1. If
\[ p = \lim_{x \to -\infty} \frac{5e^x - 10}{e^{-x} + 15}, \]
and
\[ q = \lim_{x \to 0^-} \frac{|x| - x}{x^2}, \]
find \( p \) and \( q \).

a) \( p = 5 \) and \( q = -\infty \)
b) \( p = \frac{2}{3} \) and \( q = -2 \)
c) \( p = 0 \) and \( q = -\infty \)
d) \( p = 5 \) and \( q = \infty \)
e) \( p = 0 \) and \( q = \infty \)

2. Find all the horizontal asymptotes of the function \( f(x) = \frac{x}{2x + \sqrt{x^2 - 2x}} \).

a) The function \( f \) does not have a horizontal asymptote.
b) \( y = \frac{1}{3} \)
c) \( y = \frac{1}{2} \)
d) \( y = 0 \) and \( y = \frac{1}{2} \)
e) \( y = \frac{1}{3} \) and \( y = 1 \)

3. Evaluate \( \lim_{x \to 0} \frac{\sin^2(x)}{3x^2 \sec(3x)} \).

a) 0
b) \( \frac{1}{3} \)
c) \( \frac{1}{9} \)
d) \( \frac{2}{3} \)
e) The limit does not exist.
4. Let \( f(x) = x^2 - 4x - 8 \). On which of the following intervals can we be sure that there exists some \( x \) such that \( f(x) = 4 \)?
   
   a) \([2,4]\)
   
   b) \([-1,1]\)
   
   c) \([-3,-1]\)
   
   d) \([1,4]\)
   
   e) \( f(x) \) never equals 4.

5. For the Intermediate Value Theorem to hold for a function \( f(x) \) on an interval \([a, b]\), how many of the following must be true?
   
   • \( f(b) > f(a) \)
   
   • \( \lim_{x \to a} f(x) = \lim_{x \to b} f(x) \)
   
   • \( f(a) = f(b) \)
   
   • \( f(x) \) is continuous on \([a, b]\).

   a) 0
   
   b) 1
   
   c) 2
   
   d) 3
   
   e) 4

6. What is the equation of the tangent line to \( f(x) = 1/x \) at \( x = 2 \)?
   
   a) \( 4y = 4 - x \)
   
   b) \( y = x - 4 \)
   
   c) \( y = \frac{1}{4}(x - 2) + \frac{1}{2} \)
   
   d) \( y = -\frac{1}{4}(x - \frac{1}{2}) + 2 \)
   
   e) \( y = -\frac{1}{4}(x + 2) + \frac{1}{2} \)
7. Using the definition of the derivative, find $f'(2)$ where $f(x) = x + \frac{1}{x}$

8. Evaluate the limit $\lim_{x \to 4} \frac{x-4}{\sqrt{x} - \sqrt{8-x}}$.

9. Let

$$f(x) = \begin{cases} 
3x - c & x < 2 \\
x^2 - x + 7 & x \geq 2.
\end{cases}$$

Find $\lim_{x \to 2^+} f(x)$, and find the value of $c$ so that $f(x)$ is continuous on $(-\infty, \infty)$.
10. Use the limit definition of the derivative to find $f'(x)$ if $f(x) = \pi^2$.

11. Find the limit $\lim_{x \to 0^+} x^2 \cos(\ln(x))$.

12. Draw the graph of a function $f$ that has the following properties: $\lim_{x \to \infty} f(x) = 0$, $\lim_{x \to 0^+} f(x) = \infty$, $\lim_{x \to 0^-} f(x) = -\infty$, $f(0) = 1$, $\lim_{x \to -5} f(x) = 2$, $f(-5) = 0$, and $\lim_{x \to -\infty} f(x) = 1$. 
13. An object moves along a straight line with position $s$ meters at time $t$ seconds. Given the table of data below answer the following questions.

<table>
<thead>
<tr>
<th>$t$</th>
<th>2</th>
<th>2.1</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$s$</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>16</td>
</tr>
</tbody>
</table>

A Determine the average velocity of the object over the time interval $2 \leq t \leq 5$ seconds.

B Give the best estimate of the instantaneous velocity of the object at time $t = 2$ seconds, based on the given data.

14. How many horizontal asymptotes can a function $f(x)$ possibly have?