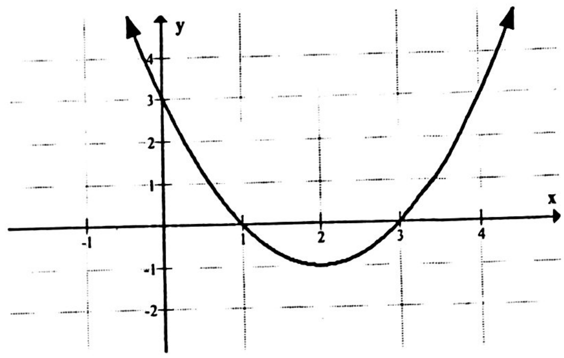
Quadratic Relations Review Note | MFM2P

We have seen that many real-life situations (revenue, areas, projectiles) can be modeled with quadratic relations.

The graph of a quadratic relation is a **parabola**. Let's review the parts of a parabola by examining the parabola at the right.



Property	Definition	What is it for this parabola?
Vertex	Highest or lowest point	(2, -1)
Axis of Symmetry	The line that cuts the parabola in half	$x = 2$
Optimal Value	Highest or lowest y-value	$y = -1$
y-intercept	where the parabola hits the y-axis	(0, 3)
x-intercepts	Where the parabola hits the x-axis	(1, 0) & (3, 0)

Over the last few weeks, we have learned about the 3 forms of quadratic relations, and what each tells us.

Vertex Form

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

VERTEX

Factored Form

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

X-INTS

Standard Form

$y = ax^2 + bx + c$

Y-INT

In all 3 cases, the graph will be a parabola. The number in front (a) always tells you the step pattern.

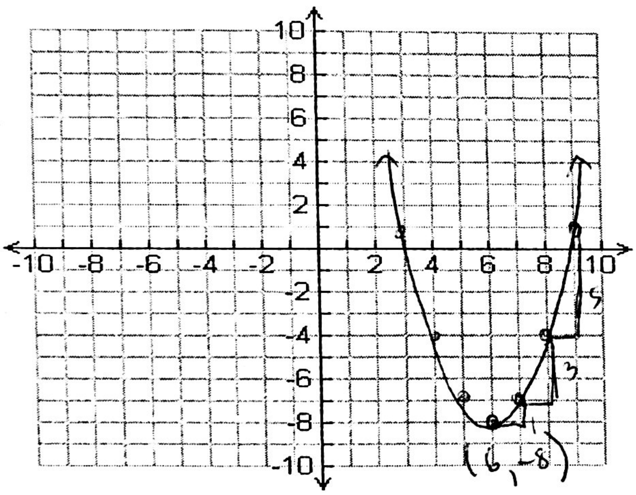
The step pattern is always... 1a, 3a, 5a

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

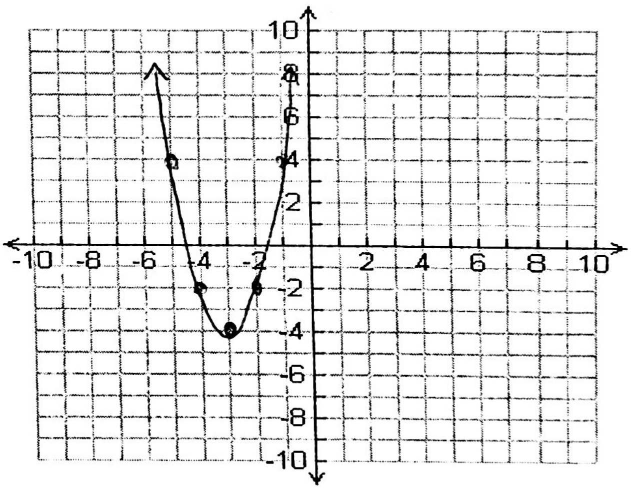
Equation	Vertex	Step Pattern
$y = (x - 6)^2 - 8$	$(6, -8)$	1, 3, 5
$y = 2(x + 3)^2 - 4$	$(-3, -4)$	2, 6, 10

Try and make a sketch of the above parabolas

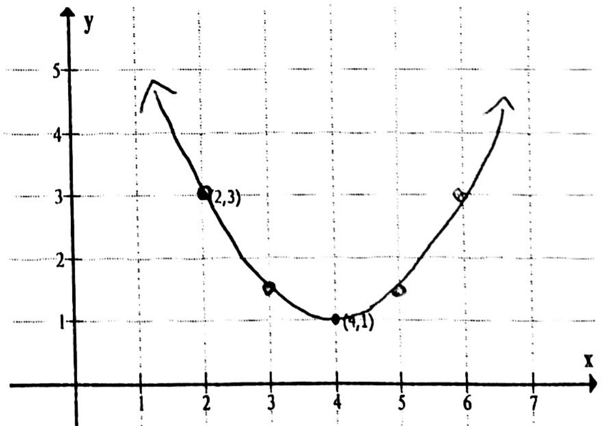
a) $y = (x - 6)^2 - 8$



b) $y = 2(x + 3)^2 - 4$



6) Find the equation of the parabola with a vertex of (4, 1) through the point (2, 3).

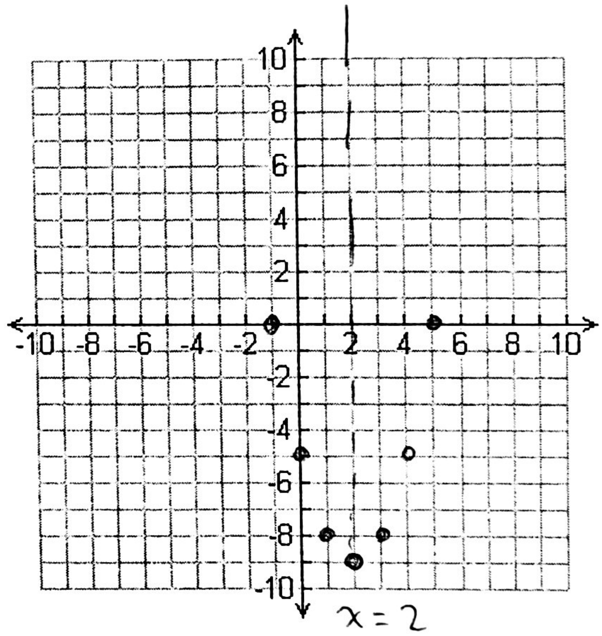
Vertex Form:	$y = a(x - \text{h})^2 + k$	Sketch: 
Sub in Vertex:	$y = a(x-4)^2 + 1$	
Sub in Point:	$3 = a(2-4)^2 + 1$	
Square and Solve:	$3 = 4a + 1$ $-1 \qquad -1$ $\frac{2}{4} = \frac{4a}{4}$ $0.5 = a$ 0.5, 1.5, 2.5	Equation: Equation: $y = \underline{0.5}(x \underline{-\ 4})^2 \ \underline{+1}$

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

Equation	Zeros (x-intercepts)	Step Pattern
$y = (x+1)(x-5)$	$(-1,0)$ & $(5,0)$	1, 3, 5
$y = 3(x+2)(x+3)$	$(-2,0)$ & $(-3,0)$	3, 9, 15

~~9)~~ Sketch the first parabola (in factored form) on the grids provided. Find the axis of symmetry, and vertex like we did in class, then use the step pattern to complete your sketch.

$y = (x+1)(x-5)$	
Zeros:	$(-1,0)$ & $(5,0)$
Axis of Symmetry:	$x = 2$
Find the vertex:	$y = (2+1)(2-5)$ $= (3)(-3)$ $= -9$



Example: The following equations are all in standard form: $y = ax^2 + bx + c$ Complete the table.

Equation	y-intercept	Step Pattern
$y = x^2 + 6x + 11$	$(0,11)$	1, 3, 5
$y = 2x^2 + 6x$	$(0,0)$	2, 6, 10

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The final new thing we did together, was learn an algebraic skill to convert from factored form to standard form. This skill is needed for parts of your grade 11 course. We started by looking at an area model for multiplying two digit numbers, and then used that to multiply binomials.

a) Multiply 31 × 53 with an area model

	50	3
30	1,500	90
1	50	3

31 × 53 = 1,500 + 90 + 50 + 3

= 1,643

b) Multiply $(x + 3)(x + 5)$ with an area model

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

$(x+3)(x+5) = x^2 + 5x + 3x + 15$

$= x^2 + 8x + 15$

You try it: Expand the following expressions by using the distributive law (FOIL), or an area model.

a) $(x + 1)(x + 7)$

$= x^2 + 7x + 1x + 7$

$= x^2 + 8x + 7$

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

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

$= x^2 + 3x - 10$

c) $(x + 1)^2$

$= (x+1)(x+1)$

$= x^2 + 1x + 1x + 1$

$= x^2 + 2x + 1$

d) $(x + 1)^2 + 3$

$= (x+1)(x+1) + 3$

$= x^2 + 1x + 1x + 1 + 3$

$= x^2 + 2x + 4$