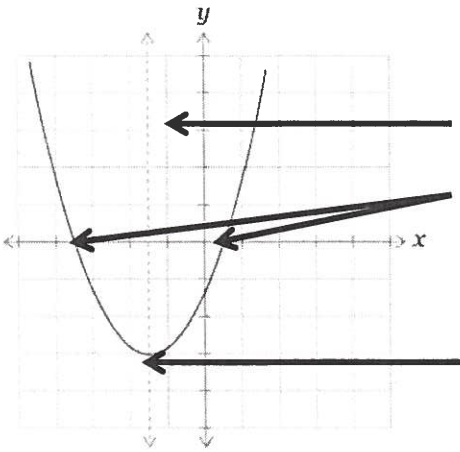
MPM2D – Unit 2: The Quadratic Relation
Review Worksheet – Part 1

Section 1 – Fill in the Blanks

1. Standard form of a quadratic relation is $y = ax^2 + bx + c$.

2. The shape of a quadratic relation is called a parabola.

3. 

axis of symmetry
x-intercepts
vertex

4. When the vertex is the highest point on the graph, it is called a maximum.

5. When the vertex is the lowest point on the graph, it is called a minimum.

6. Determine the number of x-intercepts that each of the following quadratic relations would have.

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

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

   c. $y = 7x^2 + 11$ 0 x-intercept(s).

7. Given the graph to the right, identify the following properties:

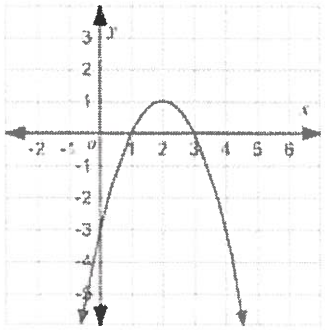
   a. Axis of Symmetry $x = 2$

   b. Vertex $(2, 1)$

   c. Number of x-intercepts 2

   d. Domain $D = \{x \in \mathbb{R}\}$

   e. Range $R = \{y \leq 1, y \in \mathbb{R}\}$



Section 2 – Equations with Transformations

1. For each of the quadratic relations below, describe the direction of opening and transformations being applied.

a. $y = 9x^2 - 11$

vertical stretch factor 9
vertical translation down 11 units

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

vertical reflection, opens down
horizontal translation left 8 units

c. $y = \frac{1}{3}(x-7)^2 + 12$

vertical compression factor 1/3
horizontal translation right 7 units
vertical translation up 12 units

d. $y = -\frac{3}{2}x^2 - 5$

vertical reflection, opens down
vertical stretch factor 3/2 (1.5)
vertical translation down 5 units

e. $y = -\frac{4}{5}(x+3)^2$

vertical reflection, opens down
vertical compression factor 4/5
horizontal translation left 3 units

2. Write an equation for the quadratic relation that results from each transformation.

a. The graph of $y = x^2$ is translated 6 units upward.

$y = x^2 + 6$

b. The graph of $y = x^2$ is translated 4 units downward.

$y = x^2 - 4$

c. The graph of $y = x^2$ is translated 7 units to the left.

$y = (x + 7)^2$

d. The graph of $y = x^2$ is translated 5 units to the right.

$y = (x - 5)^2$

e. The graph of $y = x^2$ opens down and is translated 8 units to the left.

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

f. The graph of $y = x^2$ is translated 3 units to the right.

$y = (x - 3)^2$

g. The graph of $y = x^2$ opens down and is stretched vertically by a factor of 8.

$y = -8x^2$

h. The graph of $y = x^2$ is compressed vertically by a factor of $\frac{1}{5}$.

$y = \frac{1}{5}x^2$

i. The graph of $y = x^2$ is stretched vertically by a factor of 3 and is translated 10 units to the right.

$y = 3(x - 10)^2$

j. The graph of $y = x^2$ is compressed vertically by a factor of 0.5 and translated 4 units left and 12 units up.

$y = \frac{1}{2}(x + 4)^2 + 12$ or $y = 0.5(x + 4)^2 + 12$

k. The graph of $y = x^2$ opens down and is translated 6 units to the right and 17 units down.

$y = -(x - 6)^2 - 17$

Section 3 – Properties of Graphs

1. Order each group of quadratic relations from the widest to the narrowest graph.

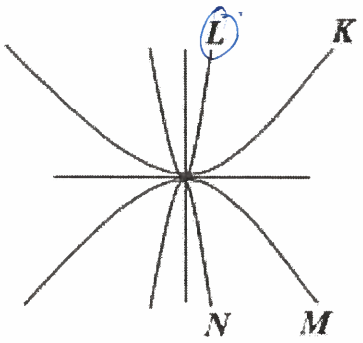
*stretch = tall & skinny
comp = short & wide

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

b. $y = -x^2$ $y = \frac{1}{5}x^2$ $y = -5x^2$ $y = \frac{1}{5}x^2 \rightarrow y = -x^2 \rightarrow y = -5x^2$

2. Match each of the following quadratic relations (K, L, M, N) in the graph with their corresponding equation.

Equation	Graph
$y = 3x^2$ opens up, tall	L
$y = -3x^2$ opens down, tall	N
$y = \frac{1}{3}x^2$ opens up, wide	K
$y = -\frac{1}{3}x^2$ opens ↓, wide	M



3. State whether each quadratic relation has a maximum or minimum and its value.

$y = 2x^2 + 7$	☐ maximum	☑ minimum	value = $y = 7$
$y = x^2 - 3$	☐ maximum	☑ minimum	value = $y = -3$
$y = -x^2 - 4$	☑ maximum	☐ minimum	value = $y = -4$
$y = -5x^2 + 12$	☑ maximum	☐ minimum	value = $y = 12$

4. Match each of the following quadratic relation equations with its corresponding graph.

a. $y = x^2 - 1$ d

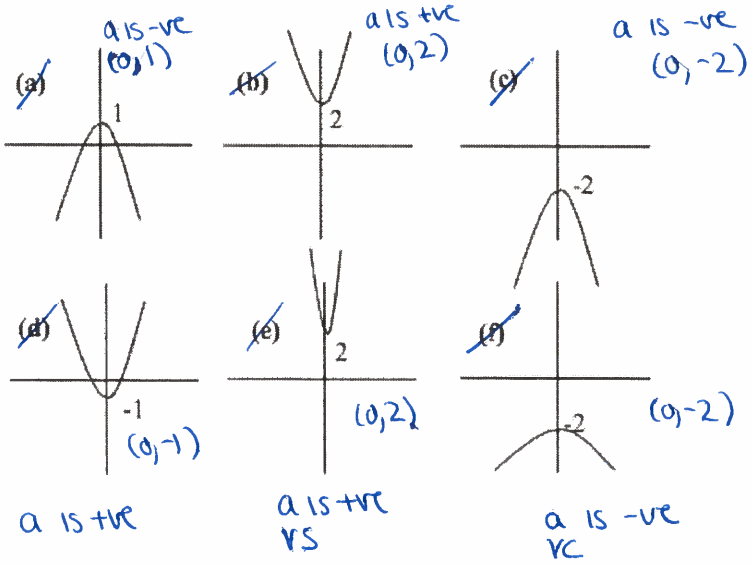
b. $y = x^2 + 2$ b

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

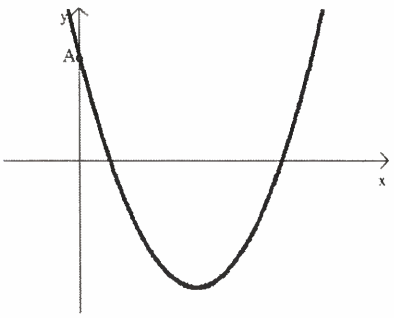
d. $y = -x^2 - 2$ c

e. $y = 3x^2 + 2$ e

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



5. The equation of the parabola below is $y = (x-3)^2 - 5$.



a. State the coordinates of the minimum point of the parabola.

V (3, -5)

b. State the equation of the axis of symmetry of the parabola.

X = 3

c. Find the coordinates of A.

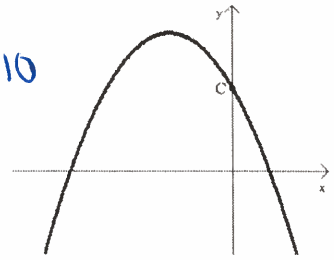
$y = (x-3)^2 - 5$
$= (0-3)^2 - 5$
$= (-3)^2 - 5$
$= 9 - 5$
$= 4$

∴ A is (0, 4)

* at A, x = 0

6. The equation of the parabola to the right is $y = 10 - (x+2)^2$.

$y = -(x+2)^2 + 10$



a. State the coordinates of the maximum point of the parabola.

V (-2, 10)

b. State the equation of the axis of symmetry of the parabola.

X = -2

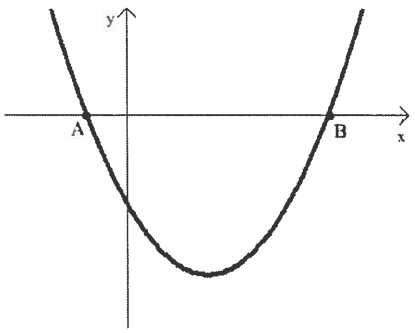
c. Find the coordinates of C.

at C, x = 0

$y = -(x+2)^2 + 10$
$= -(0+2)^2 + 10$
$= -(2)^2 + 10$
$= -4 + 10$
$= 6$

∴ C is (0, 6)

7. The equation of the parabola below is $y=(x-2)^2-9$.



a. State the coordinates of the (2, -9) vertex of the parabola.

b. State the equation of the axis of symmetry of the parabola.

$X=2$

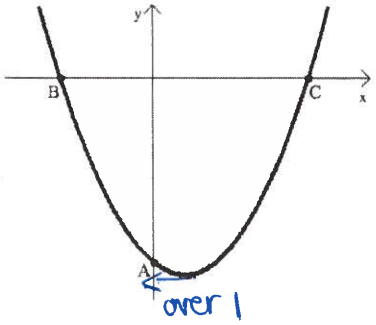
c. Find the coordinates of A and B.

(A, 0) and (B, 0)
up 9 from vertex
⇓
over 3

X	Y
1	1(1) = 1
2	4(1) = 4
3	9(1) = 9

(-1, 0) and (5, 0)
over 3, up 9 over 3, up 9

8. The equation of the parabola below is $y=(x-1)^2-16$.



a. State the coordinates of the (1, -16) vertex of the parabola.

b. Find the coordinates of A.

over 1, up 1

(0, -15)

X	Y
1	1(1) = 1
2	4(1)
3	9(1)
4	16(1)

c. Find the coordinates of B and C.

up 16.
⇓
over 4

(-3, 0) and (5, 0)

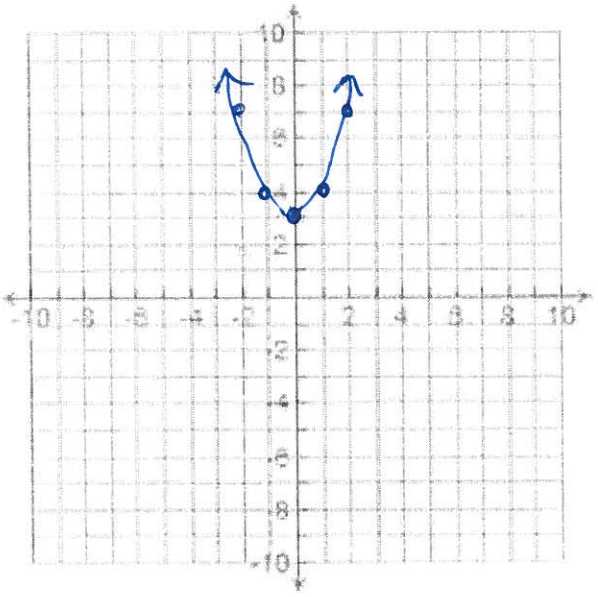
over 4, up 16 over 4, up 16

Part 4 – Graphing Combinations of Transformations

1. Graph each of the quadratic relations below on the grid(s) provided. Please use the step pattern to graph the relations.

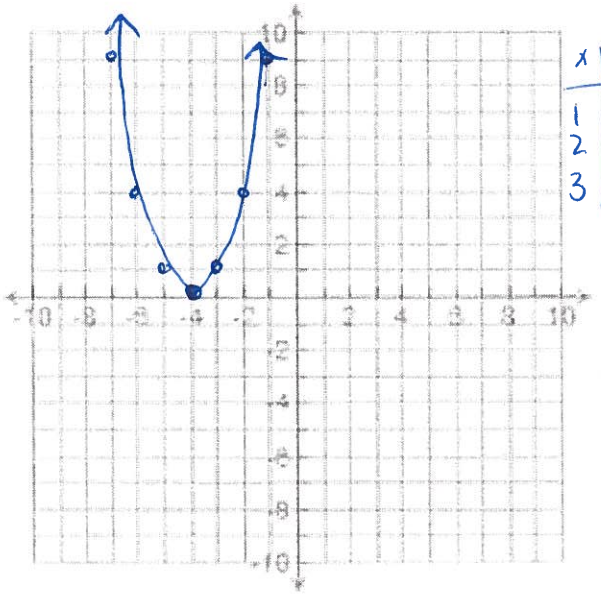
a. $y = x^2 + 3$ V(0,3)

x	y
1	1
2	4
3	9



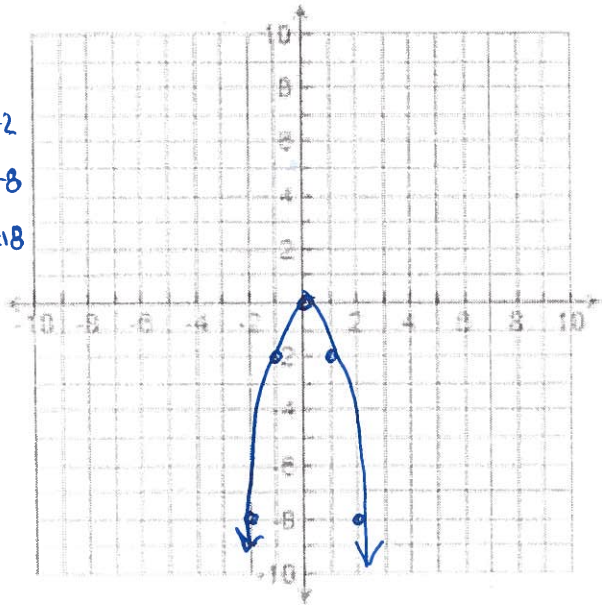
b. $y = (x+4)^2$ V(-4,0)

x	y
1	1
2	4
3	9



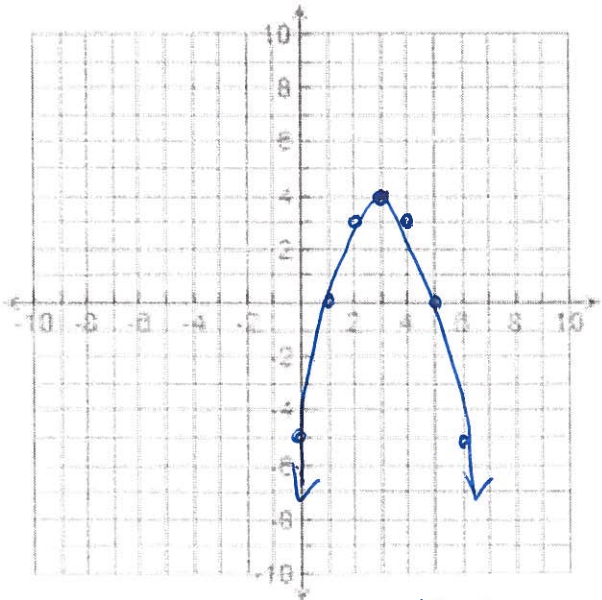
c. $y = -2x^2$ V(0,0)

x	y
1	1(-2) = -2
2	4(-2) = -8
3	9(-2) = -18



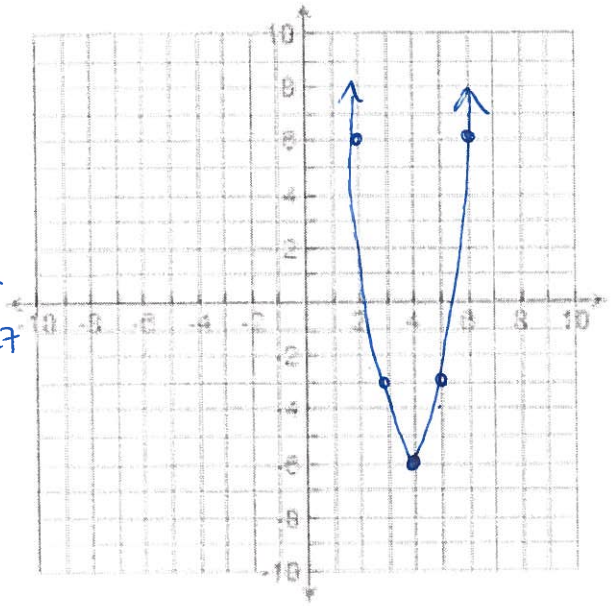
d. $y = -(x-3)^2 + 4$ V(3,4)

x	y
1	1(-1) = -1
2	4(-1) = -4
3	9(-1) = -9

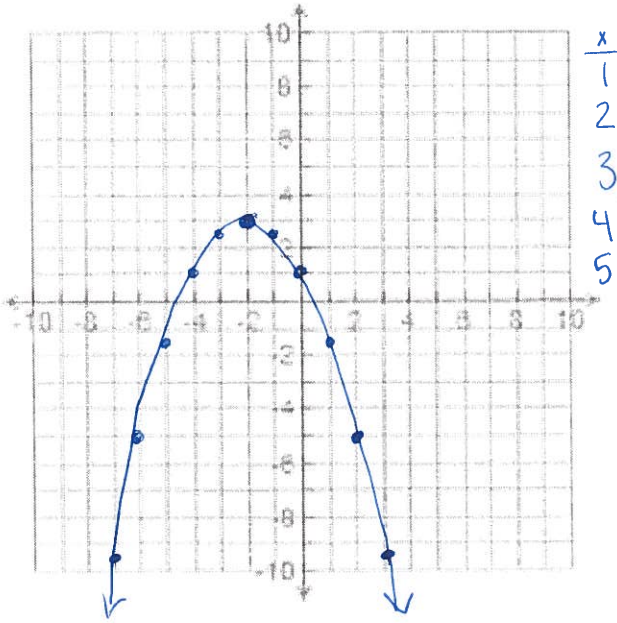


e. $y = 3(x-4)^2 - 6$ V(4, -6)

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



x	y
1	1(3)=3
2	4(3)=12
3	9(3)=27



x	y	
1	$1(-\frac{1}{2})$	$=-0.5$
2	$4(-\frac{1}{2})$	$=-2$
3	$9(-\frac{1}{2})$	$=-4.5$
4	$16(-\frac{1}{2})$	$=-8$
5	$25(-\frac{1}{2})$	$=-12.5$

Part 5 – Expanding from vertex form to standard form

1. Express each of the following quadratic relations in standard form.

a. $y = -3(x+5)^2 + 11$

$= -3(x+5)(x+5) + 11$

$= -3(x^2+5x+5x+25) + 11$

$= -3(x^2+10x+25) + 11$

$= -3x^2 - 30x - 75 + 11$

$= -3x^2 - 30x - 64$

b. $y = \frac{1}{2}(x-7)^2 - 16$

$= \frac{1}{2}(x-7)(x-7) - 16$

$= \frac{1}{2}(x^2-7x-7x+49) - 16$

$= \frac{1}{2}(x^2-14x+49) - 16$

$= \frac{1}{2}x^2 - 7x + \frac{49}{2} - \frac{32}{2}$

$= \frac{1}{2}x^2 - 7x + \frac{17}{2}$ or $y = 0.5x^2 - 7x + 8.5$