MPM 2D
Mr. Kempe

Class Notes
Unit 4, Lesson 3

Vertex Form of a Parabola

Recall:

The **standard** form of a quadratic relation is $y = ax^2 + bx + c$, where c is the y-intercept.

The **factored** form of a quadratic relation is $y = a(x - r)(x - s)$ where r and s are the zeroes.

Definition:

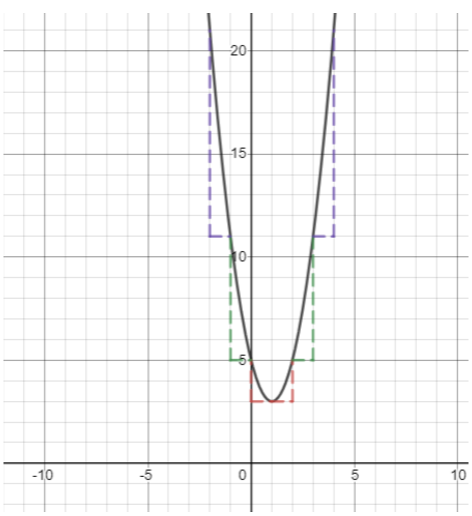
The **vertex** form of a quadratic relation is $y = a(x - h)^2 + k$, where (h, k) is the vertex.

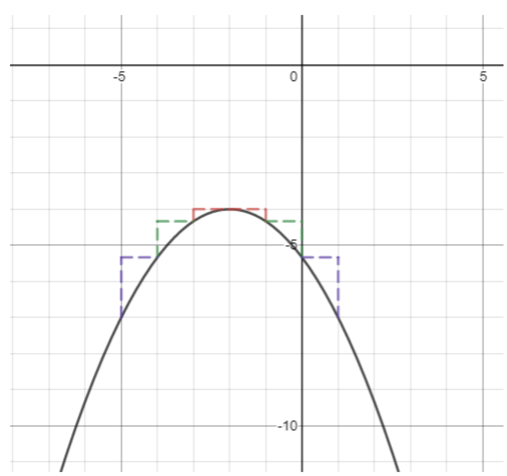
Note the presence of a in each equation. It represents the stretch / compression and direction of opening in all 3 equations.

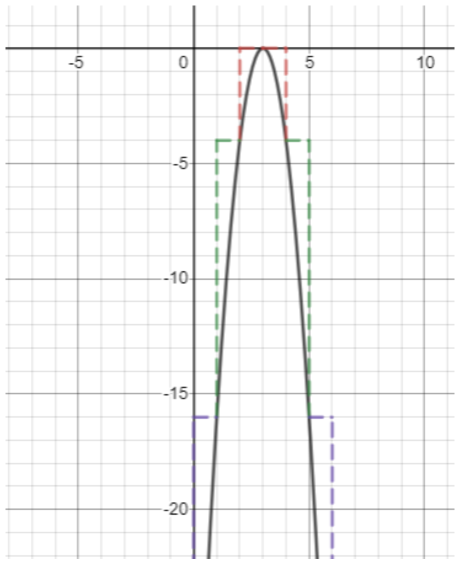
Example 1: Complete the table.

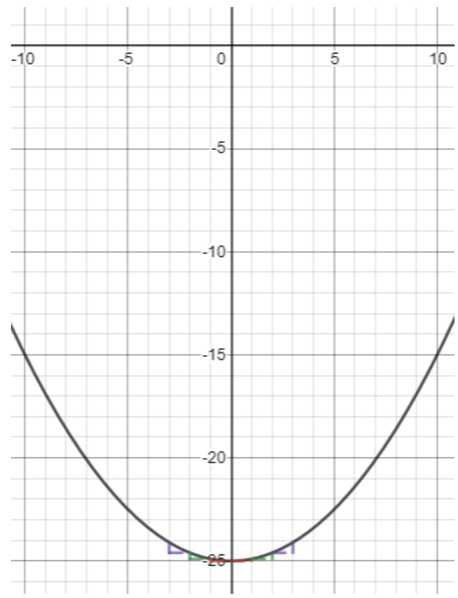
Relation	Stretch	Horizontal Translation	Vertical Translation	Vertex	Step Pattern
$y = 2(x - 1)^2 + 3$	2	Right 1	Up 3	(1, 3)	2, 6, 10
$y = -\frac{1}{3}(x + 2)^2 - 4$	$-\frac{1}{3}$	Left 2	Down 4	(-2, -4)	$-\frac{1}{3}, -\frac{3}{3}, -\frac{5}{3}$
$y = -4(x - 3)^2$	-4	Right 3	None	(-3, 0)	-4, -12, -20
$y = 0.1x^2 - 25$	0.1	None	Down 25	(0, -25)	0.1, 0.3, 0.5

Example 2: Sketch each graph from Example 1.

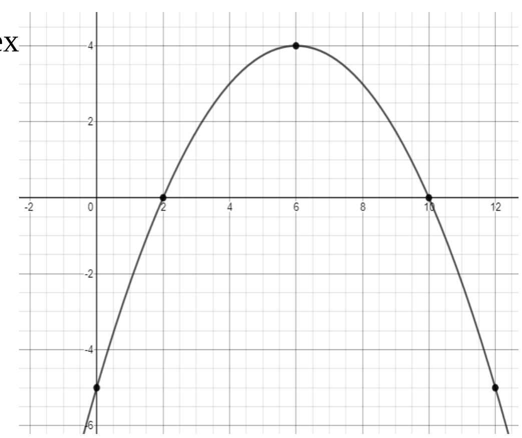








<u>Example 3:</u> Determine the equation of the graph shown, using vertex form.



The vertex of this relation is (6, 4). Putting this into vertex form, we have $y=a(x-6)^2+4$.

To determine the value of *a*, we pick another point on the graph (not the vertex) to sub in and solve for *a*. Let's use one of the roots, which is (2, 0):

$$\begin{aligned} 0&=a(2-6)^2+4 \\ -4&=a(-4)^2 \\ -4&=16a \\ -\frac{4}{16}&=a \\ -\frac{1}{4}&=a \end{aligned}$$

Therefore the equation is $y=-\frac{1}{4}(x-6)^2+4$.

<u>Practice</u>: pg. 269 #4 – 6