Date: _____

3.3 Factored Form of a Quadratic Relation

Factored Form:	$y = a(x - r)(x - s)$

In a quadratic relation in factored form:

- 'a' tells you the direction of opening (+ → up; - → down)
- (x, y) is any point on the parabola
- r and s are the zeros (r, 0) and (s, 0)

ex/ $y = -3(x - 2)(x + 3)$ opens down and has zeros at (2, 0) and (-3, 0). Why does the sign change????

Zeros: $x - 2 = 0$ $x + 3 = 0$

$x = 2$ $x = -3$

Practice Problems:

1) Without graphing, determine the direction of opening, the zeros, and the equation of the axis of symmetry for the parabola represented by $y = 4(x - 1)(x + 4)$.

$x - 1 = 0$ $x + 4 = 0$

$x = 1$ $x = -4$

⊕ opens up

zeros: (1, 0) and (-4, 0)

A of S: $x = \frac{1 + -4}{2} = \frac{-3}{2}$

To find the zeros:

x - r = 0, so x = r

x - s = 0, so x = s

*Change the sign!

2) Without graphing, determine the direction of opening and the zeros for the parabola represented by $y = -(x + 1)(x + 1)$.

⊖ opens down

$x + 1 = 0$

$x = -1$

What does it mean when r = s? The parabola has one zero

Sketching a Quadratic Relation in Factored Form

To sketch a graph given a relation in factored form:
- find the zeros and the vertex;
- plot these three points;
- draw a smooth curve through the three points;
- label it with the equation.

ex/ Sketch the graph of $y = -\frac{1}{2}(x - 2)(x - 4)$

Opens down

Zeros: $x-2=0$, $x=2$ $(2,0)$; $x-4=0$, $x=4$ $(4,0)$

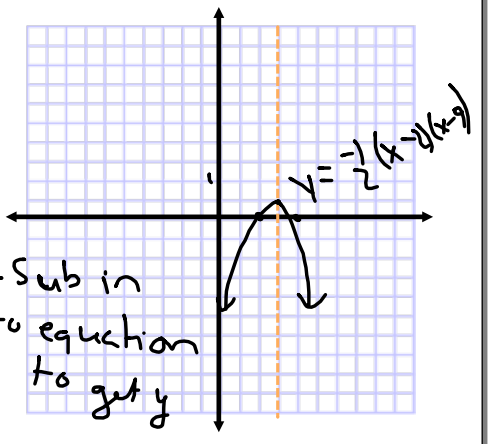
AOFS: $x=3$ ← Sub in to equation to get y

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

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

$= \frac{1}{2}$

Vertex $(3, \frac{1}{2})$



Finding an Equation in Factored Form

When you are given the zeros and any other point on the parabola, you can write a relation to represent the parabola in factored form by solving for 'a'.

ex 1/ Find a relation in factored form for a parabola with zeros at -2 and 6 that passes through (1, 4).

r s

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

$4 = a(1+2)(1-6)$

$4 = a(3)(-5)$

$4 = -15a$

$\frac{4}{-15} = \frac{-15a}{-15}$

$-\frac{4}{15} = a$

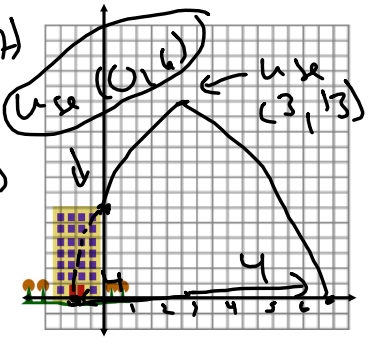
****Remember that your final equation has an 'x' and a 'y' in it!****

$y = -\frac{4}{15}(x+2)(x-6)$

ex 2/ A ball is thrown from a roof that is 6 m above the ground. It reaches a maximum height of 13 m above the ground 3 seconds after it is thrown. The ball follows a parabolic path and hits the ground 7 seconds after it is thrown.

a) Draw an accurate sketch ✓
b) Write a relation to represent the path of the ball. ✓
c) Find the height of the ball after 5 seconds ✓

Zeros: $(-1,0)$, $(7,0)$



$r = -1$, $s = 7$, $x = 0$, $y = 6$

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

$6 = a(0+1)(0-7)$

$6 = a(1)(-7)$

$\frac{6}{-7} = \frac{-7a}{-7}$

$-6/7 = a$

$y = -\frac{6}{7}(x+1)(x-7)$

c) Let $x = 5$

$y = -\frac{6}{7}(5+1)(5-7)$

$= -\frac{6}{7}(6)(-2)$

$= \frac{72}{7}$ m at 5 seconds