**Transformations of Quadratics**

The relation of y = x2 is the simplest quadratic relation. It is the base curve for all quadratic relations.



The graph of any quadratic relation can be created by altering and repositioning the above graph (y = x2).

Possible changes could be:

 - shifting the graph up or down

 - shifting the graph right or left

 - vertically stretching or compressing the graph

 - reflecting it about the x-axis (opening down instead of up)

These types of changes are called transformations.

When a quadratic relation is in vertex form y = a(x - h)2 + k, several properties of the graph of the relation are obvious.

**k** If k > 0, then the graph of y = x2 is translated

up by k units. Similarly, if k < 0, then the graph

is translated down by k units



**h** If h > 0, then the graph of y = x2 is translated

horizontally to the right by h units. Similarly,

if h < 0, then the graph moves horizontally to

the left by h units.

**a** If a > 0, then the curve opens up

If a < 0, then the curve opens down (reflected about the x-axis)



When you use transformations to graph y = a(x - h)2 + k from y = x2, apply the transformations in this order:

 1) Translation left or right (h)

 2) Vertical stretch or compression (a)

 3) Reflection about the x-axis (+ or - a)

 4) Translation up or down (k)

If **a** and **k** have opposite signs, then the graph has two x-intercepts (zeros), whereas if a and k have the same signs, then the graph has no x-intercepts (zeros).

**Example:**

For the relations below

 i) state the vertex

 ii) state the axis of symmetry

 iii) state the direction of opening

 iv) use the information from i-iii to graph the relation on graph

 paper

1. y = (x + 2)2 – 4
2. y = -2x2 + 6
3. ½ (x – 3)2 – 1

Sketch the new graph that results from applying these transformations to y = x2

 1) Translate 3 units to the left

 2) Stretch vertically by a factor of 2

 3) Translate up 1 unit

Then find the equation of the new graph.

**Homework: Pg 363 # 1, 2, 3, 4, 5, 7**