For the following functions (a) tell whether the graph opens up or opens down, (b) find the vertex, and (c) find the axis of symmetry

1. \( y = -3x^2 + 1 \)
   - a) down
   - b) \( x = \frac{0}{2(-3)} = 0 \) \(-3(0)^2 + 1 = 1\) (0, 1)
   - c) \( x = 0 \)

2. \( y = -2x^2 - 1 \)
   - a) down
   - b) \(-2(0)^2 - 1 = -1\) (0, -1)
   - c) \( x = 0 \)

3. \( y = 3x^2 - 2x \)
   - a) up
   - b) \( \frac{-(-2)}{2(3)} = \frac{2}{6} = \frac{1}{3} \) \(3\left(\frac{1}{3}\right)^2 - 2\left(\frac{1}{3}\right) = 3\left(\frac{1}{9}\right) - \frac{2}{3} = \frac{1}{3} - \frac{2}{3} = \frac{-1}{3} \)
   - c) \( x = \frac{1}{3} \)

4. \( y = -4x^2 - 2x + 9 \)
   - a) down
   - b) \(-4(-\frac{1}{4})^2 - 2(-\frac{1}{4}) + 9 = \frac{1}{4} \cdot \frac{1}{8} = \frac{1}{32} \) \(-5(-\frac{1}{2})^2 = -\frac{5}{4} \)
   - c) \( x = -\frac{1}{4} \)

5. \( -(x - 3)^2 - 4 = y \)
   - a) down
   - b) \((3, -4)\)
   - c) \( x = 3 \)

6. \( y = (x - 6)^2 + 3 \)
   - a) up
   - b) \((-5, -4)\)
   - c) \( x = \frac{5}{2} \)

Write the quadratic function in standard form.

10. \( y = (x - 2)^2 + 6 \)

11. \( y = 2x^2 + 4x + 3 \)

12. \( y = -3(x - 3)(x + 2) \)

Graph the function. Label the vertex and axis of symmetry.

13. \( y = x^2 - 3 \) \( x = 0 \)

14. \( y = -2x^2 + 4x \) \( y = -2(x - 2)^2 \)

15. \( y = 2x^2 + 6x + 1 \) \( \frac{-6}{2a} = \frac{-6}{2} = -3 \) \( \frac{b}{2a} = \frac{-3}{2} \) \( \left(-\frac{3}{2}, -3\frac{1}{2}\right) \)
\[ y = -3x^2 - 12x + 1 \] 

\[ \frac{-(-12)}{2(-3)} = \frac{12}{-6} = \frac{-2}{-3} \]

\[ (3, 0) \]

\[ (4, 0) \]

\[ \text{A.O.S: } \frac{3x - 1}{2} = 1 \]

\[ 1 + y = \frac{5}{2} = 2.5 \]

\[ 2 \]

\[ \text{Vertex: } -\frac{1-3x}{4} \]

\[ -\frac{1-2x}{1} \]

\[ (3, 0) \]

\[ (4, 0) \]

\[ -3x = 0 \]

\[ \frac{-3}{2} \]

\[ x = -1 \]

\[ x = 1 \]

\[ x = 0 \]

\[ \frac{-3(1)}{2} \]

\[ \frac{3}{2} \]

\[ \frac{-3}{2} \]
The flight of a particular golf shot can be modeled by the function \( y = -0.001x(x - 260) \) where \( x \) is the horizontal distance (in yards) from the impact point and \( y \) is the height in yards.

a. How many yards away from the impact point does the golf ball land?

\[ 260 \text{ yards} \]

b. What is the maximum height in yards of the golf shot?

\[ y = -0.001x^2 - 2.6x \]

**Vertex**

\[ x = -\frac{b}{2a} = -\frac{-2.6}{-2(0.001)} = 130 \]

\[ y_{\text{max}} = -0.001(130)(130 - 260) = 16.9 \text{ yds} \]

Find the zeros of the function by rewriting the function in intercept form (Factoring!)

**26.** \( y = x^2 + 8x + 15 \)

\[ (x + 5)(x + 3) = 0 \]

\[ x = -5, x = -3 \]

**27.** \( y = x^2 - 12x + 32 \)

\[ (x - 4)(x - 8) = 0 \]

\[ x = 4, x = 8 \]

**28.** \( f(x) = x^2 - 2x - 35 \)

\[ (x - 7)(x + 5)x - 7) = 0 \]

\[ x = -5, x = 7 \]

**29.** \( y = x^2 - x - 30 \)

\[ (x - 6)(x + 5) = 0 \]

\[ x = 6, x = -5 \]

**30.** \( g(x) = x^2 + 10x + 9 \)

\[ (x + 1)(x + 9) = 0 \]

\[ x = -1, x = -9 \]

**31.** \( y = x^2 - 6x \)

\[ y = x(x - 6) \]

\[ x = 0, x = 6 \]

**32.** \( y = x^2 - 9 \)

\[ (x - 3)(x + 3) = 0 \]

\[ x = 3, x = -3 \]

**33.** \( y = x^2 + 16x + 64 \)

\[ (x + 8)^2 = 0 \]

\[ x = -8 \]

**34.** \( x^2 - 7x - 4 = 0 \)

\[ (x - 1)(x - 6) = 0 \]

\[ x = 1, x = 6 \]

**35.** \( 9x - 8 = x^2 - 9x + 8 \)

\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

\[ x = \frac{8 \pm \sqrt{64 - 4(1)(8)}}{2(1)} \]

\[ x = 3, x = -3 \]

**36.** \( 2x^2 - 3x - 9 = y \)

\[ 2x^2 - 3x - 9 = 0 \]

\[ x = 3, x = -\frac{3}{2} \]

**37.** \( 4x^2 - 8x + 3 = 0 \)

\[ (2x - 3)(2x - 1) = 0 \]

\[ x = \frac{3}{2}, x = 1 \]
9x^2 - 4 = 0

(3x - 2)(3x + 2) = 0

\[ x = \frac{2}{3} \]
\[ x = -\frac{2}{3} \]

39. 8x^2 - 6x + 1 = 0

\[ y = x(3x + 2) = 0 \]

\[ x = 0 \]

\[ x = -\frac{2}{3} \]

40. y = 3x^2 + 2x

41. y = 25x^2 + 10x - 24

\[ \frac{-600}{25} \]
\[ 25x \div 5 \]
\[ 5x - 4 \] (5x + 6) = 0

\[ x = \frac{4}{5} \]
\[ x = -\frac{6}{5} \]

42. g(x) = 33x^2 - 9x - 24

\[ \frac{3(11x^2 - 3x - 8)}{x - 1} \]
\[ 11x \div 11 \] (11x + 8)

\[ 8 \]
\[ -88x^2 \]
\[ 11, 8 \]

\[ 3(x - 1)(11x + 8) = 0 \]

\[ x = 1 \]
\[ x = -\frac{8}{11} \]

43. You are making a square frame of uniform width for a square picture that has side lengths of 2 feet. The total area of the frame is 5 square feet. What is the length of the sides of the frame?

\[ (x \cdot x) - (2)(2) = 5 \]

\[ x^2 - 4 = 5 \]

\[ \sqrt{x^2} = \sqrt{9} \]

\[ x = 3 \text{ ft} \]

\[ x^2 - 9 = 0 \]

\[ (x + 3)(x - 3) = 0 \]

\[ x = 3 \text{ ft} \]