8.4 Notes

Vertex form of a Quadratic function

1. $y = (x-4)^2 + 1$
   - Vertex (4, 1)
   - Axis of symmetry $x = 4$
   - Opens Upward or downward
   - Domain All real numbers
   - Range $y \geq 1$

2. $y = -4(x+2)^2 - 3$
   - Vertex (-2, -3)
   - Axis of symmetry $x = -2$
   - Opens Upward or downward
   - Domain All real numbers
   - Range $y \leq -3$

3. $y = 2(x+5)^2 - 7$
   - Vertex (-5, -7)
   - Axis of symmetry $x = -5$
   - Opens Upward or downward
   - Domain All real numbers
   - Range $y \geq -7$

4. $y = 6(x+4)^2 - 5$
   - Vertex (-4, -5)
   - Axis of symmetry $x = -4$
   - Opens Upward or downward
   - Domain All real numbers
   - Range $y \geq -5$

5. $y = 2(x-3)^2 + 9$

- Vertex (3, 9)
- Axis of symmetry $x = 3$
- Opens Upward or downward
- Domain All real numbers
- Range $y \geq 9$

(6, -22)

$x = 6$

6. $y = 5(x+4)^2 - 1$

- Vertex (-4, -1)
- Axis of symmetry $x = -4$
- Opens Upward or downward
- Domain All real numbers
- Range $y \geq -1$

7. $y = (x+4)^2 + 5$

- Vertex (-4, 5)
- Axis of symmetry $x = -4$
- Opens Upward or downward
- Domain All real numbers
- Range $y \geq 5$

8. $y = -4(x-1)^2 - 6$

- Vertex (1, -6)
- Axis of symmetry $x = 1$
- Opens Upward or downward
- Domain All real numbers
- Range $y \leq -6$

Rewrite from vertex form to standard form.

Then calculate $f(1)$, and $f(-1)$.

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

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

$y = x^2 - 8x + 13$ standard form

$f(1) = x^2 - 8x + 13$

$f(1) = (1)^2 - 8(1) + 13$

$f(1) = 1 - 8 + 13$

$f(1) = 14 - 8$

$f(1) = 6$

$f(-1) = x^2 - 8x + 13$

$f(-1) = (-1)^2 - 8(-1) + 13$

$f(-1) = 1 + 8 + 13$

$f(-1) = 9 + 13$

$f(-1) = 22$

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

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

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

$y = 2x^2 + 4x - 3$ standard form.

$f(1) = 2x^2 + 4x - 3$

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

$f(1) = 2 + 4 - 3$

$f(1) = 6 - 3$

$f(1) = 3$

$f(-1) = 2x^2 + 4x - 3$

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

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

$f(-1) = 2 - 7$

$f(-1) = -5$

11) $y = 3(x-3)^2 + 7$

$y = 3(x^2 - 6x + 9) + 7$

$y = 3x^2 - 18x + 27 + 7$

$y = 3x^2 - 18x + 34$ standard form.

$f(1) = 3x^2 - 18x + 34$

$f(1) = 3(1)^2 - 18(1) + 34$

$f(1) = 3 - 18 + 34$

$f(1) = 37 - 18$

$f(1) = 19$

$f(-1) = 3x^2 - 18x + 34$

$f(-1) = 3(-1)^2 - 18(-1) + 34$

$f(-1) = 3 + 18 + 34$

$f(-1) = 21 + 34$

$f(-1) = 55$

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

$y = 4(x^2 - 8x + 16) + 4$

$y = 4x^2 - 32x + 64 + 4$

$y = 4x^2 - 32x + 68$

$f(1) = 4x^2 - 32x + 68$

$f(1) = 4(1)^2 - 32(1) + 68$

$f(1) = 4 - 32 + 68$

$f(1) = 72 - 32$

$f(1) = 40$

$f(-1) = 4x^2 - 32x + 68$

$f(-1) = 4(-1)^2 - 32(-1) + 68$

$f(-1) = 4 + 32 + 68$

$f(-1) = 36 + 68$

$f(-1) = 104$

13) Vertex $(1,1)$ and point $(4,19)$ (h k; x y)

Equation in vertex form and standard form.

$f(x) = a(x-h)^2 + k$ vertex form.

Vertex (h, k) (x, y)

$f(x) = a(x-h)^2 + k$

$19 = a(4-1)^2 + 1$

$19 = a(3)^2 + 1$

$19 = 9a + 1$

$-1 \quad -1$

$\frac{18}{9} = \frac{9a}{9}$

$2 = a$

$f(x) = a(x-h)^2 + k$

$f(x) = 2(x-1)^2 + 1$ vertex form.

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

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

$f(x) = 2x^2 - 4x + 3$ standard form.

14) vertex $(5,8)$ point $(6,4)$ (h k; x y)

$f(x) = a(x-h)^2 + k$

$4 = a(6-5)^2 + 8$

$4 = a(1)^2 + 8$

$4 = a + 8$

$-8 \quad -8$

$-4 = a$

$f(x) = a(x-h)^2 + k$

$f(x) = -4(x-5)^2 + 8$

$f(x) = -4(x^2 - 10x + 25) + 8$

$f(x) = -4x^2 + 40x - 100 + 8$

$f(x) = -4x^2 + 40x - 92$

h k x y

15) vertex (4, 1) point (3, −4)

$f(x) = a(x-h)^2 + k$

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

$-4 = a(-1)^2 + 1$

$-4 = a(+1)$

$-1 \quad -1$

$-5 = a$

$f(x) = a(x-h)^2 + k$

$f(x) = -5(x-4)^2 + 1$ vertex form

$f(x) = -5(x^2 - 8x + 16) + 1$

$f(x) = -5x^2 + 40x - 80 + 1$

$f(x) = -5x^2 + 40x - 79$

h k

16) vertex (0, 4) point (1, 1)

$f(x) = a(x-h)^2 + k$

$1 = a(1-0)^2 + 4$

$1 = a(1)^2 + 4$

$1 = a(+4)$

$-4 \quad -4$

$-3 = a$

$f(x) = a(x-h)^2 + k$

$f(x) = -3(x-0)^2 + 4$

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

h k

17) (12, −6) vertex (6, 0)

$f(x) = a(x-h)^2 + k$

$-6 = a(12-6)^2 + 0$

$-6 = a(6)^2$

$-6 = 36a$

$\frac{-6}{36} = \frac{36a}{36}$

$\frac{-1}{6} = a$

$f(x) = a(x-h)^2 + k$

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