Factored Form Warm-up | MFM2P

Summary of what we know:

Vertex Form

$y = a(x-h)^2 + k$

VERTEX

Factored Form

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

ZEROS

Note: In each case, "a" gives the step pattern 1a, 3a, 5a

1) The following equations are all in vertex form: $y = a(x - \text{h})^2 + k$. Complete the table.

Equation	Vertex	Step Pattern
$y = (x-4)^2 - 3$	$(4,-3)$	1, 3, 5
$y = 10(x-2)^2 + 0$	$(2,0)$	10, 30, 50
$y = 2x^2 - 7$	$(0,-7)$	2, 6, 10

2) The following equations are all in factored form: $y = a(x-r)(x-s)$. Complete the table.

Equation	Zeros (x-intercepts)	Step Pattern
$y = (x-4)(x+3)$	$(4,0)$ & $(-3,0)$	1, 3, 5
$y = 4(x+7)(x+9)$	$(-7,0)$ & $(-9,0)$	$4(1,3,5) = 4, 12, 20$
$y = 20x(x-5)$	$(0,0)$ & $(5,0)$	$20(1,3,5) = 20, 60, 100$

$y = 20(x-0)(x-5)$

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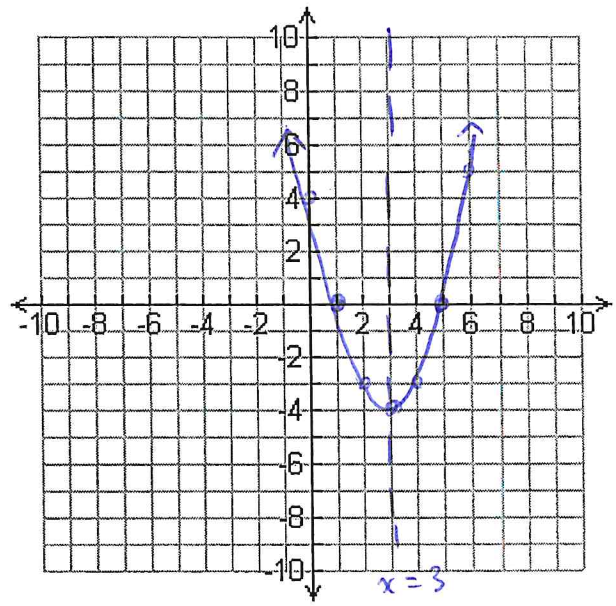
3) Sketch the following relations on the grids provided.

a) $y = 1(x-3)^2 - 4$	
Vertex:	(3, -4)
Step Pattern:	1, 3, 5

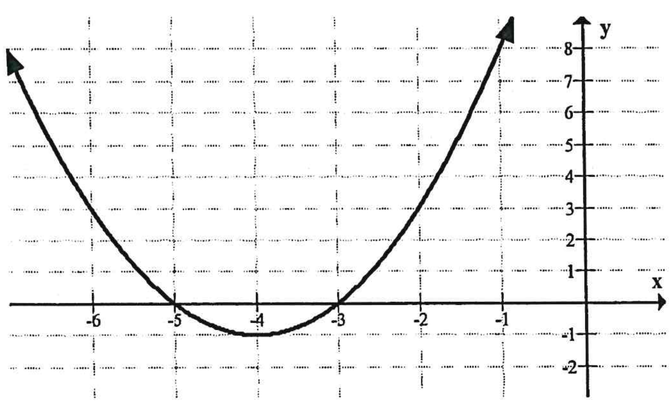


b) $y = (x-1)(x-5)$	
Zeros:	(1, 0) & (5, 0)
Axis of Symmetry:	x = 3
Find the vertex:	$y = (3-1)(3-5)$ $= (2)(-2)$ $= -4$

KEY IDEA: The same parabola can be expressed in different forms.

4) Given the following graph of a quadratic relation, write down the equation in factored form AND vertex form.

1, 3, 5



Factored Form:

$y = \underline{1}(x \underline{+5})(x \underline{+3})$

Vertex Form:

$y = \underline{1}(x \underline{+4})^2 \underline{-1}$

In this investigation you will graph different parabolas and determine the information about the equation of a quadratic relation in "standard form".

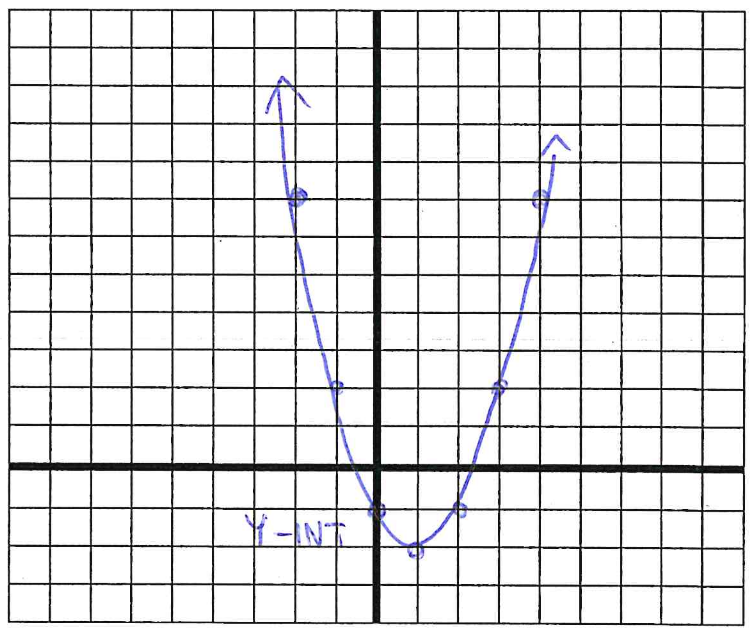
You will need to be able to determine the following about a parabola:

- The y - intercept
- The direction of opening
- The step pattern

As you do this investigation, you should be thinking about how you can read these properties directly from the equation.

Parabola Investigation #1

Equation	$y = x^2 - 2x - 1$
Table of Values	
x	y
-2	~~8~~ 7
-1	~~3~~ 2
0	~~0~~ -1
1	~~-1~~ -2
2	~~0~~ -1
3	~~3~~ 2
4	~~8~~ 7



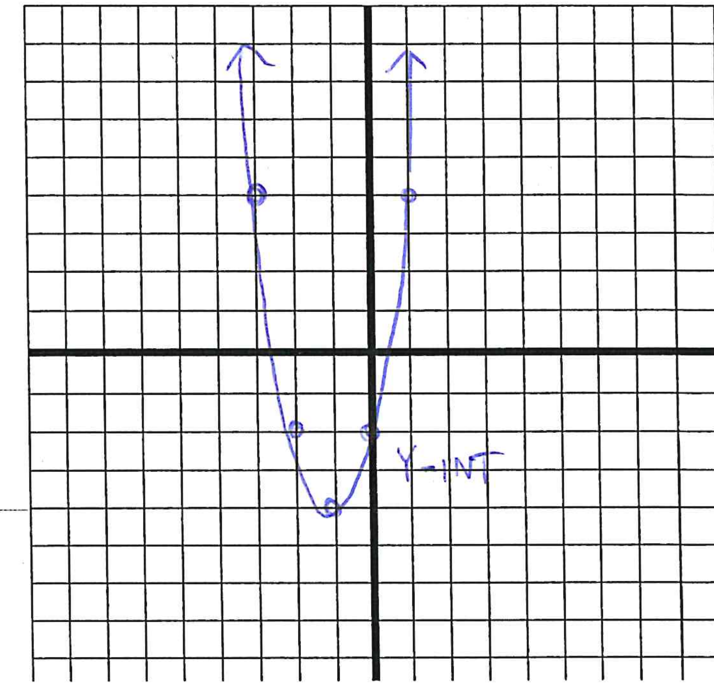
Fill in the following information about the parabola:

What is the Direction of Opening?	What is the step pattern?	What is the y-intercept?
↑	1, 3, 5	(0, -1)

What do you notice about the y-intercept and the equation?

Parabola Investigation #2

Equation	$y = 2x^2 + 4x - 2$
Table of Values	
x	**y**
-4	14
-3	4
-2	-2
-1	-4
0	-2
1	4
2	14

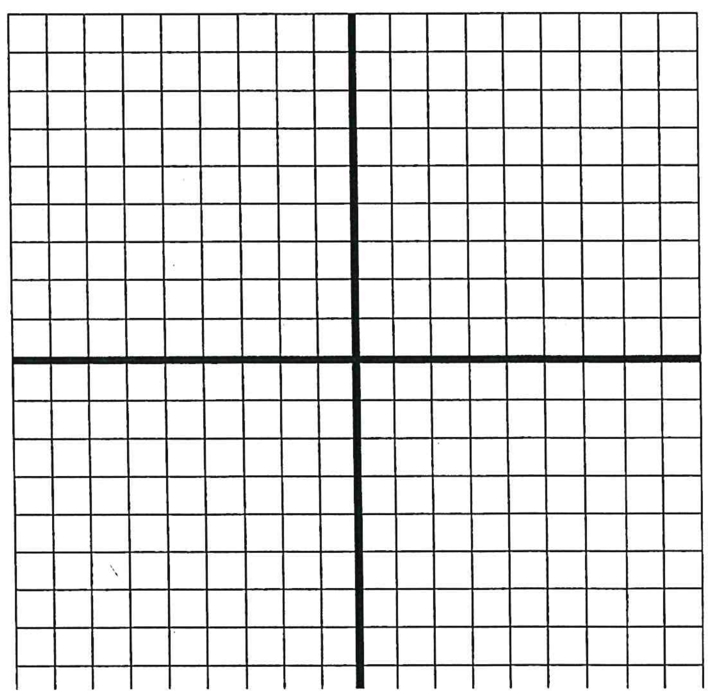


Fill in the following information about the parabola:

What is the Direction of Opening?	What is the step pattern?	What is the y-intercept?
↑	2, 6, 10	(0, -2)

Parabola Investigation #3

Equation	$y = -x^2 + 4x + 1$
Table of Values	
x	**y**
-1	-4
0	1
1	4
2	5
3	4
4	1
5	-4



Fill in the following information about the parabola:

What is the Direction of Opening?	What is the step pattern?	What is the y-intercept?
↓	-1, -3, -5	(0, 1)

Can you try these two?

c) 24 × 43

	20	+4
40	800	160
+3	60	12

$24 \times 43 = 800 + 160 + 60 + 12$

$= 1,032$

d) 81 × 23

	80	+1
20	1600	20
+3	240	3

$81 \times 23 = 1600 + 20 + 240 + 3$

$= 1,863$

We can use similar area models to multiply binomials together. This can help us express vertex form or factored form in standard form.

a) $(x + 2)(x + 4)$

	x	$+2$
x	x^2	$2x$
$+4$	$4x$	8

$(x+2)(x+4) = x^2 + \underline{2x} + \underline{4x} + 8$

$= x^2 + 6x + 8$

b) $(x + 5)(x - 3)$

	x	$+5$
x	x^2	$5x$
-3	$-3x$	-15

$(x+5)(x-3) = x^2 + \underline{5x} \underline{- 3x} - 15$

$= x^2 + 2x - 15$

c) $(x + 2)(x - 5)$

	x	$+2$
x	x^2	$2x$
-5	$-5x$	-10

$(x+2)(x-5) = x^2 + 2x - 5x - 10$

$= x^2 - 3x - 10$

d) $(x - 2)(x - 3)$

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

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

$= x^2 - 5x + 6$

Standard Form of a Quadratic Relation:

$$\boxed{y = ax^2 + bx + c}$$

"a" gives the step pattern
1a, 3a, 5a

"c" tells you the y-intercept (0, c)

Summary of the Three Forms

This diagram will encompass our learning for the quadratic relations unit!

Vertex Form
$y = a(x-h)^2 + k$
VERTEX

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

Standard Form
$y = ax^2 + bx + c$
Y-INT

In order to get to standard form we need to **multiply binomials.** To motivate how to do this, let's look at some **area models** of multiplications of 2 digit numbers.

a) 22×35

	20	+2
30	600	60
+5	100	10

$22 \times 35 = 600 + 60 + 100 + 10$

$= 770$

b) 71×39

	70	+1
40	2800	40
−1	−70	−1

$71 \times 39 = 2800 + 40 - 70 - 1$

$= 2{,}769$