

Do not write in the boxes immediately below.

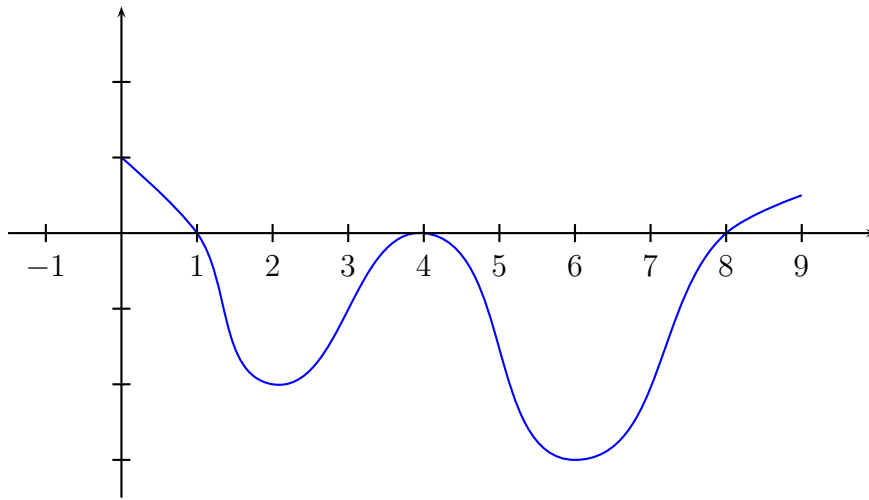
Question:	1	2	3	4	5	Total
Points:	10	30	28	8	24	100
Score:						

### MATH 2250 Exam 3

April 3, 2008

Name: \_\_\_\_\_

1. (10 points) The figure below shows the graph of **the derivative**  $f'(x)$  of a function defined on  $(0, 9)$ .



- (a) Give all values of  $x$  in  $(0, 9)$  where the function  $f(x)$  has a local minimum.
- (b) Give all values of  $x$  in  $(0, 9)$  where the function  $f(x)$  has a local maximum.

2. (30 points) Consider the function  $f(x) = x^4 - 4x^3 + 10$ .
- (a) Find the regions of increasing and decreasing and all relative minimums and maximums (both  $x$  and  $y$  coordinates) of  $f(x)$ .
- (b) Find the regions of concave up and concave down and all inflection points (both  $x$  and  $y$  coordinates) of  $f(x)$ .

(c) Sketch the graph of  $f(x)$ , taking into account all of the information determined in parts (a) and (b). Label the relative minimums and maximums and inflection points.

(d) How many roots does  $f(x)$  have, i.e. for how many real numbers  $c$  does  $f(c) = 0$ ?

3. (28 points) Wally's Wonderful Windows is a store which sells windows which have the shape of a rectangle surmounted by an equilateral triangle. (Thus the length of each side of the triangle is equal to the width of the rectangle.)
- (a) What are the dimensions of such a window with perimeter 50 inches and maximum possible area? (Hint: The area of an equilateral triangle with side length  $x$  is  $(\sqrt{3}/2)x^2$ .)

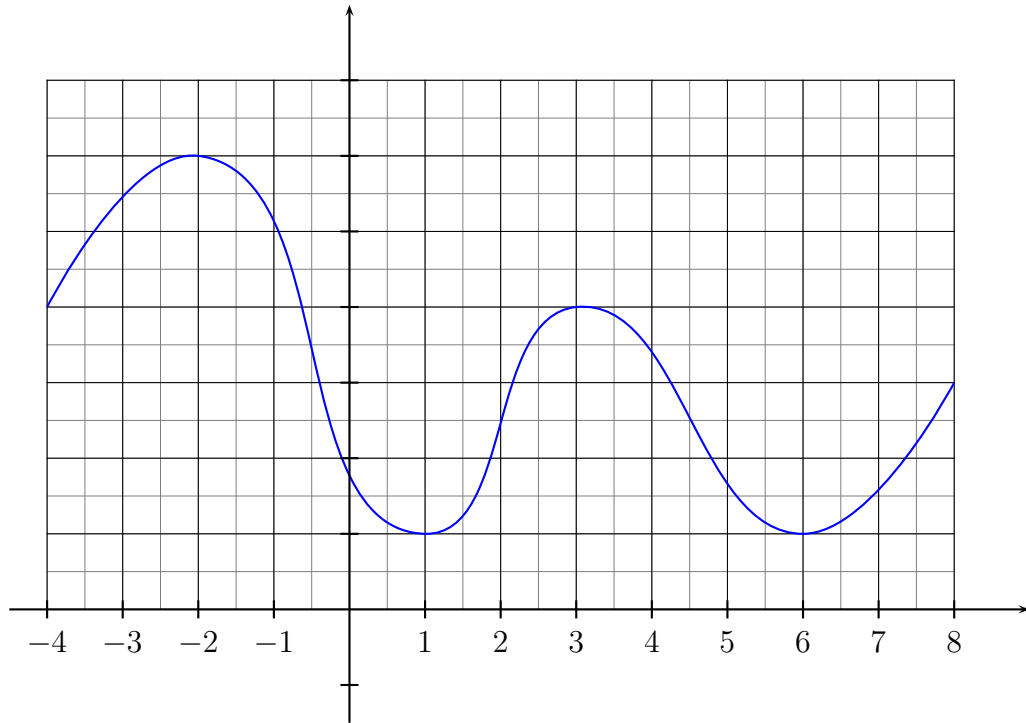
- (b) Explain how you know that the dimensions you found in part (a) give the maximum possible area.

4. (8 points) A function  $g(x)$  is defined and continuous on  $(-\infty, \infty)$ . For each of the following, answer True or False.

(a) If  $g''(c) > 0$ , then  $g(x)$  is increasing at  $x = c$ .

(b) If  $g''(c) = 0$ , then  $g(x)$  has an inflection point at  $x = c$ .

5. (24 points) The figure below shows the graph of a function  $f(x)$ .



For each of the following, answer True or False.

- (a)  $f'(x) < 0$  if  $3.5 < x < 5.5$ .
- (b)  $f''(x) < 0$  if  $3.5 < x < 5.5$ .
- (c)  $f(0.5) > 0$ .
- (d)  $f'(0.5) > 0$ .
- (e)  $f''(0.5) > 0$ .
- (f)  $f'(-2) = 0$ .
- (g)  $f''(-2) = 0$ .
- (h)  $f(x)$  has four critical points and four inflection points, for  $x$  in  $(-4, 8)$ .