = 4a$

$a = \frac{-2}{4}$

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

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

10) A baseball is batted at a height of 1 meter above the ground and reaches a maximum height of 33 meters at horizontal distance of 4 meters.

a) Determine an equation to model the path of the baseball in vertex form.

Point: $(\overset{x}{0}, \overset{y}{1})$

Vertex: $(\underset{h}{4}, \underset{k}{33})$

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

$1 = a(0-4)^2 + 33$

$1 = a(-4)^2 + 33$

$-32 = 16a$

$a = -2$

$y = -2(x-4)^2 + 33$

b) What is the height of the baseball once it has travelled a horizontal distance of 6 meters?

$y(6) = -2(6-4)^2 + 33$

$= 25\text{ m}$

c) At what other horizontal distance is the baseball at the same height as in part b) ?

It's at a height of 25m when it is 2 meters horizontally to the right of the vertex. It will be at the same height 2 meters horizontally to the left of the vertex which is a horizontal distance of 2 meters.

11) The flight path of a firework is modeled by the relation $h = -5(t-5)^2 + 127$, where h is the height, in meters, of the firework above the ground and t is the time, in seconds, since the firework was fired.

a) What is the maximum height reached by the firework? How many seconds after it was fired does the firework reach this height?

After 5 seconds the firework would be at a MAX height of 127 meters.

b) How high was the firework above the ground when it was fired?

$$h(0) = -5(0-5)^2 + 127$$
$$= -5(25) + 127$$
$$= 2m.$$

Answers

1)a)

Vertex	
Axis of Symmetry	
Direction of Opening	
Values x may take (domain)	
Values y may take (range)	

b)

Vertex	
Axis of Symmetry	
Direction of Opening	
Values x may take (domain)	
Values y may take (range)	

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

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

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

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

6)a) Vertical reflection; vertical compression by a factor of $\frac{1}{4}$; shift right 3; shift up 6

Vertex	(3,6)
Axis of Symmetry	$x = 3$
Direction of Opening	Down
Values x may take (domain)	$\{X \in \mathbb{R}\}$
Values y may take (range)	$\{Y \in \mathbb{R} \mid y \leq 6\}$

x	y
1	5
2	5.75
3	6
4	5.75
5	5

b) Vertical stretch by a factor of 2; shift left 1 unit; shift down 5 units

Vertex	$(-1,-5)$
Axis of Symmetry	$x = -1$
Direction of Opening	UP
Values x may take (domain)	$\{X \in \mathbb{R}\}$
Values y may take (range)	$\{Y \in \mathbb{R} \mid y \geq -5\}$

x	y
-3	3
-2	-3
-1	-5
0	-3
1	3

7) $y = -\frac{1}{2}x^2 + 2$

8) Vertical reflection; vertical stretch by a factor of 5; shift left 4 units; shift up 7 units

9)a) $y = (x-4)^2$ **b)** $y = -(x+3)^2 - 1$ **c)** $y = -5(x-4)^2 + 13$ **d)** $y = -\frac{1}{2}(x+6)^2 + 4$

10)a) $h = -2(d-4)^2 + 33$ **b)** 25 m **c)** 2 m

11)a) 127 m; 5 seconds **b)** 2 meters