Quadratic Functions

$$y = ax^2 + bx + c$$

where "a" and "b" are **coefficients** and "c" is a **constant**

- The functions is said to have a degree of 2 (highest exponent)
- There are 3 forms of a quadratic equation...

GENERAL	STANDARD	TRANSFORMATIONAL
$y = ax^2 + bx + c$	$y = a(x-h)^2 + k$ vertex: (h, k)	$\frac{1}{a}(y-k) = (x-h)^2$ $V(h, k)$

where **"a"** is the **vertical stretch factor**
"**h**" is the **horizontal translation**
"**k**" is the **vertical translation**

Mapping Notation - a notation that describes how a graph and its standard image are related.

For Quadratic Functions...

$$(x, y) \Rightarrow (x + h, ay + k)$$

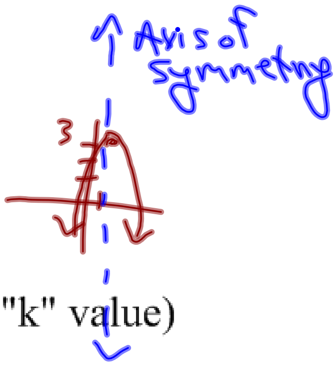
Where the first point from the graph $y = x^2$ maps onto a point in the image graph.

Properties of a Quadratic

- identify key properties and points...

STANDARD FORM:

- Stretch Factor (direction of opening / shape)
- Translations (horizontal / vertical)
- Vertex (h, k)
- Domain {any real number}
- Range (depends on direction of opening and "k" value)
- Mapping Notation: $(x, y) \longrightarrow (x + h, ay + k)$
- Axis of symmetry where $x = h$
- y intercept (let $x = 0$)



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

→ opens Down, Narrower

→ Right 1 unit, Up 3 units

→ Vertex $(1,3)$

→ Domain: $\{x \in R\}$

→ Range: $\{y \mid y \leq 3, y \in R\}$

→ Mapping: $(x,y) \rightarrow (x+1, -2y+3)$

→ Axis of Symmetry: $x = 1$

y-Intercept: $(x=0)$

$y = -2(0-1)^2 + 3$

$y = 1$

$(0, 1)$

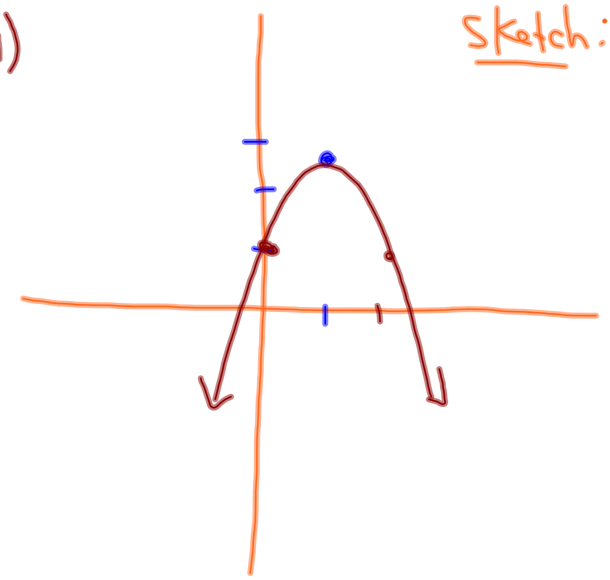
Sketch: Use 3 Points

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

VS

$y = x^2$

x	y
0	0
1	



Converting to the Various Forms of the Quadratic Function

Standard Form

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

Transformational Form

$$\frac{1}{a}(y-k) = (x-h)^2$$

General Form

$$y = ax^2 + bx + c$$

Mapping Notation

$$(x, y) \rightarrow (x+h, ay+k)$$

Example #1: Change from standard to transformational form.

Standard

Transformational

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

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

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

$$y = 3(x+7)^2 - 4$$

$$\frac{1}{3}(y+4) = (x+7)^2$$

Example #2: Change from transformational to standard form.

Transformational

$$(3)\,\frac{1}{\cancel{3}}(y+6)\overset{(3)}{=}(x+5)^2$$

$y+6=3(x+5)^2$

Rearrange

$y=3(x+5)^2-6$

ex

$\frac{3}{4}(y-5)=(x+6)^2$

$y=\frac{4}{3}(x+6)^2+5$

Standard

Example #3: Change from standard to general form.

Standard

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

$y=\left(-\frac{3}{4}\right)(x^2-8x+16)+2$

$y=-\frac{3}{4}x^2+6x-12+2$

Expand

$\boxed{y=-\frac{3}{4}x^2+6x-10}$

General

Homework...

TEXT: p. 30 #6 - 10

Text Solns_p. 30 Ques. 6 - 10.doc

Bonus

Create a quadratic sequence of 5 terms satisfying the following properties:

$t_1 = 4$

Second level of difference results in the constants 6

Attachments

Text Solns_p. 30 Ques. 6 - 10.doc