Vertex Form Using Completing the Square

Name: Key Hr:_____

Vertex form: $y = a(x-h)^2 + k$ $\quad c = \left(\frac{b}{2}\right)^2$

Find the value of 'c' that would make a perfect square trinomial. Then write the expression as a square of a binomial.

a) $x^2 + 4x + c$ $\left(\frac{4}{2}\right)^2 = 4$

b) $x^2 - 2x + c$ $\left(\frac{-2}{2}\right)^2 = 1$

c) $x^2 + 18x + c$ $\left(\frac{18}{2}\right)^2 = 81$

Change the equation from standard form to vertex form. Identify the vertex and axis of symmetry.

1. $y = x^2 + 4x - 12$

$y = x^2 + 4x + 4 - 12 - 4$

$y = (x+2)^2 - 16$

V: $(-2, -16)$

$x = -2$

2. $y = x^2 - 6x + 21$

$x^2 - 6x + 9 + 21 - 9$

$y = (x-3)^2 + 12$

V: $(3, 12)$

$x = 3$

3. $y = x^2 - 8x + 4$

$x^2 - 8x + 16 + 4 - 16$

$y = (x-4)^2 - 12$

V: $(4, -12)$

$x = 4$

4. $y = x^2 + 3x - 5$

$x^2 + 3x + \frac{9}{4} - 5 - \frac{9}{4}$

$(x + \frac{3}{2})^2 - \frac{29}{4}$ or $(x+1.5)^2 - 7.25$

$(-\frac{3}{2}, -\frac{29}{4})$ or $(-1.5, -7.25)$

$x = -\frac{3}{2}$ $\quad x = -1.5$

5. $y = 2x^2 + 4x - 12$ $\quad 2(x^2 + 2x - 6)$

$y = 2(x^2 + 2x + 1 - 6 - 1)$

$y = 2(x+1)^2 - 14$

V: $(-1, -14)$

$x = -1$

6. $y = -x^2 - 3x + 18$

$-1(x^2 + 3x - 18)$

$-1(x^2 + 3x + \frac{9}{4} - 18 - \frac{9}{4})$

$-1((x + \frac{3}{2})^2 - \frac{81}{4})$ $\quad (-\frac{3}{2}, \frac{81}{4})$

$y = -(x + \frac{3}{2})^2 + \frac{81}{4}$ or $y = -(x+1.5)^2 + 20.25$

AOS: $x = -1.5$ or $x = -3/2$

$(-1.5, 20.25)$

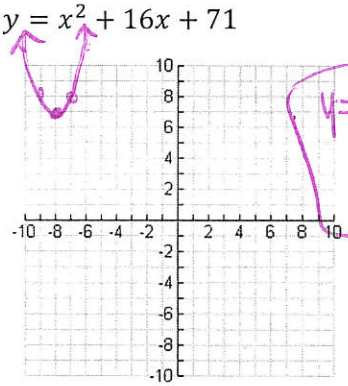
Change the equation from standard form to vertex form and identify the vertex. Then sketch a graph

7. $y = x^2 + 16x + 71$

$x^2 + 16x + 64 + 71 - 64$

$y = (x+8)^2 + 7$

V: $(-8, 7)$

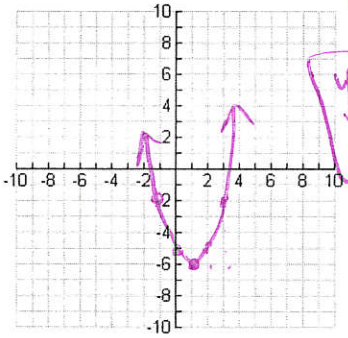


8. $y = x^2 - 2x - 5$

$y = x^2 - 2x + 1 - 5 - 1$

$y = (x-1)^2 - 6$

V: $(1, -6)$

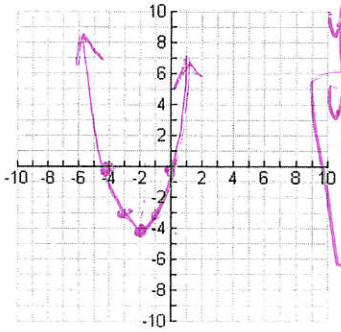


9. $y = x^2 + 4x$

$y = x^2 + 4x + 4 - 4$

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

V: $(-2, -4)$



10. $y = -x^2 - 6x - 5$

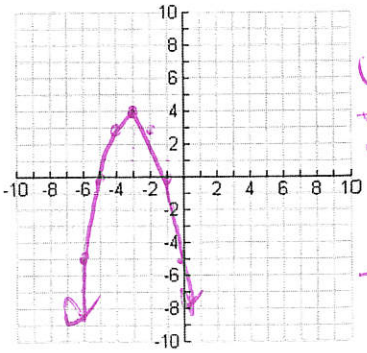
$y = -(x^2 + 6x + 5)$

$y = -(x^2 + 6x + 9 + 5 - 9)$

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

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

V: $(-3, 4)$



11. $y = -2x^2 + 4x + 3$

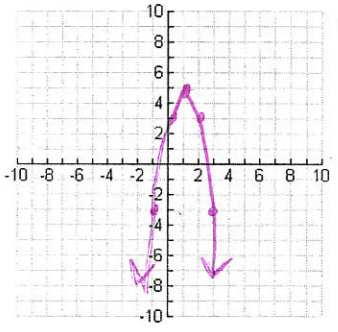
$y = -2(x^2 - 2x - \frac{3}{2})$

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

$= -2((x-1)^2 - \frac{5}{2})$

$= -2(x-1)^2 + 5$

V: $(1, +5)$



12. $y = 3x^2 + 6x + 9$

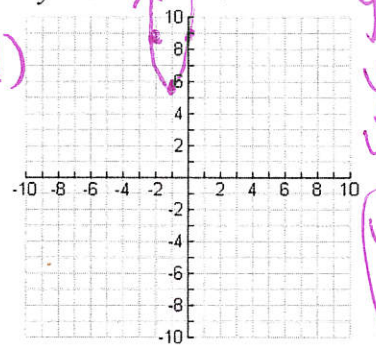
$y = 3(x^2 + 2x + 3)$

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

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

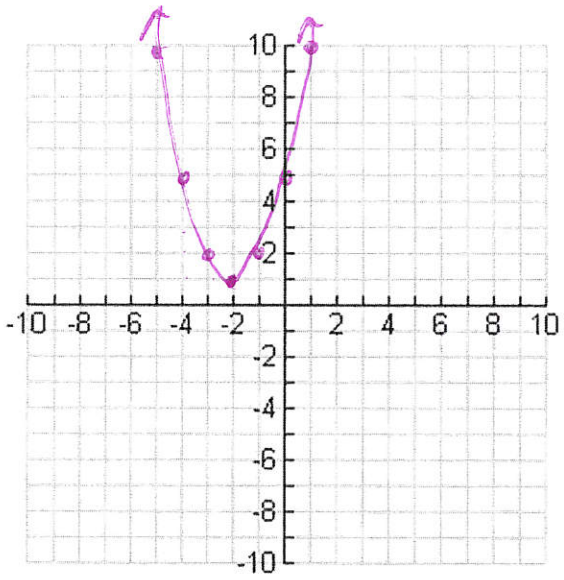
$y = 3(x+1)^2 + 6$

V: $(-1, 6)$



Given the quadratic equations in standard form, find the following and graph:

13. $y = x^2 + 4x + 5$



$y = x^2 + 4x \underline{+4} + 5 \underline{-4}$

$(x+2)^2 + 1$

A) Vertex Form $y = (x+2)^2 + 1$

B) Vertex $(-2, 1)$

C) Axis of Symmetry $x = -2$

D) Max/Min min at 1

E) y-intercept $(0, 5)$

F) x-intercept(s): none

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

H) Range: $[1, \infty)$

I) Find f(4): 37

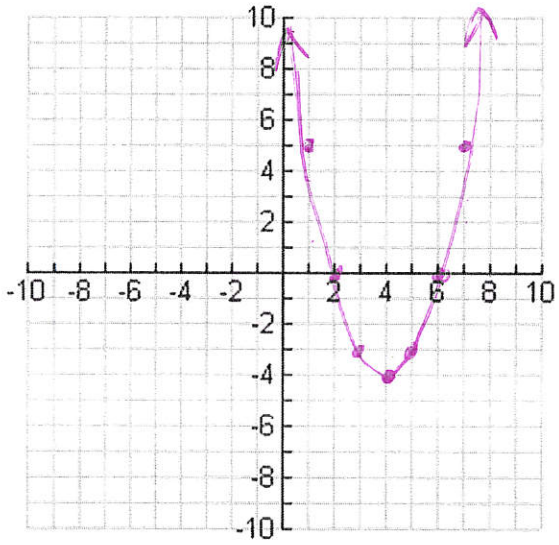
$f(4) = 4^2 + 4(4) + 5$

$= 16 + 16 + 5$

$= 32 + 5$

$= 37$

14. $y = x^2 - 8x + 12$



$y = x^2 - 8x \underline{+16} + 12 \underline{-16}$

$(x-4)^2 - 4$

A) Vertex Form $y = (x-4)^2 - 4$

B) Vertex $(4, -4)$

C) Axis of Symmetry $x = 4$

D) Max/Min min at -4

E) y-intercept $(0, 12)$

F) x-intercept(s): $(2, 0)$ and $(6, 0)$

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

H) Range: $[-4, \infty)$

I) Find f(3): -3

$f(3) = 3^2 - 8(3) + 12$

$= 9 - 24 + 12$

$= 9 - 12$

$= -3$