

Factored Form of a Quadratic Relation



Learning Goal

- Relate the factors of a quadratic relation to the key features of its graph.



Minds on ...

- Let's watch a GIZMO!



Big Ideas

- A second way of writing the equation of a quadratic relation is called FACTORED FORM.
- It is $y = a(x - r)(x - s)$.
- You can find the key features of the parabola from this equation. (You may have to perform some calculations.)



Big Ideas (continued)

- The zeros (x-intercepts) are the values of r and s .
- The equation of the axis of symmetry is the vertical line halfway between any two symmetric points on the parabola (such as the zeros).
- This is also the x-coordinate of the vertex.

$$x = \frac{(r + s)}{2}$$



Big Ideas (continued again)

- The y-coordinate of the vertex is found by substituting the x-coordinate of the vertex into the equation and evaluating.
- The y-intercept is found by substituting a value of $x=0$ into the equation and evaluating or using the relationship $c = a x r x s$.



Example #1

y coordinate of vertex

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

$x = -0.5$

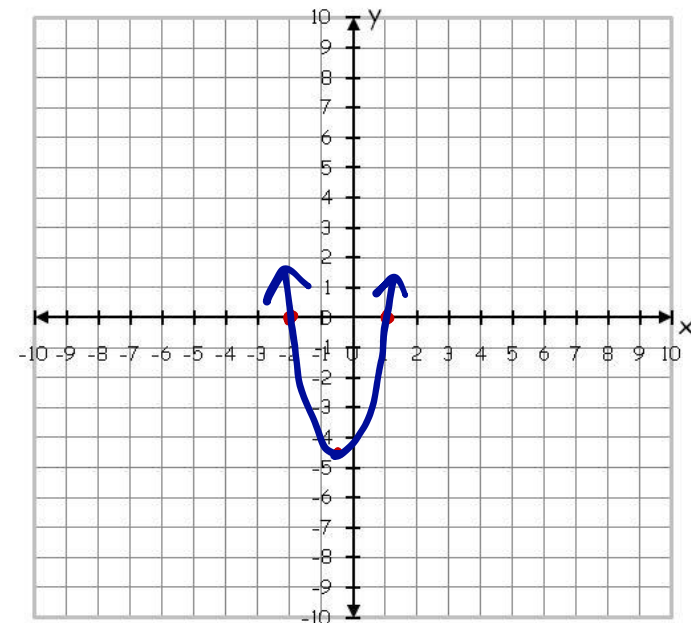
$$y = 2(-0.5-1)(-0.5+2)$$
$$y = 2(-1.5)(1.5)$$
$$y = -4.5$$

- Identify the key features for the parabola with the equation $y = 2(x-1)(x+2)$ and sketch the graph. Vertex $(-0.5, -4.5)$

$$y = a(x-r)(x-s)$$

$x=r$ $x=s$

$x=1$ $x=-2$



A.O.S.

$$\frac{1 + (-2)}{2}$$
$$= -1/2$$

$x = -0.5$

Example #2

- A quadratic relation has an equation of the form $y = a(x - r)(x - s)$, determine the value of a when the parabola has x -intercepts at $(5, 0)$ and $(-3, 0)$ and a maximum value of 6.

Vertex $(1, 6)$

$y = 6$

a

$$\text{A.O.S.} = \frac{5 + (-3)}{2}$$
$$= \frac{2}{2}$$

$$y = \frac{-3}{8}(x - 5)(x + 3)$$

A.O.S. $x = 1$

$$y = a(x - 5)(x + 3)$$
$$6 = a(1 - 5)(1 + 3)$$
$$6 = a(-4)(4)$$

$$\frac{6}{-16} = \frac{-16a}{-16}$$
$$a = -\frac{6}{16}$$

$$a = -\frac{3}{8}$$

Consolidation

- Let's try #2 on page 155 together!

a) $y = (x-2)(x+3)$
zeros $x=2, x=-3$

graph ii)

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

$y = a(x-r)(x-s)$

opens down

graph (vi) $x=3, x=-2$

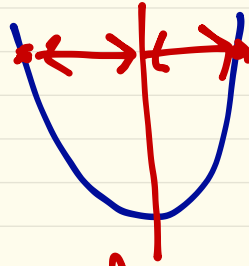


Pg. 147

#10. $(-1, 41)$ and $(5, 41)$

$$y = 4x^2 - 16x + 21$$

symmetry



Because y values of
2 pts. are the same

$$\text{A.O.S.} = \frac{-1 + 5}{2}$$

$$= \frac{4}{2}$$

$$\boxed{x = 2}$$

x coordinate of the vertex.

$$y = 4x^2 - 16x + 21$$

$$x = 2$$

y coordinate of vertex.

$$y = 4(2)^2 - 16(2) + 21$$

$$= 4(4) - 32 + 21$$

$$= 16 - 32 + 21$$

∴ Vertex is $(2, 5)$

Reinforcement

- Pages 156 – 157
 - #4, 5, 6abc, 7c, 11, 14(table)

