1. From Equation 1,
\[ \lim_{x \to 4} f(x) = f(4) \]

4. \( g \) is continuous on \([-4, -2), (-2, 2), (2, 4), (4, 6), (6, 8)\).

6. See the picture for this problem.

8. a. Continuous; at the location in question, the temperature changes smoothly as time passes, without any instantaneous jumps from one temperature to another.

b. Continuous; the temperature at a specific time changes smoothly as the distance due west from New York City increases, without any instantaneous jumps.

c. Discontinuous; as the distance due west from New York City increases, the altitude above sea level may jump from one height to another without going through all of the intermediate values - at a cliff, for example.

d. Discontinuous; as the distance travelled increases, the cost of the ride jumps in small increments.

e. Discontinuous; when the lights are switched on (or off), the current suddenly changes between 0 and some nonzero value, without passing through all of the intermediate values. This is debatable, though, depending on your definition of current.

12. For \(-4 < a < 4\), we have
\[
\lim_{x \to a} f(x) = \lim_{x \to a} x\sqrt{16 - x^2} = \lim_{x \to a} x \sqrt{\lim_{x \to a} 16 - \lim_{x \to a} x^2} = a\sqrt{16 - a^2} = f(a)
\]
so \( f \) is continuous on \((-4, 4)\). Similarly, we get
\[
\lim_{x \to 4^-} f(x) = 0 = f(4)
\]
\[
\lim_{x \to 4^+} f(x) = 0 = f(-4)
\]
so \( f \) is continuous from the left at 4 and from the right at \(-4\). Thus, \( f \) is continuous on \([-4, 4]\).

16. See the picture for this problem.

\[
    f(x) = \begin{cases} 
        1 + x^2 & x < 1 \\
        4 - x & x \geq 1 
    \end{cases}
\]

\[
\lim_{x \to 1^-} f(x) = \lim_{x \to 1^-} (1 + x^2) = 1 + 1^2 = 2 \\
\lim_{x \to 1^+} f(x) = \lim_{x \to 1^+} (4 - x) = 4 - 1 = 3
\]

Thus, \( f \) is discontinuous at 1 because \( \lim_{x \to 1^-} f(x) \) does not exist.

28. Because \( \arctan \) is a continuous function, we can apply Theorem 8.

\[
\lim_{x \to 2} \arctan \left( \frac{x^2 - 4}{3x^2 - 6x} \right) = \arctan \left( \lim_{x \to 2} \frac{(x + 2)(x - 2)}{3x(x - 2)} \right) = \arctan \left( \lim_{x \to 2} \frac{x + 2}{3x} \right) = \arctan \frac{2}{3} \approx 0.588
\]

32. See the picture for this problem.

40. \( a. \) \( f(x) = x^5 - x^2 + 2x + 3 \) is continuous on \([-1, 0]\), \( f(-1) = -1 < 0 \), and \( f(0) = 3 > 0 \). Since \(-1 < 0 < 3\), there is a number \( c \) in \((-1, 0)\) such that \( f(c) = 0 \) by the Intermediate Value Theorem. Thus, there is a root of the equation \( x^5 - x^2 + 2x + 3 \) in the interval \((-1, 0)\).

\( b. \) \( f(-0.88) \approx -0.062 < 0 \) and \( f(-0.87) \approx 0.0047 > 0 \), so there is a root between \(-0.88\) and \(-0.87\).