Quadratic Functions

Recall: A quadratic function…

- Has three forms, standard ($y = ax^2 + bx + c = 0$), vertex ($y = a(x-h)^2 + k$) and factored ($y = a(x-s)(x-t)$).
- Is a parabola when graphed.
- 's key features are the vertex, zeroes, and direction of opening.

Example 1: Determine the zeroes, vertex, direction of opening, and domain and range of the function $y = 2(x-4)(x-6)$.

Since we have factored form, we'll start with the zeroes, which are **4** and **6**.

The vertex is halfway between the zeroes:

$x = \frac{4+6}{2} = 5$

$y = 2(5-4)(5-6)$

$y = -2$

The vertex is (2, -2).

The value of *a* is positive, so it opens **up**.

The domain is $\{x \in R\}$; the range is $\{y \geq -2, y \in R\}$.

Example 2: Determine the zeroes, vertex, direction of opening, and domain and range of the function $y = 3x^2 + 12x + 5$.

Since this quadratic is not factorable (you can verify this for yourself), we start with the vertex by completing the square.

$f(x) = 3x^2 + 12x + 5$

$f(x) = 3(x^2 + 4x) + 5$

$f(x) = 3(x^2 + 4x + 4 - 4) + 5$

$f(x) = 3(x^2 + 4x + 4) - 12 + 5$

$f(x) = 3(x+2)^2 - 7$

The vertex is (-2, -7).
The parabola opens up.
The domain is $\{x \in R\}$
The range is $\{y \geq -7, y \in R\}$

We set $f(x) = 0$ to find the zeroes:

$0 = 3(x+2)^2 - 7$

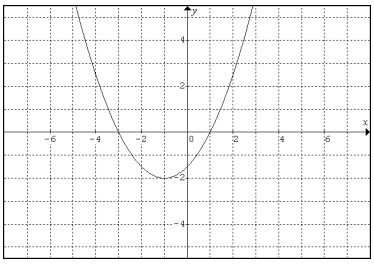
$7 = 3(x+2)^2$

$\frac{7}{3} = (x+2)^2$ The zeroes are approximately –0.47 and –3.53.

$\pm\sqrt{\frac{7}{3}} = x+2$

$x = -2 \pm \sqrt{\frac{7}{3}}$

<u>Example 3:</u> Determine the equation of the graph shown.



We have both the vertex and zeroes available, so let's start with vertex form.

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

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

$0 = a(-3+1)^2 - 2$ Sub in one of the zeroes (in this case (-3,0)) to find *a*.

$2 = a(-2)^2$

$0.5 = a$

Thus the equation is $y = 0.5(x+1)^2 - 2$.

<u>Example 4:</u> Determine the point(s) of intersection of $y = 0.5(x+1)^2 - 2$ and $y = x + 3$.

$x + 3 = 0.5(x+1)^2 - 2$

$x + 3 = 0.5(x^2 + 2x + 1) - 2$

$2x + 6 = (x^2 + 2x + 1) - 4$

$2x + 6 = x^2 + 2x + 1 - 4$ The points are (-3,0) and (3, 6).

$0 = x^2 - 9$

$9 = x^2$

$\pm 3 = x$

<u>Homework:</u> # 6 - 8