Notes

PC 11

Quadratic Function – Review I

1. Fill in the blanks:

a) Every equation of a quadratic function has to contain term of the form $\mathbb{R} \cdot x^2$ and the exponent of 2 has to be the greatest exponent if the equation.

b) The graph of every quadratic function is called a parabola.

c) Every graph of a quadratic function has the following features:

- vertex
- axis of symmetry with the equation of the form: $x = \#$.
- y - intercept of the form: $(0, \#)$.
- End behaviour of two possible types: opens down or opens up

d) Every graph of a quadratic function has at most 2 x-intercepts. Some graphs have (one) 1 x-intercept and some have no x- intercept.

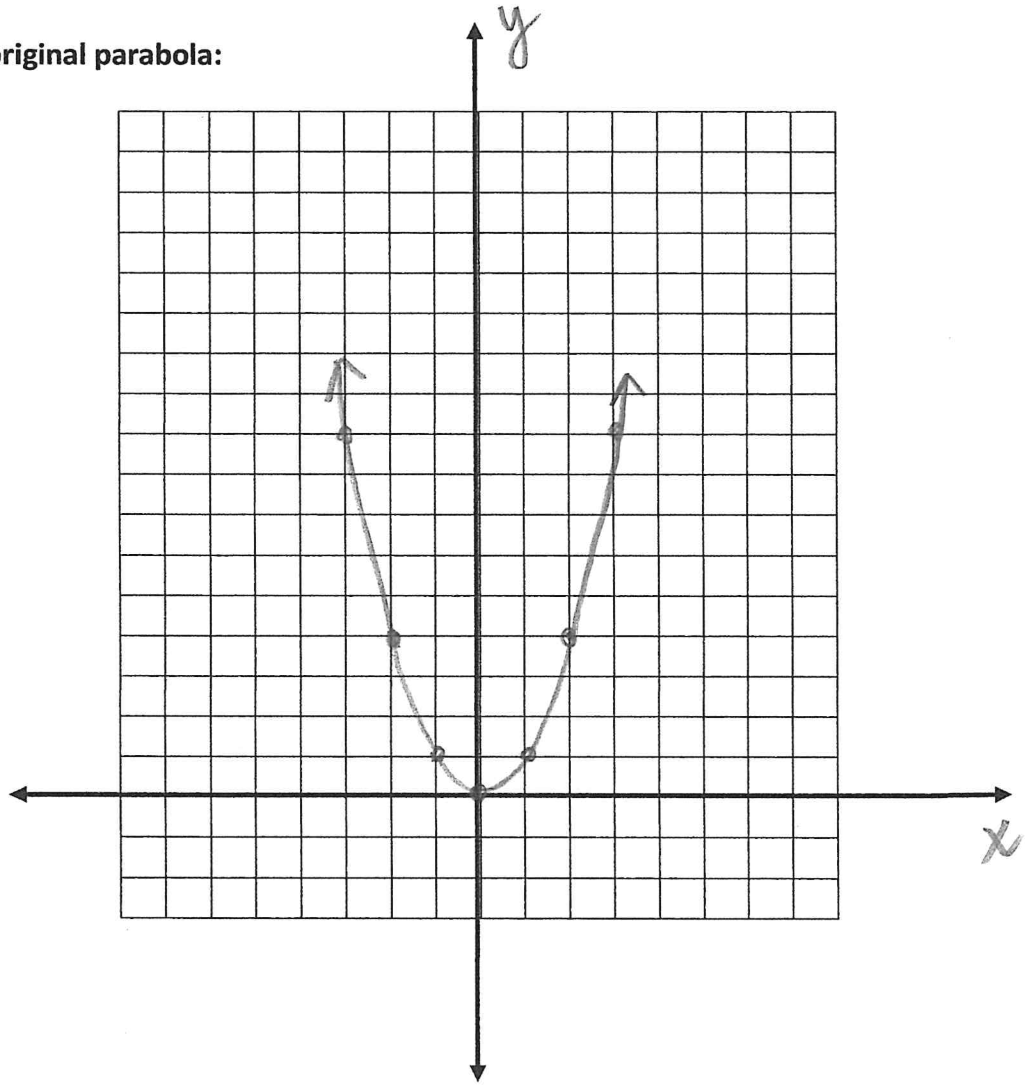
e) The original graph of a quadratic function has the equation: $y = x^2$ and contains these seven points:

(-3,9)	(-2,4)	(-1,1)	(0,0)	(1,1)	(2,4)	(3,9)

f) The original graph of a quadratic function can undergo several types of transformations:

- Reflection in x -axis will result in a graph that opens down
- Horizontal translation (HT) will result in a graph that has a vertex moved either to the right or to the left .
- Vertical translation (VT) will result in a graph that has a vertex moved either up or down
- Vertical stretch compression (VS C) will result in a graph that is wider than the original graph.
- Vertical stretch expansion (VS E) will result in a graph that is narrower than the original graph.

2. **Graph the original parabola:**



3. **Identify what transformations are represented by letters/symbols in the vertex form of the quadratic equation:**

VS < C (0<a<1), E (a>1)

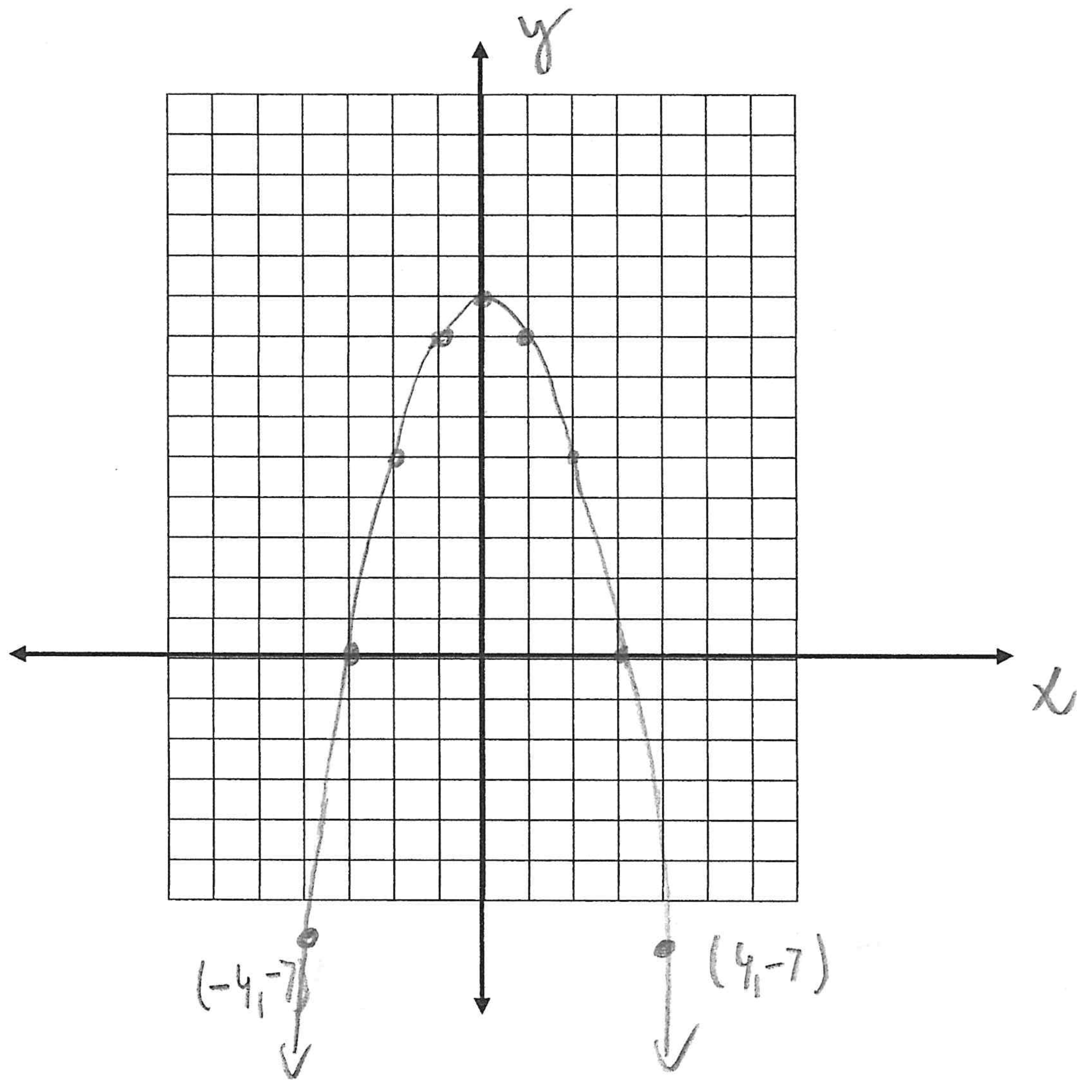
VT < up (+#), down (-#)

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

R- in x-axis

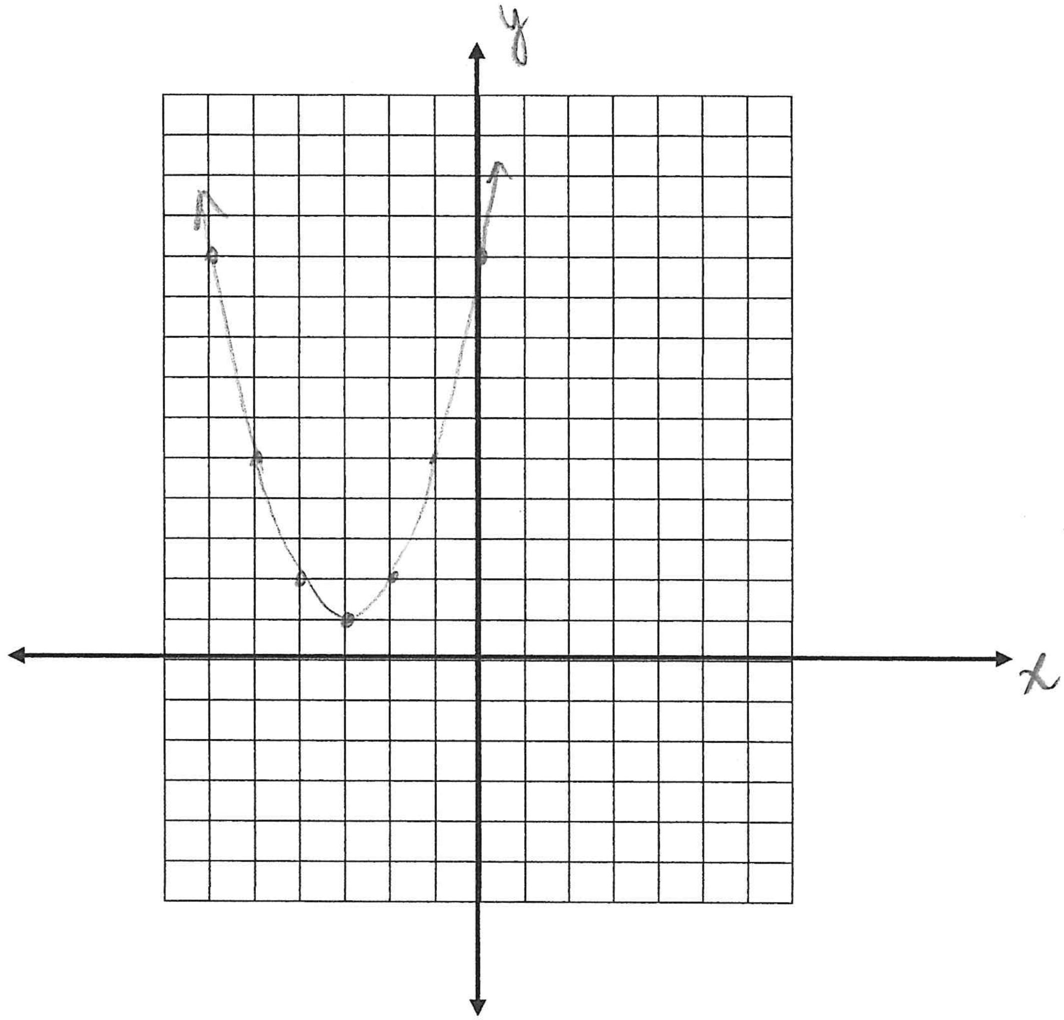
HT < Right (x-#), left (x+#)

4. **Graph $y = -x^2 + 9$ and describe the graph. At least 5 points have to be exact.**



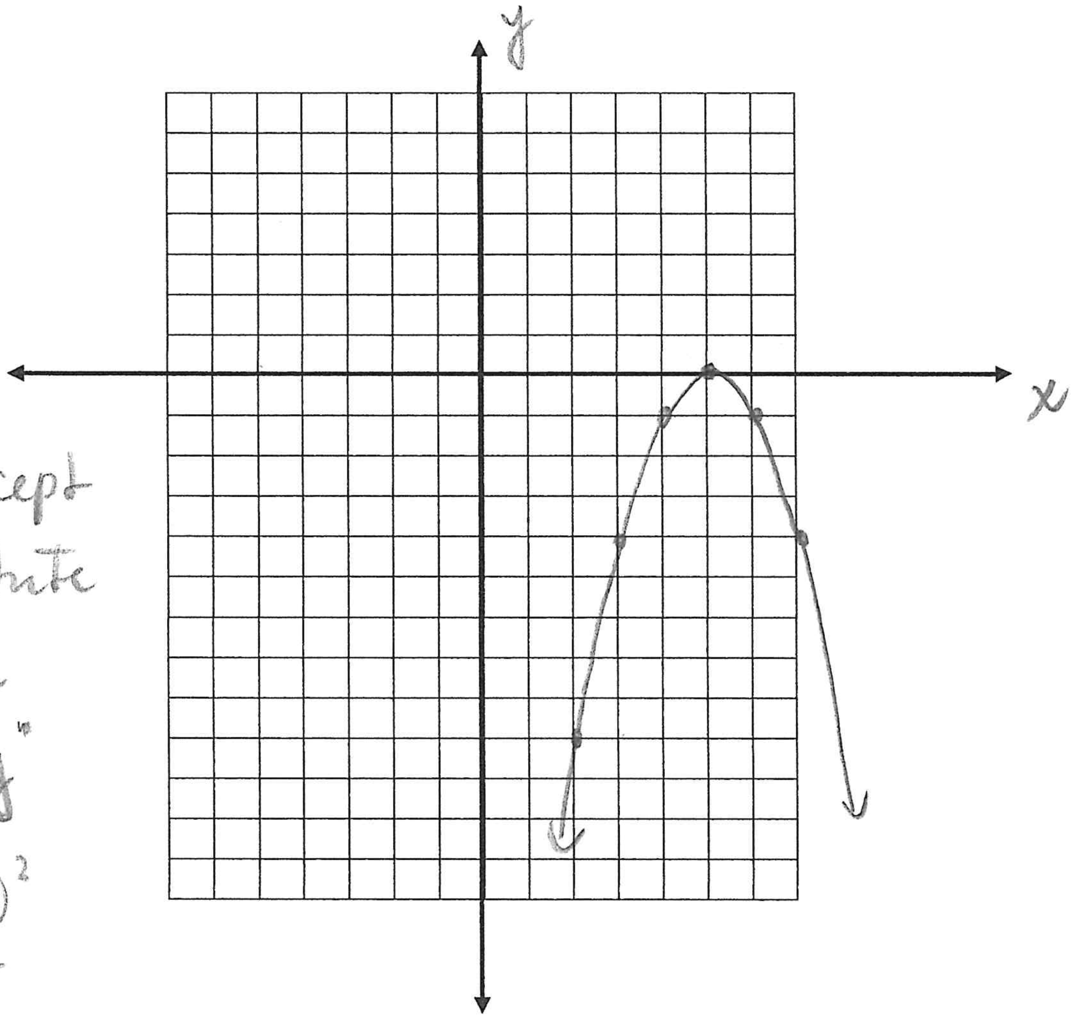
Mapping notation:	$(x,y) \rightarrow (x, -y+9)$	Transformations:	R in x-axis VT up by 9 units
Vertex:	(0,9)	Axis of symmetry:	$x = 0$
y-intercept:	(0,9)	End behaviour:	Opens down
x-intercept(s):	(-3,0) and (3,0)	Maximum or Mininmum value:	Maximum at $y = 9$

5. Graph $y = (x + 3)^2 + 1$ and describe the graph. At least 5 points have to be exact.



Mapping notation:	$(x, y) \rightarrow (x-3, y+1)$	Transformations:	HT left by 3 units VT up by 1 unit
Vertex:	$(-3, 1)$	Axis of symmetry:	$x = -3$
y-intercept:	$(0, 10)$	End behaviour:	Opens up
x-intercept(s):	none	Maximum or Mininmum value:	minimum at $y = 1$

6. **Graph $y = -(x-5)^2$ and describe the graph. At least 5 points have to be exact.**

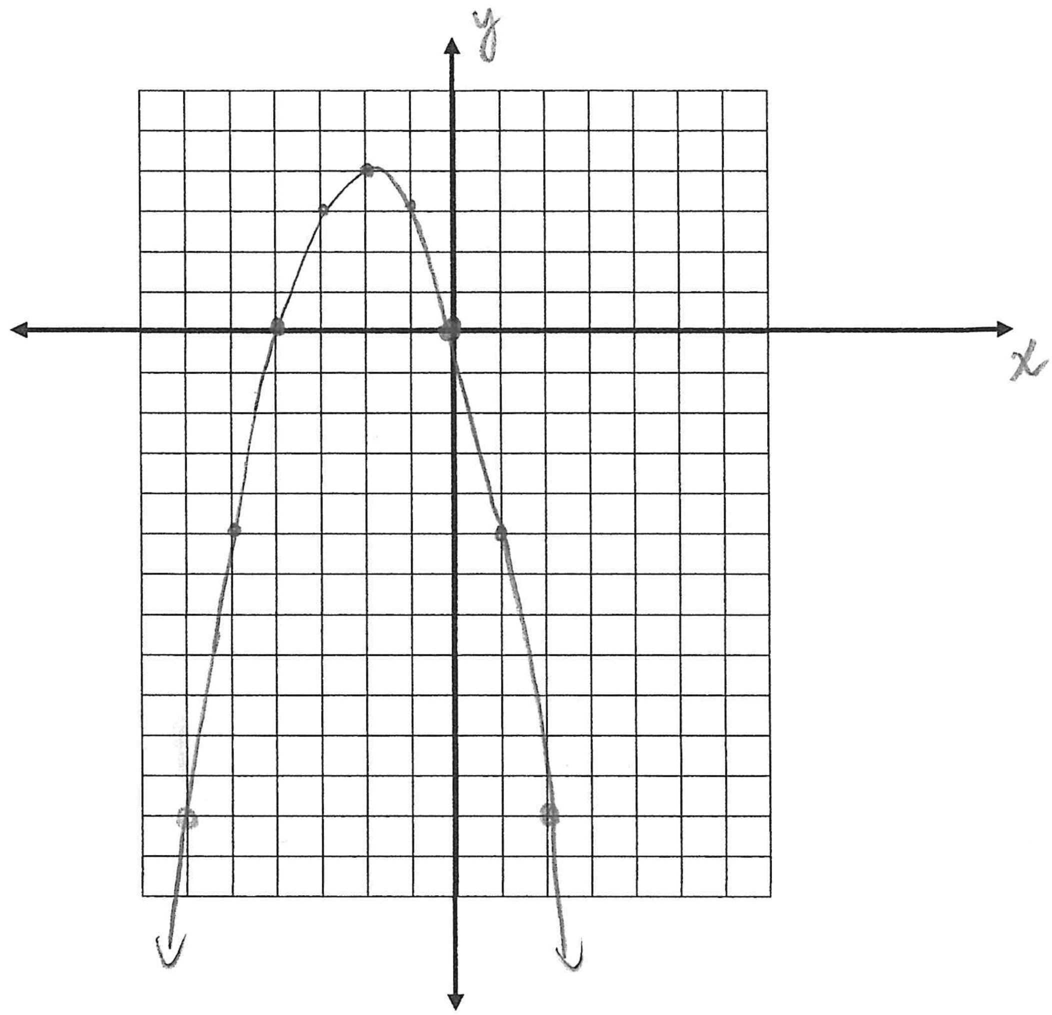


(*) y-intercept
⇒ substitute
$x=0$ and
Solve for "y"

$y = -(0-5)^2$
$y = -(-5)^2$
$y = -25$

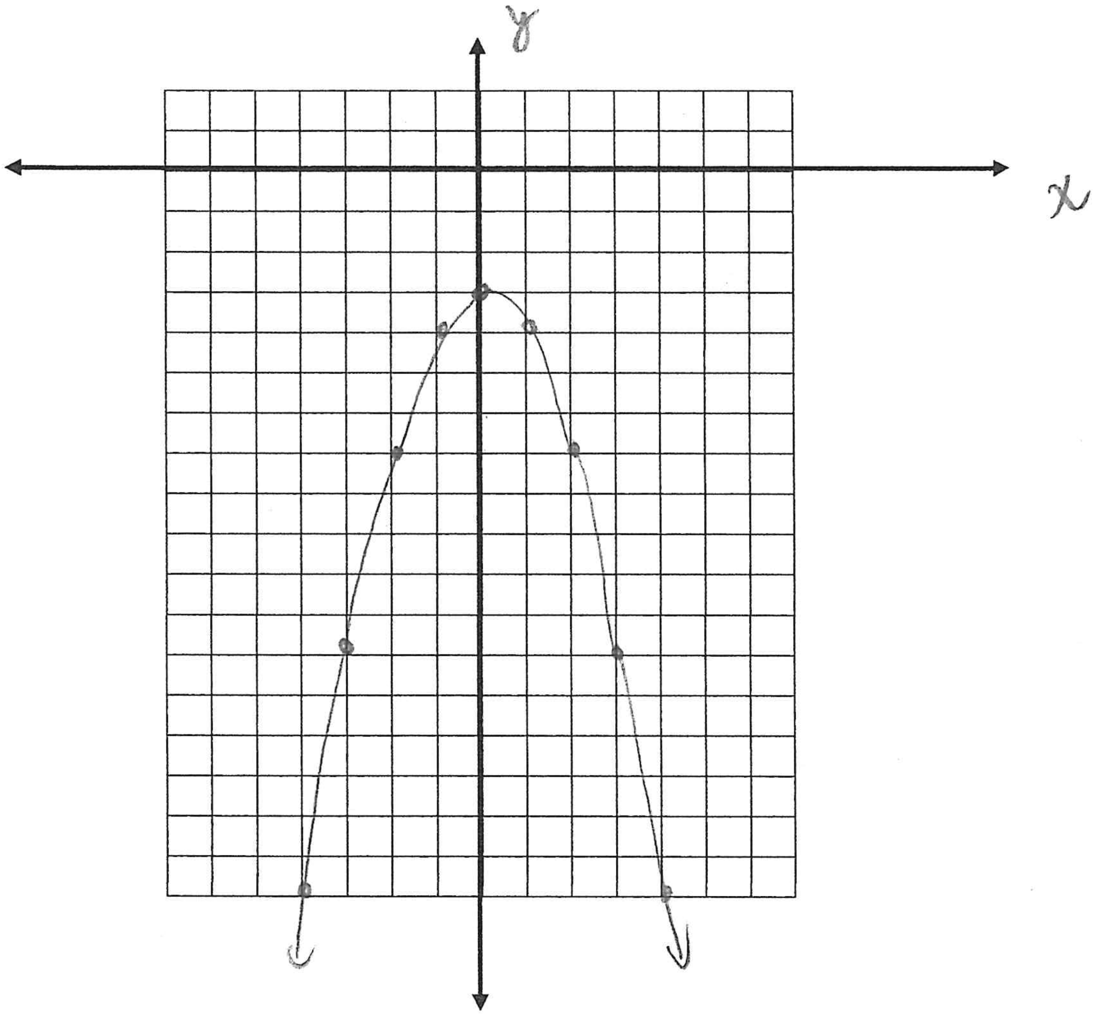
Mapping notation:	$(x,y) \rightarrow (x+5, -y)$	Transformations:	R in x-axis HT right by 5 units
Vertex:	$(5,0)$	Axis of symmetry:	$x=5$
y-intercept:	(*) $(0,-25)$	End behaviour:	Open down
x-intercept(s):	$(5,0)$	Maximum or Mininmum value:	maximum at $y=0$

7. **Graph** $y = -(x+2)^2 + 4$ **and describe the graph. At least 5 points have to be exact.**



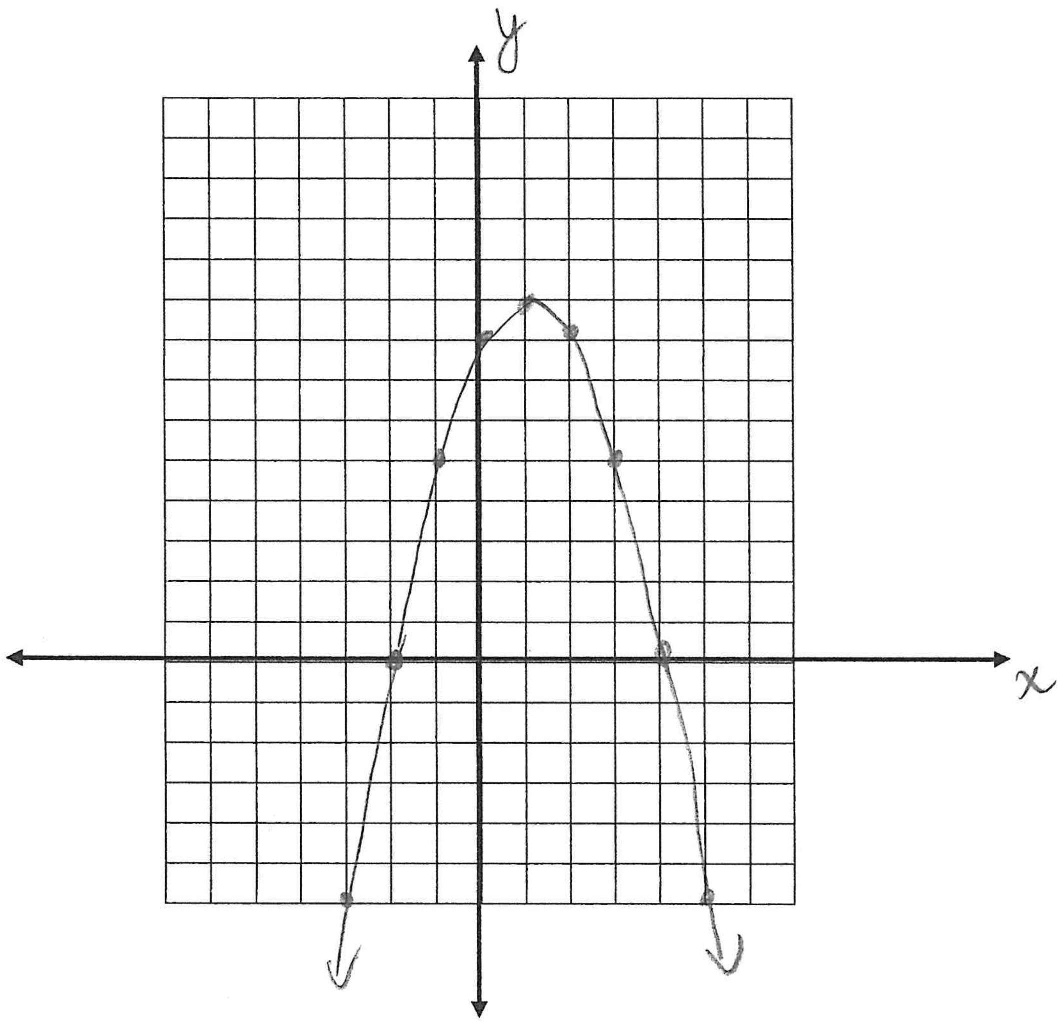
Mapping notation:	$(x,y) \to (x-2, -y+4)$	Transformations:	R in x-axis HT left by 2 units VT up by 4 units
Vertex:	$(-2,4)$	Axis of symmetry:	$x=-2$
y-intercept:	$(0,0)$	End behaviour:	opens down
x-intercept(s):	$(0,0)$ and $(-4,0)$	Maximum or Mininmum value:	maximum at $y=4$

8. **Graph $y = -x^2 - 3$ and describe the graph. At least 5 points have to be exact.**



Mapping notation:	$(x,y) \to (x, -y-3)$	Transformations:	R in x-axis VT down by 3
Vertex:	$(0,-3)$	Axis of symmetry:	$x = 0$
y-intercept:	$(0,-3)$	End behaviour:	opens down
x-intercept(s):	none	Maximum or Mininmum value:	maximum at $y = -3$

9. **Graph $y = -(x-1)^2 + 9$ and describe the graph. At least 5 points have to be exact.**



Mapping notation:	$(x,y) \rightarrow (x+1, -y+9)$	Transformations:	R - in x-axis HT right by 1 unit VT up by 9 units
Vertex:	$(1,9)$	Axis of symmetry:	$x = 1$
y-intercept:	$(0,8)$	End behaviour:	opens down
x-intercept(s):	$(-2,0)$ and $(4,0)$	Maximum or Mininmum value:	maximum at $y = 9$

10. Conclusion:

a) When the original graph undergoes a reflection in the x-axis, a y-coordinate of any point on the new graph is either __0__ or __negative__.

b) If the original graph undergoes a reflection in the x-axis, then the transformed graph opens __down__.

c) If the original graph undergoes a reflection in the x-axis, then the transformed graph has a maximum value. This value is the same as the __y__ - coordinate of the __vertex__.

d) If the original graph does not undergo a reflection in the x-axis, then the graph opens __up__, and has a __minimum__ value. This value is the same as the __y__ - coordinate of the __vertex__.

e) Every graph of a quadratic function has an axis of symmetry with an equation $x = a\, real\, number$. This number is the same as the __x__ - coordinate of the __vertex__.

f) The value of maximum or minimum is affected by 2 transformations:
__Vertical translation__ and __Reflection in the x-axis__.

g) __Horizontal translation__ and __vertical stretch__ have no effect on the value of the minimum or maximum.