1. Write an equation that expresses the continuity of the given function at the given value.
   
a) $\sqrt{x}$ at $x = 3$

b) $\ln(x)$ at $x = e$

c) $\cos(x)$ at $x = \pi$

2. Where is the function not continuous (or is it continuous everywhere)?
   
a) $f(x) = \frac{x + 1}{x^2 - x - 12}$

b) $f(x) = \frac{x + 1}{x^4 + 2}$

c) $f(x) = \frac{x + 1}{1 - e^x}$

d) $f(x) = \frac{\tan(x)}{x}$
3. Use the definition of continuity to explain why each of the functions graphed below is not continuous at $x = 2$. Also, what type of discontinuity is it?
4. Is $f(x)$ continuous at $x = 2$? Justify your answer.

$$f(x) = \begin{cases} 
  x + 3, & \text{if } x \leq 2 \\
  x^2 - 2, & \text{if } x > 2
\end{cases}$$

5. Find the value of $k$ that makes $f(x)$ continuous at $x = 2$.

$$f(x) = \begin{cases} 
  kx - 1, & \text{if } x \leq 2 \\
  x^2 + k, & \text{if } x > 2
\end{cases}$$
6. Use your knowledge of familiar functions and the properties of continuous functions to explain why each of the following functions is continuous everywhere.

   a) \( f(x) = \sin(x) + \cos(x) \)

   b) \( g(x) = x^2 - e^x \)

   c) \( h(x) = x \tan^{-1}(x) \)

   d) \( k(x) = \sin(3x) \)
7. Use the **Intermediate Value Theorem** to show that the equation has a solution in the indicated interval.

   a) \( 2x - x^3 = -1 \) on the interval \((1, 2)\).

   b) \( e^x = 3x \) on the interval \((0, 1)\).
8. Find the derivative, $f'(x)$, and the equation of the tangent line to the given function at the given point.

a) $f(x) = \sqrt{x+1}$ at $x = 3$.

b) $f(x) = \frac{1}{x}$ at $x = 2$. 