

Practice 3.3

Date: _____

Write each quadratic function in vertex form by completing the square. Identify the vertex of each function.

$$1) y = x^2 + 14x + 39 \quad \left(\frac{14}{2}\right)^2 = 49$$

$$y = \underbrace{x^2 + 14x + 49}_{(x+7)^2} - 49 + 39$$

$$\boxed{y = (x+7)^2 - 10}$$

vertex:

$$(-7, -10)$$

$$2) y = x^2 + 2x \quad \left(\frac{2}{2}\right)^2 = 1$$

$$y = \underbrace{x^2 + 2x + 1}_{(x+1)^2} - 1$$

$$\boxed{y = (x+1)^2 - 1}$$

vertex:

$$(-1, -1)$$

$$3) y = x^2 + 4x + 14 \quad \left(\frac{4}{2}\right)^2 = 4$$

$$y = \underbrace{x^2 + 4x + 4}_{(x+2)^2} - 4 + 14$$

$$\boxed{y = (x+2)^2 + 10}$$

vertex:

$$(-2, 10)$$

$$4) y = x^2 + 18x + 78 \quad \left(\frac{18}{2}\right)^2 = 81$$

$$y = \underbrace{x^2 + 18x + 81}_{(x+9)^2} - 81 + 78$$

$$\boxed{y = (x+9)^2 - 3}$$

vertex:

$$(-9, -3)$$

$$5) y = -x^2 - 2x + 1 \quad \left(\frac{2}{2}\right)^2 = 1$$

$$y = -\underbrace{(x^2 + 2x + 1)}_{(x+1)^2} - 1 + 1$$

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

$$\boxed{y = -(x+1)^2 + 2}$$

vertex:

$$(-1, 2)$$

$$6) y = -x^2 + 8x - 17 \quad \left(\frac{8}{2}\right)^2 = 16$$

$$y = -\underbrace{(x^2 - 8x + 16)}_{(x-4)^2} - 16 - 17$$

$$y = -(x-4)^2 - 16(-1) - 17$$

$$\boxed{y = -(x-4)^2 - 1}$$

vertex:

$$(4, -1)$$

$$7) f(x) = 3x^2 - 24x + 41 \quad \left(\frac{8}{2}\right)^2 = 16$$

$$f(x) = 3(x^2 - 8x + 16 - 16) + 41$$

$$f(x) = 3(x - 4)^2 - 16(3) + 41$$

$$\boxed{f(x) = 3(x - 4)^2 - 7}$$

vertex:

$$(4, -7)$$

$$8) f(x) = \frac{1}{4}x^2 - \frac{9}{2}x + \frac{57}{4} \quad \left(\frac{18}{2}\right)^2 = 81$$

$$f(x) = \frac{1}{4}(x^2 - 18x + 81 - 81) + \frac{57}{4}$$

$$f(x) = \frac{1}{4}(x - 9)^2 - 81\left(\frac{1}{4}\right) + \frac{57}{4}$$

$$f(x) = \frac{1}{4}(x - 9)^2 - \frac{24}{4}$$

$$\boxed{f(x) = \frac{1}{4}(x - 9)^2 - 6}$$

vertex:

$$(9, -6)$$

$$9) f(x) = -x^2 + 4x - 7 \quad \left(\frac{4}{2}\right)^2 = 4$$

$$f(x) = -(x^2 - 4x + 4 - 4) - 7$$

$$f(x) = -(x - 2)^2 - 4(-1) - 7$$

$$\boxed{f(x) = -(x - 2)^2 - 3}$$

vertex:

$$(2, -3)$$

$$10) f(x) = 8x^2 + 96x + 281 \quad \left(\frac{12}{2}\right)^2 = 36$$

$$f(x) = 8(x^2 + 12x + 36 - 36) + 281$$

$$f(x) = 8(x + 6)^2 - 36(8) + 281$$

$$\boxed{f(x) = 8(x + 6)^2 - 7}$$

vertex:

$$(-6, -7)$$

$$11) f(x) = -x^2 - 14x - 49 \quad \left(\frac{14}{2}\right)^2 = 49$$

$$f(x) = -(x^2 + 14x + 49 - 49) - 49$$

$$f(x) = -(x + 7)^2 - 49(-1) - 49$$

$$\boxed{f(x) = -(x + 7)^2}$$

vertex:

$$(-7, 0)$$

$$12) f(x) = -x^2 + 12x - 30 \quad \left(\frac{12}{2}\right)^2 = 36$$

$$f(x) = -(x^2 - 12x + 36 - 36) - 30$$

$$f(x) = -(x - 6)^2 - 36(-1) - 30$$

$$\boxed{f(x) = -(x - 6)^2 + 6}$$

vertex:

$$(6, 6)$$

Answers to Practice 3.3

1) $(-7, -10)$

2) $(-1, -1)$

3) $(-2, 10)$

4) $(-9, -3)$

5) $(-1, 2)$

6) $(4, -1)$

7) $(4, -7)$

8) $(9, -6)$

9) $(2, -3)$

10) $(-6, -7)$

11) $(-7, 0)$

12) $(6, 6)$