

Math 171 - Test 3a
November 15, 2012

Name _____

Score _____

Show all work to receive full credit. Supply explanations where necessary.

1. (4 points) What is the maximum number of horizontal asymptotes that the graph of a function can have? Sketch the graph of a function with that number of horizontal asymptotes.

2. (6 points) Let $f(x) = x^3 + \sin(10x)$. Without looking at the graph of f , determine whether the graph is concave up or down at the point where $x = 0.65$.

3. (8 points) Given a function f and its first and second derivatives, f' and f'' , which would you use and how would you use it to determine

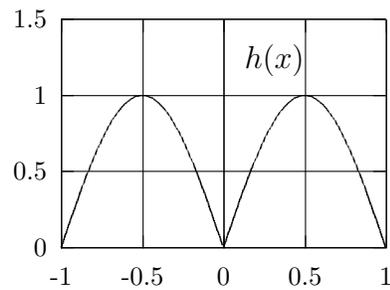
(a) if f has a critical point at $x = 3$?

(b) the zeros of f ?

(c) if the graph of f has an inflection point at $x = -1$?

(d) intervals on which f is decreasing?

4. (3 points) The function h , defined on the interval $[-1, 1]$, has the graph shown below. Find the critical numbers of h .



5. (20 points) The function g and its first two derivatives are shown below.

$$g(x) = \frac{4x^2 - 1}{2x^2 + 1}$$

$$g'(x) = \frac{12x}{(2x^2 + 1)^2}$$

$$g''(x) = \frac{12 - 72x^2}{(2x^2 + 1)^3}$$

- (a) Find all vertical and horizontal asymptotes of the graph of g .
- (b) Use the 1st derivative test to find open intervals on which g is increasing/decreasing.
- (c) Find all relative extreme values of g .
- (d) Use the 2nd derivative test to find open intervals on which the graph of g is concave up/down.
- (e) Find all points of inflection of the graph of g .

6. (5 points) Determine the following limit.

$$\lim_{x \rightarrow \infty} \frac{5x^4 - 8x^3 + 9x}{8x^7 - 99x^4 + 100}$$

7. (8 points) Determine the following limit.

$$\lim_{x \rightarrow \infty} \frac{\sqrt{3x^6 + 6x^2 + 8}}{-8x^3 + 7x^2 + 5x}$$

Is the limit any different as $x \rightarrow -\infty$?

8. (8 points) Use Newton's method to approximate the only real solution of the equation $7 - 2x - x^3 = 0$. Write down the recursive formula for x_{n+1} , choose a suitable initial estimate x_0 , and write down each improved estimate until your estimates differ by less than 0.00001.

9. (8 points) Find the linearization $L(x)$ of the function $f(x) = \sin 2x + \cos x$ at $x = 0$. Then complete the following table. Round each entry to the nearest hundredth.

x	$f(x)$	$L(x)$
0.01		
0.05		
0.1		

10. (10 points) A rancher has 200 feet of fencing with which to enclose two adjacent rectangular corrals. What dimensions should be used so that the enclosed area will be a maximum?

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Show all work to receive full credit. Supply explanations where necessary. **YOU MUST WORK INDIVIDUALLY ON THESE PROBLEMS.**

1. (10 points) Use algebra and calculus techniques to sketch the graph of

$$y = \frac{-x^3 + 3x^2 + 3x - 9}{10}.$$

Use graph paper! This problem is open-ended on purpose. Be thorough enough to make your work worth 10 points.

Free graph paper is available online at <http://www.printfreegraphpaper.com>.

2. (10 points) The top and bottom margins of a poster are each 6 cm and the side margins are each 4 cm. If the area of the printed material on the poster is fixed at 384 cm^2 , find dimensions of the poster with the smallest total area.