1. For each part, write your answer on the provided line. You are not required to show work, but you may use the provided space for scratch work. For each part, there is no partial credit.

(a) If $x > 2$, simplify the following expression.

(b) Find all solutions to the equation $2^{x^2 - 2x} = 8$.

(c) Simplify the following expression.

(d) Find an equation of the line through the point $(-1, 4)$ with slope 2.

(e) Find the domain of $f(x) = \frac{\ln(x)}{x - 2}$. Write your answer in interval notation.

2. For each part, write your answer on the provided line. You are not required to show work, but you may use the provided space for scratch work. For each part, there is no partial credit.

(a) Calculate $\lim_{x \to 0} \left( \frac{\sin(5x)}{3x} \cos(4x) \right)$ or determine that the limit does not exist.

(b) Calculate $\lim_{x \to -2} \left( \frac{x^2 + 3x + 2}{x^2 + x - 2} \right)$ or determine that the limit does not exist.

(c) Find the derivative of $f(x) = \frac{\tan(x)}{\pi - \sec(x)}$.

(d) An account in a certain bank pays 5% annual interest, compounded continuously. An initial deposit of $200 is made into the account. How many years does it take for the $200 to double? You must write an exact answer in terms of logarithms.

(e) Find the derivative of $f(x) = \cos(e^{-3x})$.

(f) The graph of $f(x)$ is given below. Find all values of $x$ in the interval $(-4, 4)$ for which $f$ is not continuous.

Some values of $g$, $h$, $g'$, and $h'$ are given below. Use this table to answer parts (g) and (h).

<table>
<thead>
<tr>
<th>$x$</th>
<th>$g(x)$</th>
<th>$g'(x)$</th>
<th>$h(x)$</th>
<th>$h'(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>7</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>-3</td>
<td>-9</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>-1</td>
<td>1</td>
<td>-6</td>
</tr>
</tbody>
</table>
(g) Let \( f(x) = 3g(x)h(x) \). Calculate \( f'(2) \).

(h) Let \( F(x) = g(\sqrt{x}) \). Calculate \( F'(4) \).

3. Find an equation of the line normal to the graph of \( f(x) = 2x^2 - \ln(x) + 3 \) at \( x = 1 \). (Recall that the normal line is perpendicular to the tangent line.)

Any form of the equation of a line is acceptable.

4. Let \( f(x) = 3\sqrt{x} \). Use the limit definition of the derivative to find \( f'(x) \). Show all work.

You will receive no credit if you simply quote a derivative rule. You must use the limit definition.

5. Find the absolute extreme values of \( f(x) = 3x^4 - 4x^3 - 12x^2 \) on \([-2, 1]\).

6. Find the absolute extreme values of \( f(x) = x^2(x + 5)^3 \) on \([-6, 0]\).

7. Find the values of the constants \( a \) and \( b \) that make \( f \) continuous at \( x = 9 \).

\[
f(x) = \begin{cases} 
\sin(2\pi x) - 2ax & , \ x < 9 \\
b & , \ x = 9 \\
x - 9 & \sqrt{x} - 3 , \ x > 9 
\end{cases}
\]

You must use proper calculus and notation to give a complete and clear justification for your answer.