	Vertex	Vertical Stretch or Shrink and by what factor.	Parabola opens
$y = (x)^2$	(0,0)	———	up
$y = (x-3)^2$	(3,0)	1	up
$y = x^2 + 2$	(0,2)	1	up
$y = 2(x+1)^2 - 3$	(-1,-3)	STRETCH 2	up
$y = -3(x-2)^2 + 4$	(2,4)	STETCH 3	Down
$y = 4(x+7)^2 + 9$	(-7,9)	STRETCH 4	up
$y = -0.5(x-3)^2 -1$	(3,-1)	SHRINK 1/2	Down
$y = a(x - h)^2 + k$	(h,k)	$\|a\|>1$ STRETCH $0<\|a\|<1$ SHRINK	$a>0$ up $a<0$ down

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

h: Horizontal translation

x-h: h units right x+h: h units left

k: Vertical translation

+k: k units up -k: k units down

a: If a<0 upsidedown: (x-axis reflection)

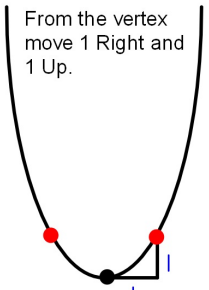
If a>1 Vertical stretch factor

If 0<a<1 Vertical shrink factor

Parent Function: $y = x^2$

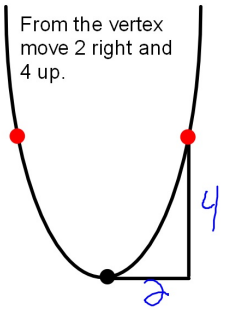
First "good" point

From the vertex move 1 Right and 1 Up.



Second "good" point

From the vertex move 2 right and 4 up.



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Vertical stretch and shrink factors will change the vertical position of the first and second "good" points

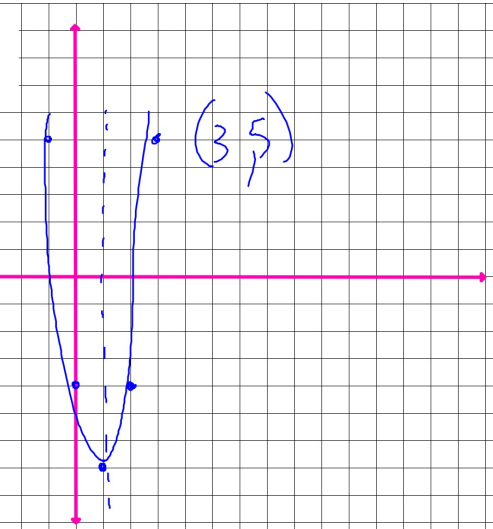
Graph each of these parabolas using the coordinates of the vertex, the stretch/shrink factor, and whether it opens up or down.

1. $y = 3(x-1)^2 -7$

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

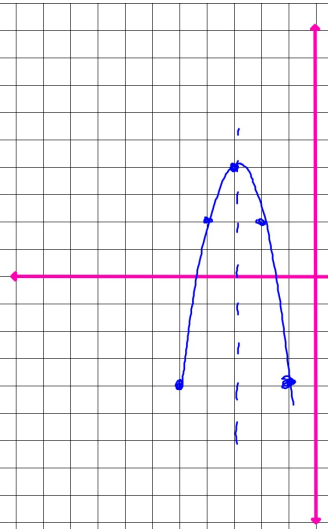
1. $y = 3(x-1)^2 - 7$

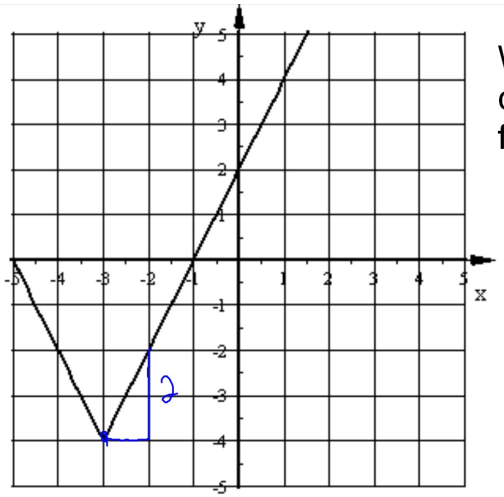
Vertex (1,-7)
Opens Up
Vertical Stretch
Factor = 3



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

Vertex (-3,4)
Opens Down
Vertical stretch factor = 2

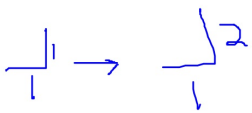


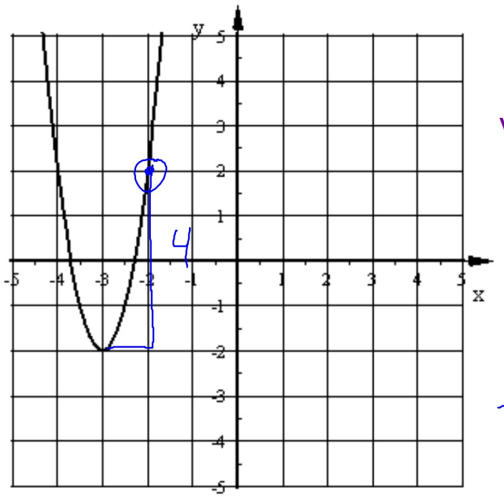


What is the equation of this absolute value function?

Vertex (-3,-4)

$y = 2|x+3| - 4$

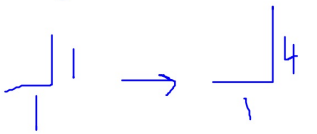


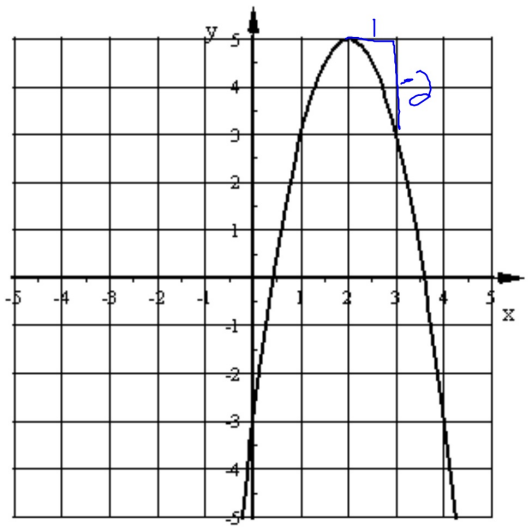


What is the equation for this parabola?

Vertex (-3,-2)

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



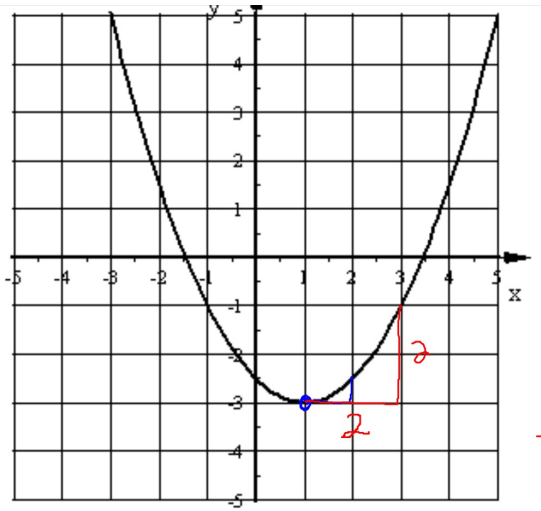


What is the equation for this parabola?

Vertex (2,5)

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

1 → 1, -2



What is the equation for this parabola?

Vertex (1,-3)

$y = \frac{1}{2}(x-1)^2 - 3$

2 → 4, 2