MCF3MI **Unit 3: Solving Quadratic Equations** **Day 2: Relating the Standard and Factored Forms**

Standard Form **Factored Form**

$y = ax^2 + bx + c$ $y = a(x - r)(x - s)$

From the Standard Form, we can easily find the y-intercept by substituting in $x = 0$. Only the y intercept will remain!

Expand each of the following to put them in Standard Form and state the y-intercept:

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

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

$y = x^2 + 1x - 6$ y int

b) $y = (2x - 3)(3x + 5)$

$= 6x^2 + 10x - 9x - 15$

$= 6x^2 + 1x - 15$

c) $y = x(x - 4)$

$= x^2 - 4x + 0$

y int is 0

d) $y = 3(4x - 5)(x + 7)$

$= 3(4x^2 + 28x - 5x - 35)$

$= 3(4x^2 + 23x - 35)$

$= 12x^2 + 69x - 105$

y int is -105

y int

10R

$= (12x - 15)(x + 7)$

$= 14x^2 + 84x - 15x - 105$

$= 12x^2 + 69x - 105$

Once we are in Factored Form, we can determine the zeros (x-intercepts) by:

set $y = 0$

Find the zeros of the following quadratics:

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

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

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

$x = 2$ $x = -3$

b) $y = (2x - 3)(3x + 5)$

$0 = (2x - 3)(3x + 5)$

$2x - 3 = 0$ $3x + 5 = 0$

$2x = 3$ $3x = -5$

$x = \frac{3}{2}$ $x = -\frac{5}{3}$

c) $y = x(x - 4)$

$0 = x(x - 4)$

$x = 0$ $x - 4 = 0$

$x = 4$

d) $y = 3(4x - 5)(x + 7)$

$0 = 3(4x - 5)(x + 7)$

$4x - 5 = 0$ $x + 7 = 0$

$4x = 5$ $x = -7$

$x = \frac{5}{4}$

If we know the zeros, we can determine the axis of symmetry and the vertex of the parabola.

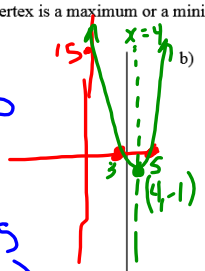
Step 1: The axis of symmetry, also known as the x value of the vertex, can be found by finding the midpoint of the zeros (add the zeros together and divide by 2).

Step 2: Once we have the x-coordinate of the vertex, we can substitute it into the equation to find the y-coordinate of the vertex.

For each of the following, determine

i. The y-intercept of the function.
ii. The zeros of the function (by factoring)
iii. The axis of symmetry (by finding the midpoint of the zeros)
iv. The vertex (by substituting the axis of symmetry (x-coordinate) into the equation to find the y-coordinate). Write the vertex in coordinate form.
v. State whether the vertex is a maximum or a minimum.

a) $y = x^2 - 8x + 15$



i) y int → x = 0
y = 15

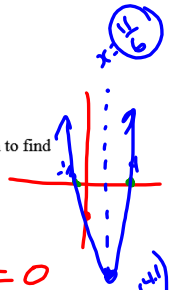
ii) zeros
$y = x^2 - 8x + 15$
$0 = (x-3)(x-5)$
x = 3 x = 5

iii) Axis of sym = $\frac{3+5}{2}$
$x = 4$

iv) Sub x = 4 into
$y = x^2 - 8x + 15$
$= (4)^2 - 8(4) + 15$
$= -1$ ∴ vertex is $(4, -1)$

v) minimum because the a value is pos.

b) $y = 3x^2 - 11x - 4$



i) y int, x = 0
y = -4

ii) zeros
$y = (3x+1)(x-4)$
$0 = (3x+1)(x-4)$
$3x + 1 = 0$ $x - 4 = 0$
$3x = -1$ $x = 4$
$x = -\frac{1}{3}$

iii) AOS
$x = \frac{-\frac{1}{3} + 4}{2}$
$= \left[-\frac{1}{3} + \frac{4}{1}\right] \div 2$
$= \left[-\frac{1}{3} + \frac{12}{3}\right] \div \frac{2}{1}$
$= \frac{11}{3} \times \frac{1}{2}$
$x = \frac{11}{6}$

iv) Sub $x = \frac{11}{6}$ into
$y = 3x^2 - 11x - 4$ approx
$y = 3\left(\frac{11}{6}\right)^2 - 11\left(\frac{11}{6}\right) - 4$
$= 3\left(\frac{121}{36}\right) - \frac{121}{6} - \frac{4}{1}$
$= \frac{121}{12} - \frac{242}{12} - \frac{48}{12}$
$= -\frac{169}{12}$
$= -14.1$

∴ vertex is approx $(1.8, -14.1)$

Homework: Pg. 140 #2, 3, 4, 5, 6, 7