5.4 Graphing from Standard Form

What information do you need in order to graph a quadratic function? Vertex & a-value

STANDARD FORM:
$$y = ax^2 + bx + c$$

Here are the key features that we'll be able to pick out easily from standard form:

Vertex	$\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$	
Axis of Symmetry	$x = \frac{-b}{2a}$	
Direction of Opening	Up: a is positive	Down: a is negative
y-intercept	$(0, c)$	

Function Notation: $f(x)$

This means to plug in whatever you get for $\frac{-b}{2a}$ in for x into your equation. It will give you the y-value of the vertex.

Example 1: Find the vertex of the parabola. Then graph.

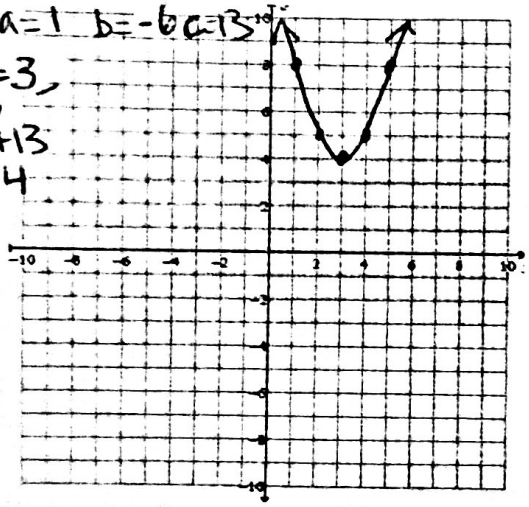
a) $y = x^2 - 6x + 13$

$a=1 \quad b=-6 \quad c=13$

$\frac{-b}{2a} = \frac{6}{2(1)} = 3$,

$(3)^2 - 6(3) + 13$

$= 4$



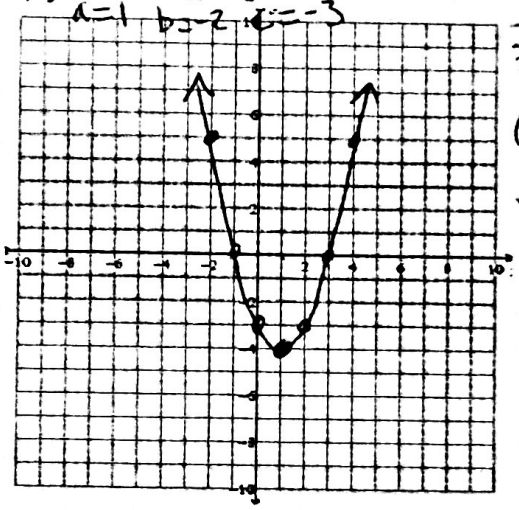
b) $y = x^2 - 2x - 3$

$a=1 \quad b=-2 \quad c=-3$

$\frac{-b}{2a} = \frac{2}{2(1)} = \frac{2}{2} = 1$

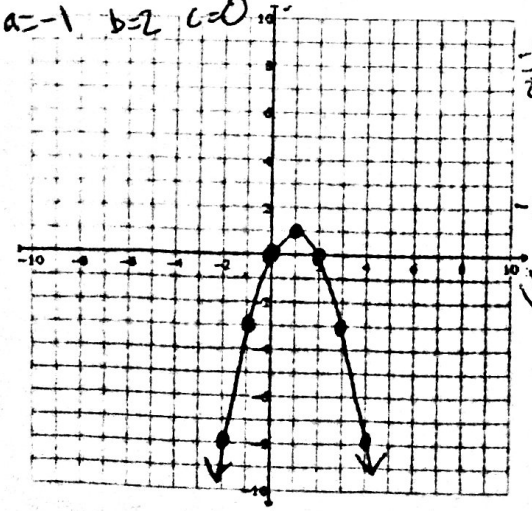
$(1)^2 - 2(1) - 3 = -4$

Vertex: $(1, -4)$



c) $y = -x^2 + 2x$

$a=-1 \quad b=2 \quad c=0$



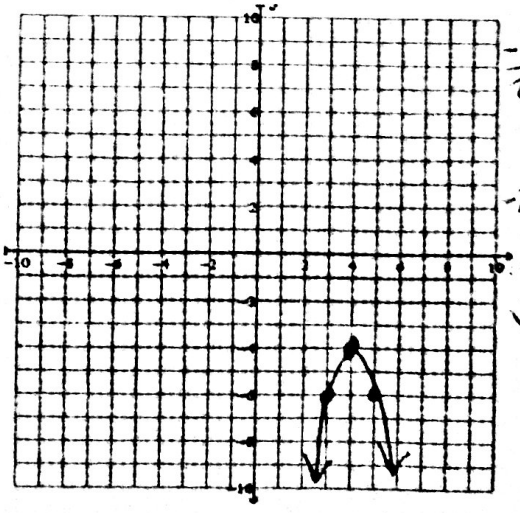
$\frac{-b}{2a} = \frac{-2}{2(-1)}$

$= \frac{-2}{-2} = 1$

$-(1)^2 + 2(1) = 1$

Vertex: $(1, 1)$

d) $y = -2x^2 + 16x - 36 \quad a=-2 \quad b=16 \quad c=-36$



$\frac{-b}{2a} = \frac{-16}{2(-2)} = \frac{-16}{-4}$

$= 4$

$-2(4)^2 + 16(4) - 36$

$= -4$

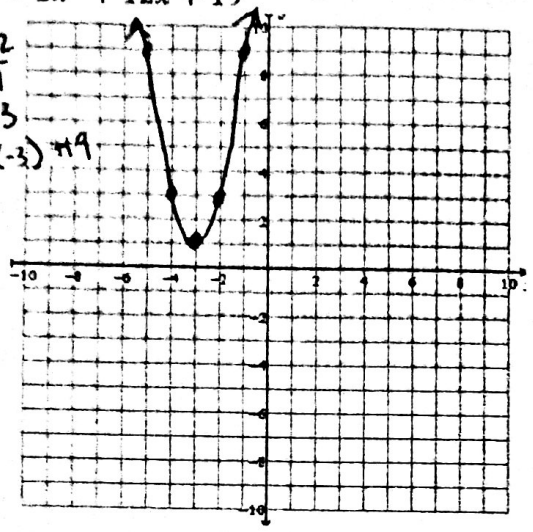
Vertex: $(4, -4)$

a=2 b=12 c=19

e) $y = 2x^2 + 12x + 19$

$\frac{-12}{2(2)} = \frac{-12}{4} = -3$

$2(-3)^2 + 12(-3) + 19 = 1$



x-intercept(s): None

y-intercept: (0, 19)

Axis of Symmetry: $x = -3$

Vertex: (-3, 1)

Max/min value: 1

Domain: $(-\infty, \infty)$

Range: $[1, \infty)$

Increasing: $(-3, \infty)$

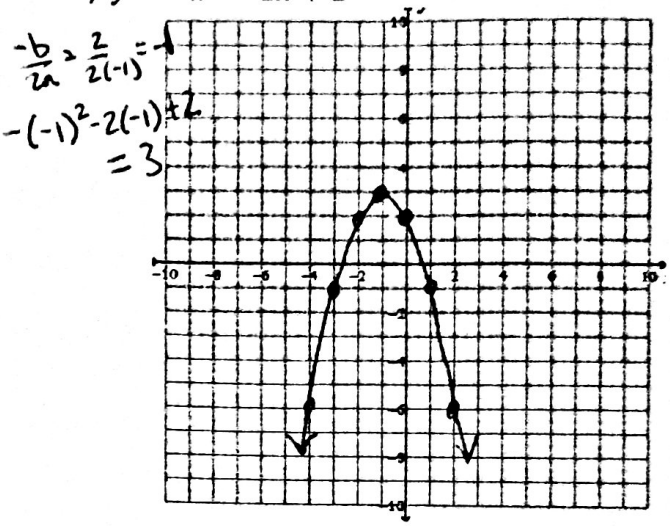
Decreasing: $(-\infty, -3)$

a=-1 b=-2 c=2

f) $y = -x^2 - 2x + 2$

$\frac{-b}{2a} = \frac{2}{2(-1)} = -1$

$-(-1)^2 - 2(-1) + 2 = 3$



*x-intercept(s): (-2.75, 0), (.75, 0)

y-intercept: (0, 2)

Axis of Symmetry: $x = -1$

Vertex: (-1, 3)

Max/min value: 3

Domain: $(-\infty, \infty)$

Range: $(-\infty, 3]$

Increasing: $(-\infty, -1)$

Decreasing: $(-1, \infty)$

* If the x-intercepts are not clear, take your best guess