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	$\left(\frac{-b}{2a}, \text{plug it in}\right)$
Axis of Symmetry	$x = \frac{-b}{2a}$
Direction of Opening	a-value (+ or −)
y-intercept	$(0, c)$

* The x-intercepts of a graph represent the solutions to the equation

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

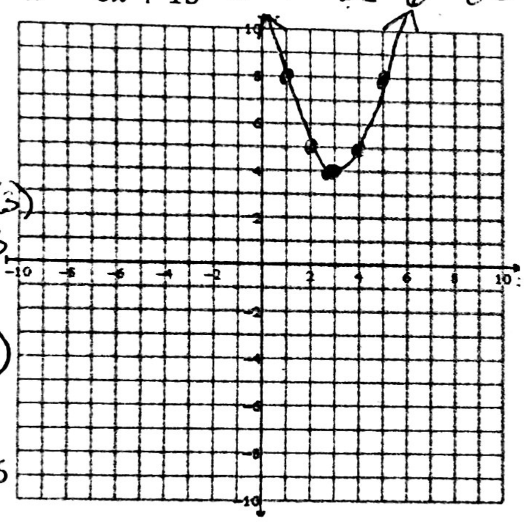
a) $y = x^2 - 6x + 13$ $a = 1$ $b = -6$ $c = 13$

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

$y = (3)^2 - 6(3) + 13 = 4$

V: $(3, 4)$

$1a = 1(1) = 1$
$3a = 3(1) = 3$
$5a = 5(1) = 5$



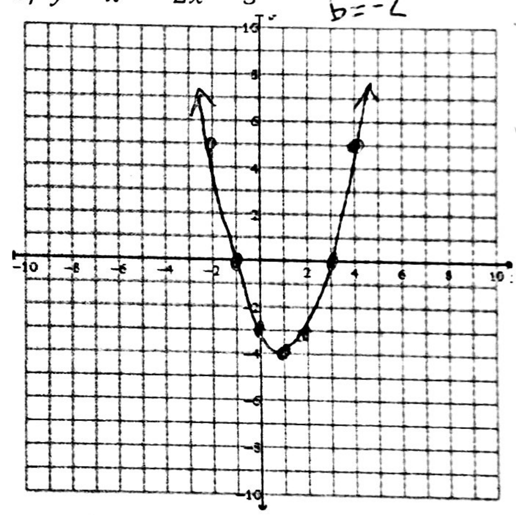
b) $y = x^2 - 2x - 3$ $a = 1$ $b = -2$

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

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

V: $(1, -4)$

$1a = 1$
$3a = 3$
$5a = 5$



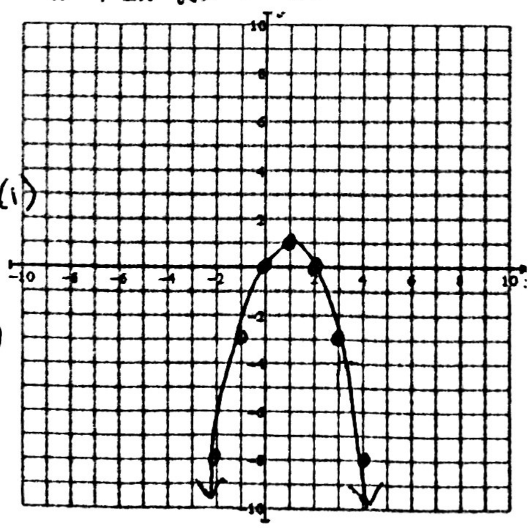
c) $y = -x^2 + 2x$ $a = -1$ $b = 2$

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

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

V: $(1, 1)$

$1a = -1$
$3a = -3$
$5a = -5$



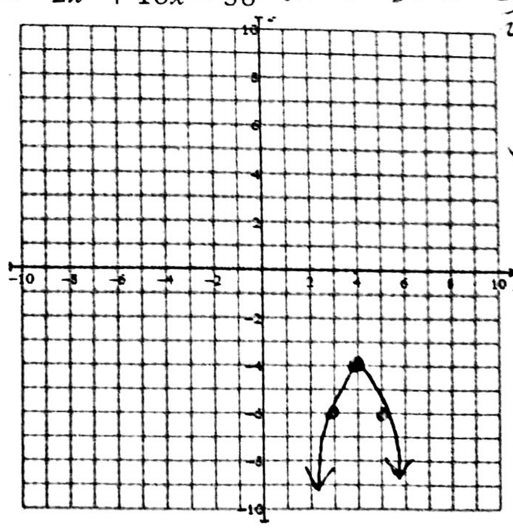
d) $y = -2x^2 + 16x - 36$ $a = -2$ $b = 16$

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

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

V: $(4, -4)$

$1a = -2$
$3a = -6$
$5a = -10$



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

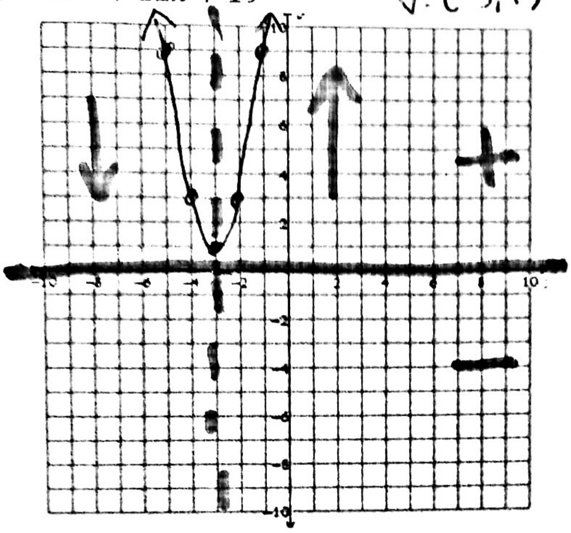
$a=2 \quad b=12$

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

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

V: $(-3, 1)$

1a = 2
3a = 6
5a = 10



x-intercept(s):

y-intercept:

Axis of Symmetry:

Vertex: $(-3, 1)$

Max/min value:

Domain:

Range:

Increasing: $(-3, \infty)$ $\quad x > -3$

Decreasing: $(-\infty, -3)$ $\quad x < -3$

Positive: $(-\infty, \infty)$ $\quad -\infty < x < \infty$

Negative: None

End behavior:

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

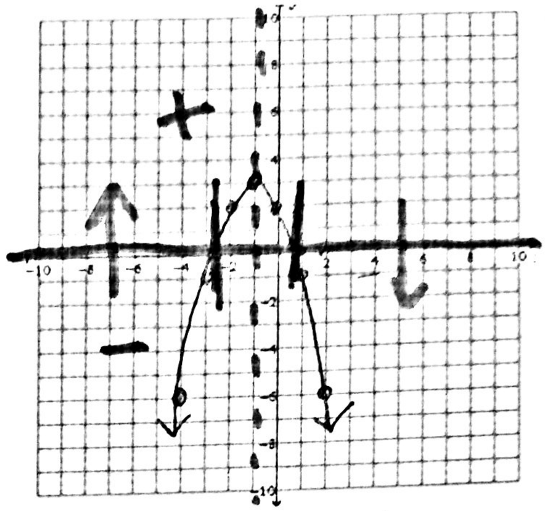
$a=-1 \quad b=-2$

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

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

V: $(-1, 3)$

1a = -1
3a = -3
5a = -5



*x-intercept(s): $(-3.8, 0)$, $(0.8, 0)$

y-intercept:

Axis of Symmetry:

Vertex: $(-1, 3)$

Max/min value:

Domain:

Range:

*Left is less than

Increasing: $(-\infty, -1)$ $\quad x < -1$

Decreasing: $(-1, \infty)$ $\quad x > -1$

Positive: $(-3.8, 0.8)$ $\quad -3.8 < x < 0.8$

Negative: $(-\infty, -3.8) \cup (0.8, \infty)$

End behavior: $x < -3.8$ and $x > 0.8$