KEY

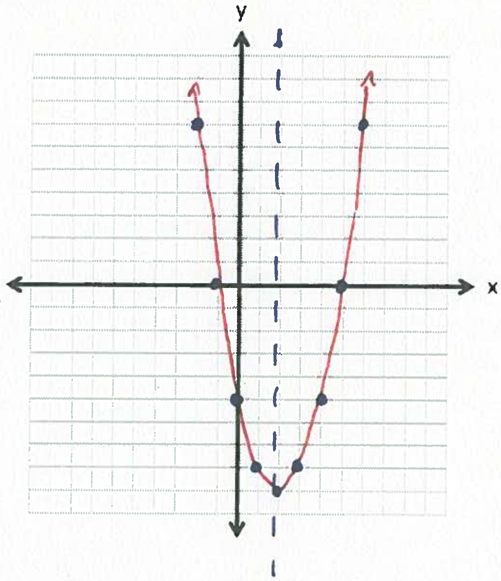
Math 20-1

Lxx – Worksheet – Intro to Factored Form

Part 1 – Quick Overview (Q1-5)

Q1: Graph the equation $f(x) = x^2 - 4x - 5$ below.

x	y
-2	7
-1	0
0	-5
1	-8
2	-9
3	-8
4	-5
5	0
6	7



Q2: Evaluate $f(0)$. What is the significance of this point (a) on the graph, and (b) in the original equation?

$f(0) = (0)^2 - 4(0) - 5$
$= -5$

when $x = 0$, $y = -5$

(A) This is our y-intercept.
(B) This is our c-value in $ax^2 + bx + c$

Q3: Use the Quadratic Equation to determine the zeroes (x-intercepts).

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{4 \pm \sqrt{16 - 4(1)(5)}}{2(1)} = \frac{4 \pm \sqrt{36}}{2} = \frac{4 \pm 6}{2}$$

$x_1 = \frac{4+6}{2} = 5$

$x_2 = \frac{4-6}{2} = -1$

So $x = -1, 5$ which we can confirm by looking at our graph.

Q4: The equation $f(x) = x^2 - 4x - 5$ factors to $f(x) = (x - a)(x - b)$. Factor this equation, and determine the significance of these points.

$f(x) = (x - 5)(x + 1)$
$= (x - +5)(x - -1)$

These points are our "zeroes".

$f(x) = (x - 5)(x + 1)$
$0 = (x - 5)(x + 1)$

$x - 5 = 0$
$x = 5$

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

Q5: Using the zeroes, determine the axis of symmetry. Plug this value back into the original equation to determine the coordinates of the vertex.

Axis of symmetry is exactly halfway between these points.
Average them. $\frac{(+5) + (-1)}{2} = 2$, so $x = 2$ is our axis of symmetry.

$f(2) = (2)^2 - 4(2) - 5$
$= 4 - 8 - 5$
$= -9$

So when $x = 2$, $y = -9$.
Our vertex is at $(2, -9)$.

KEY

Math 20-1

***Part 2** – Standard, Vertex, and Factored (Q6-8)*

Q6: The equation $f(x) = x^2 + 2x - 8$ can be written in several different forms:

Standard Form	*Vertex Form*	*Factored Form*
$f(x) = x^2 + 2x - 8$	$f(x) = 1(x^2 + 2x) \quad - 8$ $= 1(x^2 + 1x + 1x) \quad - 8$ $= 1(x^2 + 1x + 1x + 1) - 8 - 1$ $f(x) = 1(x+1)^2 - 9$	$f(x) = (x+4)(x-2)$

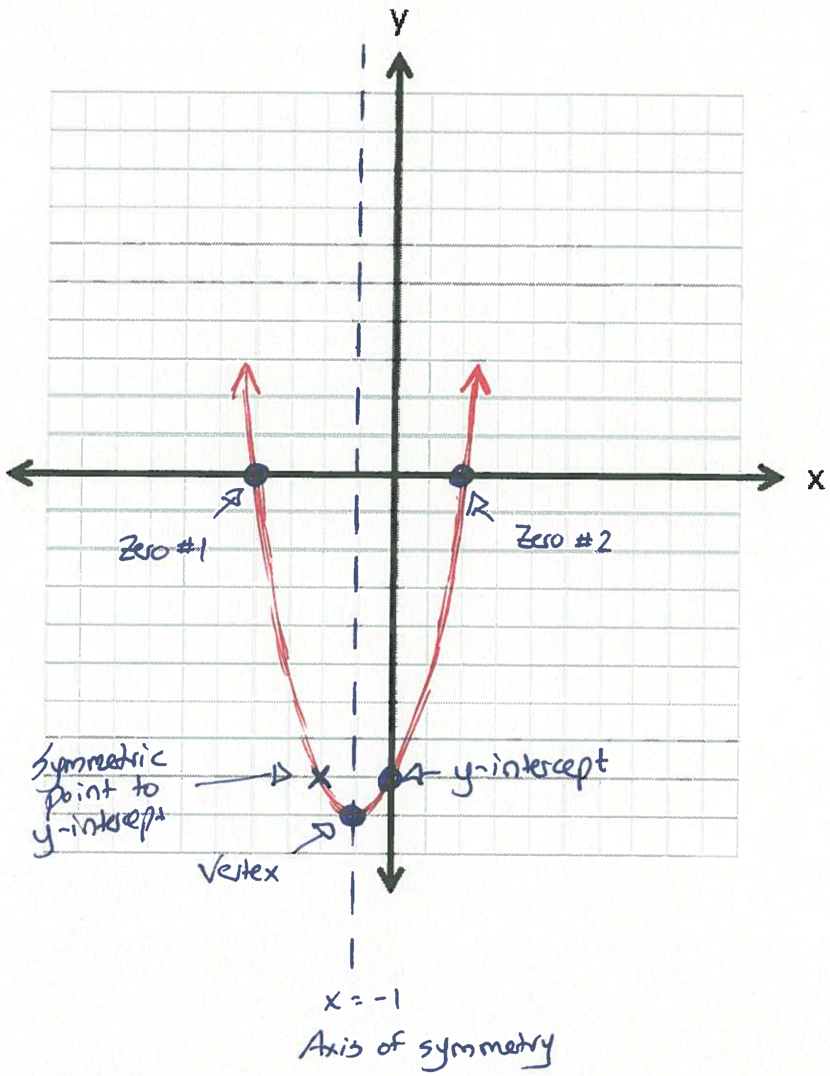
Q7: Using each of form of the equation above, complete the table.

Equation Form	Information	How did you find this information?
Standard Form $f(x) = x^2 + 2x - 8$	*y-Intercept* $(0, -8)$	This is our c-value in $y = ax^2 + bx + c$.
Vertex Form $f(x) = 1(x+1)^2 - 9$	*Axis of Symmetry* $x = -1$	Axis of symmetry goes through our vertex.
	Vertex Coordinate $(-1, -9)$	If $f(x) = a(x-h)^2 + k$ Vertex is at (h, k)
Factored Form $f(x) = (x+4)(x-2)$	*Zeroes* $f(x) = (x+4)(x-2)$ $0 = (x+4)(x-2)$ $x = -4 \qquad x = 2$	When $y = 0$, determine the x-values.
	Axis of Symmetry Halfway between the zeroes. $\frac{(-4)+(2)}{2} = -1$, so $x = -1$	Average the zeroes to find the halfway point.
	Vertex Coordinate $f(-1) = (-1+4)(-1-2)$ $= (3)(-3)$ $= -9$ so vertex at $(-1, -9)$	This occurs on the axis of symmetry.

Math 20-1

KEY

Q8: Using only your information from Q7, and ***without building a table of values***, sketch the original equation.



Math 20-1

KEY

***Part 3** – Standard and Factored (Q9-11)*

Q9: The equation $f(x) = x^2 - 2x - 3$ can be written in several different forms:

Standard Form	*Factored Form*
$f(x) = x^2 - 2x - 3$	$f(x) = (x-3)(x+1)$

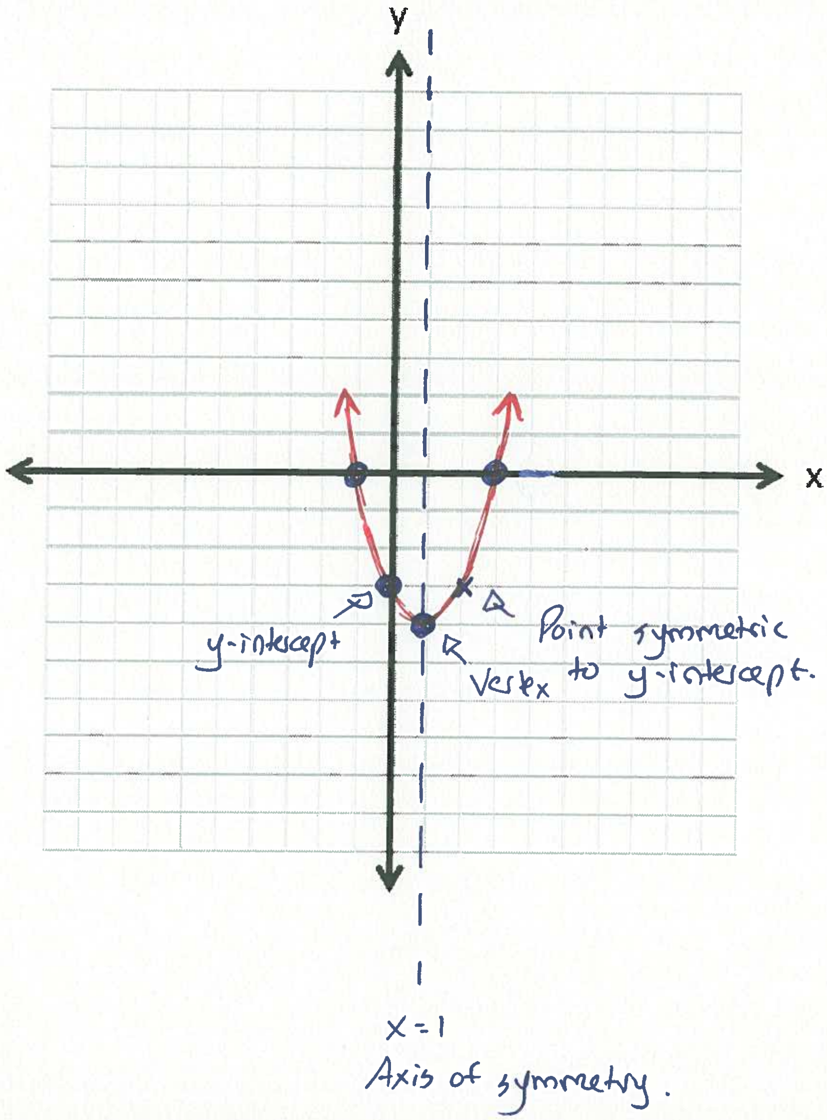
Q10: Using each of form of the equation above, complete the table.

Equation Form	Information	How did you find this information?
Standard Form $f(x) = x^2 - 2x - 3$	*y-Intercept* $(0, -3)$	c-value in $ax^2 + bx + c$
	Zeroes x-intercept when $y=0$ $0 = x^2 - 2x - 3$, where $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{2 \pm \sqrt{4 - 4(1)(-3)}}{2(1)} = \frac{2 \pm \sqrt{16}}{2}$ $x_1 = \frac{2+4}{2} = 3 \quad x_2 = \frac{2-4}{2} = -1$ so $x = 3, -1$	Use quadratic formula. If $ax^2 + bx + c = 0$ then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Factored Form $f(x) = (x-3)(x+1)$	*Zeroes* $0 = (x-3)(x+1)$ $x - 3 = 0 \quad x + 1 = 0$ $x = 3 \quad x = -1$	set $y = 0$. Solve for x.
	Axis of Symmetry Halfway between the zeroes. $\frac{(3) + (-1)}{2} = 1$ so $x = 1$	Average zeroes (x-int).
	Vertex Coordinate $f(1) = (1-3)(1+1)$ $= (-2)(2)$ $= -4$ so vertex at $(1, -4)$	This occurs on the axis of symmetry.

Math 20-1

KEY

Q11: Using only your information from Q10, and ***without building a table of values***, sketch the original equation.



Math 20-1

KEY

Part 3 – Standard and Vertex (Q12-14)

Q12: The equation $f(x) = -x^2 - 4x + 5$ can be written in several different forms:

Standard Form	*Vertex Form*
$f(x) = -1x^2 - 4x + 5$	$f(x) = -1x^2 - 4x + 5$ $= (-1x^2 - 4x) + 5$ $= -1(x^2 + 4x) + 5$ $= -1(x^2 + 2x + 2x) + 5$ $= -1(x^2 + 2x + 2x + 4) + 5 + 4$ $f(x) = -1(x+2)^2 + 9$

Q13: Using each of form of the equation above, complete the table.

Equation Form	Information	How did you find this information?
Standard Form $f(x) = -1x^2 - 4x + 5$	*y-Intercept* $(0, 5)$	c-value of $ax^2 + bx + c$
	Zeroes Set $y = 0$. Solve for x-intercepts. $0 = -1x^2 - 4x + 5$ $x = \frac{4 \pm \sqrt{16 - 4(-1)(5)}}{2(-1)} = \frac{4 \pm \sqrt{36}}{-2}$ $x_1 = \frac{4+6}{-2} = -5$ $x_2 = \frac{4-6}{-2} = 1$ So $x = -5, 1$	If $ax^2 + bx + c = 0$ then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Vertex Form $f(x) = -1(x+2)^2 + 9$	*Zeroes* Set $y = 0$. Solve for x-intercepts. $0 = -1(x+2)^2 + 9$ $-9 = -1(x+2)^2$ $9 = (x+2)^2$ $\pm\sqrt{9} = (x+2)$ Option #1 $+3 = x + 2$ $x = +1$ Option #2 $-3 = x + 2$ $x = -5$	Set $y = 0$. Remember that $(+3)(+3) = 9$ and $(-3)(-3) = 9$ so $\sqrt{9} = \pm 3$
	Axis of Symmetry Halfway between the zeroes. $\frac{(1) + (-5)}{2} = -2$ So $x = -2$	Average the zeroes to find the halfway point.
	Vertex Coordinate $f(-2) = -1(-2 + 2)^2 + 9$ $= -1(0)^2 + 9$ $= 9$ Vertex at $(-2, 9)$	This occurs on the axis of symmetry.

Math 20-1

KEY

Q14: Using only your information from Q12, and ***without building a table of values***, sketch the original equation.