30. \( g(u) = \sqrt{u} + \sqrt{4 - u} \) is defined when \( u \geq 0 \) and \( 4 - u \geq 0 \) \( \iff \) \( u \leq 4 \). Thus, the domain is \( 0 \leq u \leq 4 = [0, 4] \).

44. \( f(x) = \begin{cases} 
  x + 9 & \text{if } x < -3 \\
  -2x & \text{if } |x| \leq 3 \\
  -6 & \text{if } x > 3 
\end{cases} \)

Note that for \( x = -3 \), both \( x + 9 \) and \( -2x \) are equal to 6; and for \( x = 3 \), both \( -2x \) and \( -6 \) are equal to \( -6 \). Domain is \( \mathbb{R} \).

45. Recall that the slope \( m \) of a line between the two points \((x_1, y_1)\) and \((x_2, y_2)\) is \( m = \frac{y_2 - y_1}{x_2 - x_1} \) and an equation of the line connecting those two points is \( y - y_1 = m(x - x_1) \). The slope of this line segment is \( \frac{7 - (-3)}{5 - 1} = \frac{10}{4} = \frac{5}{2} \), so an equation is \( y - (-3) = \frac{5}{2}(x - 1) \). The function is \( f(x) = \frac{5}{2}x - \frac{11}{2}, \ 1 \leq x \leq 5 \).

64. (a) If \( f \) is even, we get the rest of the graph by reflecting about the \( y \)-axis.

(b) If \( f \) is odd, we get the rest of the graph by rotating \( 180^\circ \) about the origin.

2. (a) \( y = \frac{(x - 6)}{(x + 6)} \) is a rational function because it is a ratio of polynomials.

(b) \( y = x + x^2/\sqrt{x - 1} \) is an algebraic function because it involves polynomials and roots of polynomials.

(c) \( y = 10^x \) is an exponential function (notice that \( x \) is the exponent).

(d) \( y = x^{10} \) is a power function (notice that \( x \) is the base).

(e) \( y = 2t^6 + t^4 - \pi \) is a polynomial of degree 6.

(f) \( y = \cos \theta + \sin \theta \) is a trigonometric function.
8. The vertex of the parabola on the left is \((3, 0)\), so an equation is \(y = a(x - 3)^2 + 0\). Since the point \((4, 2)\) is on the parabola, we'll substitute 4 for \(x\) and 2 for \(y\) to find \(a\). 
\[ 2 = a(4 - 3)^2 \quad \Rightarrow \quad a = 2, \] so an equation is \(f(x) = 2(x - 3)^2\).

The \(y\)-intercept of the parabola on the right is \((0, 1)\), so an equation is \(y = ax^2 + bx + 1\). Since the points \((-2, 2)\) and \((1, -2.5)\) are on the parabola, we'll substitute \(-2\) for \(x\) and 2 for \(y\) as well as 1 for \(x\) and \(-2.5\) for \(y\) to obtain two equations with the unknowns \(a\) and \(b\).

\[
\begin{align*}
(-2, 2): \quad 2 &= 4a - 2b + 1 \\ 
(1, -2.5): \quad -2.5 &= a + b + 1 \\
\end{align*}
\]

\(2 \cdot (2) + (1)\) gives us \(6a = -6 \quad \Rightarrow \quad a = -1\). From (2), \(-1 + b = -3.5 \quad \Rightarrow \quad b = -2.5\), so an equation is \(g(x) = -x^2 - 2.5x + 1\).

18. (a) Using \(d\) in place of \(x\) and \(C\) in place of \(y\), we find the slope to be 
\[
\frac{C_2 - C_1}{d_2 - d_1} = \frac{460 - 380}{800 - 480} = \frac{80}{320} = \frac{1}{4}.
\]

So a linear equation is \(C - 460 = \frac{1}{4} (d - 800) \quad \Rightarrow \quad C - 460 = \frac{1}{4}d - 200 \quad \Rightarrow \quad C = \frac{1}{4}d + 260\).

(b) Letting \(d = 1500\) we get \(C = \frac{1}{4} (1500) + 260 = 635\).

The cost of driving 1500 miles is $635.

(c) The slope of the line represents the cost per mile, $80.25.

(d) The \(y\)-intercept represents the fixed cost, $260.

(e) A linear function gives a suitable model in this situation because you have fixed monthly costs such as insurance and car payments, as well as costs that increase as you drive, such as gasoline, oil, and tires, and the cost of these for each additional mile driven is a constant.
3. (a) (graph 3) The graph of $f$ is shifted 4 units to the right and has equation $y = f(x - 4)$.

(b) (graph 1) The graph of $f$ is shifted 3 units upward and has equation $y = f(x) + 3$.

(c) (graph 4) The graph of $f$ is shrunk vertically by a factor of 3 and has equation $y = \frac{1}{3}f(x)$.

(d) (graph 5) The graph of $f$ is shifted 4 units to the left and reflected about the $x$-axis. Its equation is $y = -f(x + 4)$.

(e) (graph 2) The graph of $f$ is shifted 6 units to the left and stretched vertically by a factor of 2. Its equation is $y = 2f(x + 6)$.

39. $(f \circ g \circ h)(x) = f(g(h(x))) = f(g(x^3 + 2)) = f[(x^3 + 2)^2]$
   \[= f(x^6 + 4x^3 + 4) = \sqrt{x^6 + 4x^3 + 4} - 3 = \sqrt{x^6 + 4x^3 + 1} \]

41. Let $g(x) = x^2 + 1$ and $f(x) = x^{10}$. Then $(f \circ g)(x) = f(g(x)) = f(x^2 + 1) = (x^2 + 1)^{10} = F(x)$. 