This is a 60-minute exam. The actual exam will be a little bit shorter. It will also resemble this practice exam less than the first exam resembled the first practice exam. (I’m thinking about having a true/false section.)

1. (24 points) Assume $f$ is defined on the interval $[a, b]$. State the
   (a) Intermediate value theorem for $f$.
   (b) Extreme value theorem for $f$.
   (c) Mean value theorem for $f$.
   (d) First fundamental theorem of calculus for $f$ (about the derivative of the integral).

Make sure you include the hypotheses for each theorem.

2. (16 points) Compute the following limit using the limit properties.
   [Hint: Consider the definition of $f'(2)$ if $f(x) = x^3$.]

$$\lim_{h \to 0} \frac{(h + 2)^3 - 8}{h(h - 2)}.$$

3. (24 points)
   (a) State the definition of uniform continuity for a function $f$ defined on a set $S \subseteq \mathbb{R}$.
   (b) Prove that $f(x) = 3x + 5$ is uniformly continuous on $\mathbb{R}$.

4. (16 points) Let $f(x)$ be continuous for all $x$ except $x = 2$. Let

$$g(x) = \begin{cases} x^2 & \text{for } x \geq 0 \\ x^2 + 1 & \text{for } x < 0. \end{cases}$$

For what values of $x$ can you be sure that the function $h(x) = f(g(x))$ is continuous?

5. (20 points) The following table was computed for the strictly increasing function $f$ and its first two derivatives. (Assume $f'$ and $f''$ exist for all $x$.)

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
<th>$f'(x)$</th>
<th>$f''(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-2</td>
<td>3</td>
<td>-2</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>3/2</td>
<td>-1/2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Let $g$ be the inverse function to $f$. Find the values of $g(0)$, $g(1)$, $g'(0)$, and $g''(0)$. 