1A

(10) 1. Suppose \( f(x) = 2x^2 - 3x \). Use the definition of derivative to find \( f'(x) \).

(9) 2. Find an equation for the line tangent to the graph of \( y = \sqrt{x} + 2x^2 \) 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></th>
<th>( u(x) )</th>
<th>( v(x) )</th>
<th>( u'(x) )</th>
<th>( v'(x) )</th>
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<tbody>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>-1</td>
<td>2</td>
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<tr>
<td>3</td>
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<td>4</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>-2</td>
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Define \( f(x) = u(x)^2 + 2v(x) \) and \( g(x) = v(x)/u(x) \). Answer the following, giving a brief explanation of how the answers were obtained.

a) What is \( f'(2) \)?

b) What is \( g'(3) \)?

c) What can be said about the number and location of solutions to the equation \( f(x) = 6.5 \) with \( x \) in \([2, 4]\)?

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

\[
f(x) = \begin{cases} 
  x + B & \text{if } x < 1 \\
  Ax + 3 & \text{if } x \geq 1 
\end{cases}
\]

a) Find \( A \) and \( B \) so that \( f(x) \) is continuous for all numbers and \( f(-1) = 0 \). 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 \([-2, 2]\).
(16) 5. Evaluate the indicated limits exactly. Give evidence to support your answers without appealing to calculator computations, to graphing, or to l'Hôpital's Rule.

a) \[ \lim_{x \to 4} \frac{\sqrt{x} - 2}{x - 4} \]

b) \[ \lim_{x \to 2^-} \frac{|x - 1| - 1}{|x - 2|} \]

c) \[ \lim_{x \to 0} \frac{\sin^2 2x}{x^2} \]

d) \[ \lim_{x \to 0} \frac{\cos 3x - 1}{x} \]

(14) 6. In the following, distances are measured in feet and time in seconds. A particle is moving on the x-axis. Its position at time t is given by \( s(t) = 2t^3 - 3t^2 - 12t + 7 \).

a) What is the net distance traveled by the particle from \( t = 1 \) to \( t = 3 \)?

b) What is the total distance traveled by the particle from \( t = 1 \) to \( t = 3 \)?

(10) 7. Solve the following two equations for x.

a) \( 4^{2x-3} = 8^{x+1} \)

b) \( \ln(x - 2) + \ln(x + 1) = \ln(3x - 2) \)
8. (There is no single correct answer to this problem.) On the axes below, sketch the graph of a function \( f(x) \) with all the following properties:

a) The domain of \( f(x) \) is \([-4, 4]\).

b) \( f(x) \) is differentiable at all points of its domain except \( x = -1 \) and \( x = 2 \).

c) \( f(x) \) is not continuous at \( x = -1 \).

d) \( f(x) \) is continuous but not differentiable at \( x = 2 \).

e) \( f(0) = 1 \) and \( f'(0) = -1 \).
(9) 9. a) If \( f(x) = 2x^2 \sqrt{x} + \frac{3}{x^3 \sqrt{x}} \), what is \( f'(x) \)?

b) If \( f(x) = \frac{2 \tan x - 3 \sec x}{\ln x} \), what is \( f'(x) \)?

c) If \( f(x) = xe^x \sin x \), what is \( f'(x) \)?