(10) 1. Suppose \( f(x) = \frac{3}{x + 2} \). Use the definition of derivative to find \( f'(x) \).

(9) 2. Find an equation for the line tangent to the graph of \( y = \frac{4x}{2 + x^2} \) at the point where \( x = 1 \).

(12) 3. Assume that the functions \( u(x) \) and \( v(x) \) are defined and differentiable for all real numbers \( x \). The following data is known about \( u, v, \) and their derivatives.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( u(x) )</th>
<th>( v(x) )</th>
<th>( u'(x) )</th>
<th>( v'(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>-1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>-1</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>-2</td>
</tr>
</tbody>
</table>

Define \( f(x) = u(x)v(x) \), \( g(x) = u(x)/v(x) \), and \( h(x) = u(v(x)) \). Give the values of the following with a brief indication of how they were obtained:

a) \( f'(2) \)

b) \( g'(3) \)

c) \( h'(4) \)

(14) 4. Suppose that the function \( f(x) \) is described by

\[
f(x) = \begin{cases} 
3 - x^2 & \text{if } x < 0 \\
Ax + B & \text{if } 0 \leq x \leq 1 \\
2^x & \text{if } 1 < x
\end{cases}
\]

a) Find \( A \) and \( B \) so that \( f(x) \) is continuous for all numbers. Briefly explain your answer.

b) Sketch \( y = f(x) \) on the axes given for the values of \( A \) and \( B \) found in a) when \( x \) is in the interval \([-2, 2]\).
5. Evaluate the indicated limits exactly. Give evidence to support your answers.

\( a) \lim_{x \to 1} \frac{x^2 + 2x - 3}{x - 1} \)

\( b) \lim_{x \to 2^+} \frac{|x - 1| - 1}{|x - 2|} \)

\( c) \lim_{x \to 0} \frac{\sin 2x}{\tan 3x} \)

\( d) \lim_{x \to 4} \frac{3x - 2}{\cos(\pi x)} \)

6. Suppose that \( f(x) \) is defined and continuous for all real numbers \( x \) and assume that \( f(x) \) takes on the following values: \( f(-2) = 6, f(0) = -3, f(2) = 4, f(3) = 0, f(4) = -1, f(7) = -3, \) and \( f(10) = 8. \)

a) What can be said about the number of solutions to the equation \( f(x) = 0? \)

b) Give a list of nonoverlapping intervals in which solutions to the equation \( f(x) = 0 \) can be found.

7. What is the domain of \( f(x) = \frac{\ln x + \sqrt{4 - x}}{\sin x} \)? Give your answer as a list of intervals. Explain how you arrived at your answer.
(8) 8. In this problem the function $f(x)$ has domain the open interval $(-4, 4)$. A graph of $y = f(x)$ is displayed below. Answer the following questions as well as you can based on the information in the graph.

![Graph of $f(x)$]

a) For which $x$ is $f(x)$ not continuous?

ANSWER: 

b) For which $x$ is $f(x)$ not differentiable?

ANSWER: 

c) For which $x$ is $f'(x) = 0$?

ANSWER: 

d) For which $x$ is $f'(x) > 0$?

ANSWER: 

(9) 9. a) If $f(x) = \frac{1 - e^x}{x^2 + 1}$, what is $f'(x)$?

b) If $f(x) = (2x + 3\cos x)(x^4 - x^2)$, what is $f'(x)$?

c) If $f(x) = \sec(x^3 + 2x)$, what is $f'(x)$?