Do not write in the boxes immediately below.

Question:	1	2	3	4	5	6	Total
Points:	12	15	13	10	24	26	100
Score:							

MATH 2250 Exam 3

April 9, 2009

Name:________________________________

1. (12 points) Let $f(x)$ be a function, and suppose that $f(5) = 2$ and $f'(5) = 3$.

   (a) What is the linear approximation of $f(x)$ at $x = 5$?

   (b) Use (a) to approximate $f(5.3)$.

2. (15 points) For each of the following, answer True or False.

   (a) If $f(x)$ is continuous on $(-\infty, \infty)$, then $f(x)$ must have both an absolute maximum value and an absolute minimum value on $(-\infty, \infty)$.

   (b) If $f'(x)$ is increasing on an interval (a, b), then $f(x)$ is increasing on (a, b).

   (c) If c is a critical point of $f(x)$, then $f(x)$ must either have a local maximum or a local minimum at $x = c$.

   (d) If c is a critical point of $f(x)$, and $f''(c) < 0$, then $f(x)$ has a local maximum at $x = c$.

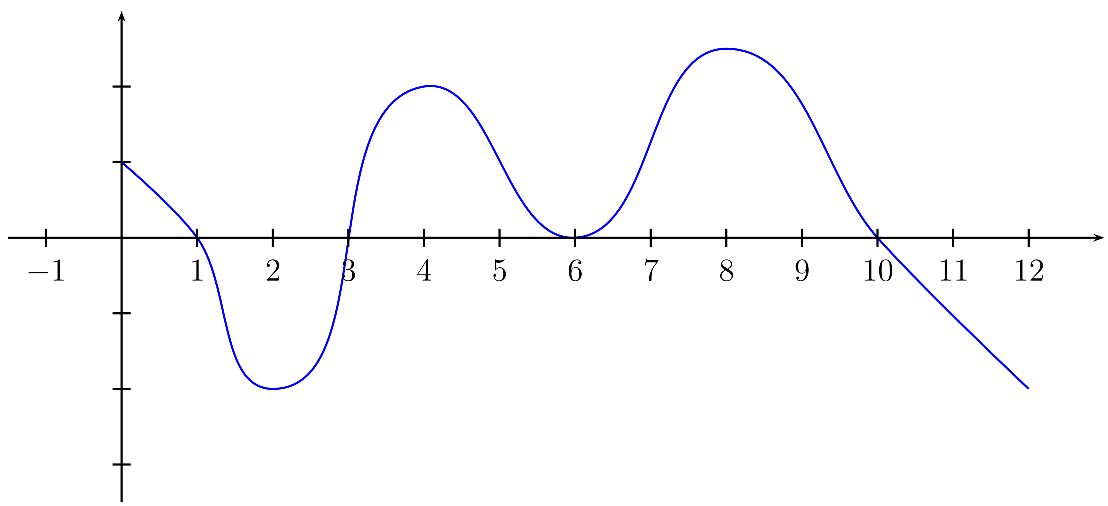
   (e) If $f'(3) < 0$ on an interval (a, b), then it is possible that $f(x)$ may be concave up on (a, b).

3. (13 points) Let $f(x) = \dfrac{x^2}{(x-3)^2}$. You may use the following facts:

$$f'(x) = \frac{-6x}{(x-3)^2} \quad \text{and} \quad f''(x) = \frac{12x+18}{(x-3)^4}.$$

Find all inflection points of $f(x)$, or state if there are none. Show all work supporting your assertions.

4. (10 points) The figure below shows the graph of **the derivative** $f'(x)$ of a function defined on $(0, 12)$.



(a) Give all critical points of $f(x)$.

(b) For what values of x in $(0, 12)$ is $f(x)$ decreasing? Express your answer in interval notation.

5. (24 points) Find the absolute maximum value and absolute minimum value of the function $f(x) = 3x^{2/3} - 2x$ on the interval $[-1, 8]$.

6. (26 points) A person wishes to construct a cardboard box with an open top and vertical sides, such that the length of the base is three times the width of the base. The surface area of the box is to be 36 ft^2 (since only 36 ft^2 of cardboard is available).

   (a) What is the maximum possible volume of the box? What are the dimensions of the box of maximum volume?

   (b) Explain how you know that the volume you found in (a) is the maximum possible volume.