Section 5.1
1. TRUE or FALSE? If $f$ is increasing on $(a, b)$ and increasing on $(b, c)$, then $f$ is increasing on $(a, c)$. If true, prove it. If false, provide a counter-example.

2. Sketch 3 different-shaped graphs which are decreasing on $(-1, 2)$. Explain what is different about each graph.

3. The graphs of a function, its first derivative, and its second derivative are shown below. Which graph is which? Explain your reasoning.

Section 5.2
4. Prove Fermat’s Theorem: If $f$ has a local maximum at $x = c$ and $f'(c)$ exists, then $f'(c) = 0$.

5. Sketch the graph of a function $f$ on $[2, 5]$ such that:

   a) $f$ has an absolute minimum but no local minimum.

   b) $f$ has a local minimum but no absolute minimum.

   If either of these is not possible, explain why.

Section 5.3
6. Use the Mean Value Theorem to prove that, if $f' < 0$ on $(a, b)$, then $f$ is decreasing on $(a, b)$.

7. In Section 2.5, you used the Intermediate Value Theorem to prove that an equation such as $x^3 + 3x - 7 = 0$ has a solution. Use the Mean Value Theorem to prove that this equation $(x^3 + 3x - 7 = 0)$ has ONLY one solution.

8. Show that, if two functions have the same derivative, then they differ at most by a constant. i.e., if $f'(x) = g'(x)$ for all $x$, then there is a constant $C$ such that $f(x) = g(x) + C$. 