Problem 1: (10 pts) Give a formula for a function which has the following graph.

![Graph of a function with points (0,6), (5,2), (10,6) plotted.]

Problem 2: (20 pts) A differentiable function $f(x)$ has the following values given by the table

<table>
<thead>
<tr>
<th>$x$</th>
<th>-2</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f(x)$</td>
<td>2</td>
<td>10</td>
<td>16</td>
<td>20</td>
<td>22</td>
<td>21</td>
</tr>
</tbody>
</table>

a) Using the data from this table, make a table of the approximate values of the derivative function $f'(x)$ for the same values of $x$.

b) Is $f(x)$ increasing or decreasing on the interval $-2 \leq x \leq 8$? Explain your answer.

c) Using the data from your answer to part a), make a table of the approximate values of the second derivative function $f''(x)$ for the same values of $x$.

d) Is $f(x)$ linear, concave up, or concave down on the interval $-2 \leq x \leq 8$? Explain your answer.

Problem 3: (20 pts) Let $f(x) = x^3 + x$. Calculate $f'(2)$ using the limit definition of the derivative.

Problem 4: (20 pts) Given the function

$$f(x) = \begin{cases} 
  x^2 + x + 1 & \text{if } x \geq 1 \\
  3 - x & \text{if } x < 1 
\end{cases}$$

(a) State the domain of the function.

(b) Determine $\lim_{x \to 1^-} f(x)$.

(c) Determine $\lim_{x \to 1^+} f(x)$.

(d) Is $f(x)$ continuous on its domain? Explain your answer.

Problem 5: (20 pts) Let $f(x) = \frac{3x^2 - 3}{x^2 - 4}$.

a) What are the zeros of $f(x)$?

b) Find all asymptotes for $f(x)$.

c) Made a careful graph of $y = f(x)$. Be sure to label the axes, label the zeros and indicate all asymptotes.

Problem 6: (10 pts) Suppose that $f(2) = -5$ and $f'(2) = 3$. Write the formula for the tangent line to $f$ at $x = 2$.

Return this copy of the exam with your solutions.