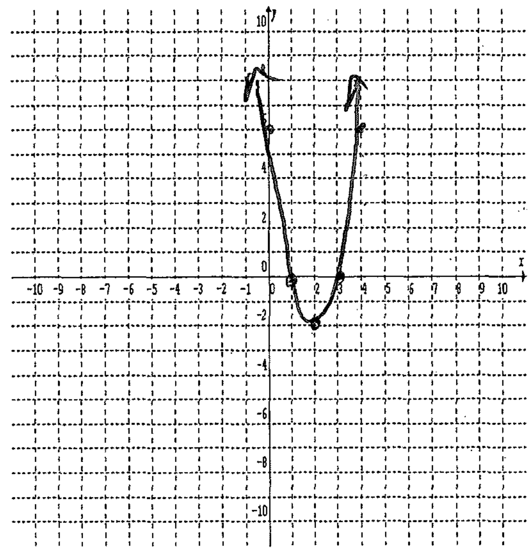
MPM2D Day 2: Quadratic Relations of the form y = a(x-r)(x-s)

Recall $y = a(x-h)^2 + k$ → Vertex Form
$y = ax^2 + bx + c$ → Standard Form

Consider $y = 2(x-2)^2 - 2$



1) How many x-intercepts do you expect? How do you know? State the transformations and sketch the graph.

2 x-intercepts (a, k have different signs)

Transformations: vertically stretched by a factor of 2
- horizontal shift 2 units to the right
vertical shift 2 units down.

2) Calculate the x- and y-intercepts for the quadratic relation above.

x-int: set y=0

$0 = 2(x-2)^2 - 2$

$\frac{2}{2} = \frac{2}{2}(x-2)^2$

$(x-2)^2 = 1$

$x-2 = \pm\sqrt{1}$

$x-2 = \pm 1$

$x-2 = 1$, $\boxed{x=3}$

$x-2=-1$, $\boxed{x=1}$

$\boxed{\text{y-int is 6} \quad \text{sub } x=0}$

3) Convert the above relation into standard form. What information does standard form provide us?

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

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

$= 2x^2 - 8x + 8 - 2$

$= 2x^2 - 8x + 6$

y-int.

4) Factor the quadratic relation from #3. What information does this form provide us?

$y = 2x^2 - 8x + 6$

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

$= 2(x-3)(x-1)$

provides us with the zeros. (x-intercepts)

Recall: A quadratic relation is said to be in **factored form** if its algebraic expression appears in the form

$$\boxed{y = a(x-r)(x-s)}$$

For a quadratic in factored form, $y = a(x-r)(x-s)$, the zeros/roots/x-intercepts are $x = r$ and $x = s$.

Ex 1: Solve for the x-intercepts for the quadratic relation $y = 2(x-1)(x-3)$.

$x = 1, 3$

Ex 2: Solve for the x-intercepts for the quadratic relation $y = (2x-5)(x+1)$

$x = 5/2, -1$

Ex 3: Solve for the x-intercepts for the quadratic relation $y = 3x^2 - 5x - 2$

$y = 3x^2 - 5x - 2$

$= 3x^2 - 6x + x - 2$

$= 3x(x-2) + (x-2)$

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

$\therefore x = -1/3, 2$

M	A	N
-6	-5	$-6, 1$

Questions for the day:

1. If x=5 and x=11 are the zeros (x-intercepts), what would be the equation of axis of symmetry? How would it be related to the vertex?

   $x = \frac{5+11}{2} = \frac{16}{2} = 8$ would be the axis of of symmetry. (It is the x_v)

2. How can we find the optimal (max/min) from axis of symmetry?

   Sub x_v in $y = a(x-r)(x-s)$ to find y_v

Seatwork: p. 192 #4, 8, 10, 11, 13