Plymouth State
UNIVERSITY

MA 2550: Calculus I, Fall 2008

EXAM 2

NAME:

Instructions: Answer each of the following questions completely. To receive full credit, you must *justify* each of your answers (unless stated otherwise). How you reached your answer is more important than the answer itself. If something is unclear, or if you have any questions, then please ask. Good luck!

1. (5 points each) Differentiate each of the following functions. You do *not* need to simplify your answers, but sufficient work must be shown to receive full credit.

   (a) $f(x) = \dfrac{x^3}{2} + x^2\sqrt{2} - \dfrac{3}{x} + \pi^2$

   (b) $g(x) = x\sqrt{1-x^2}$

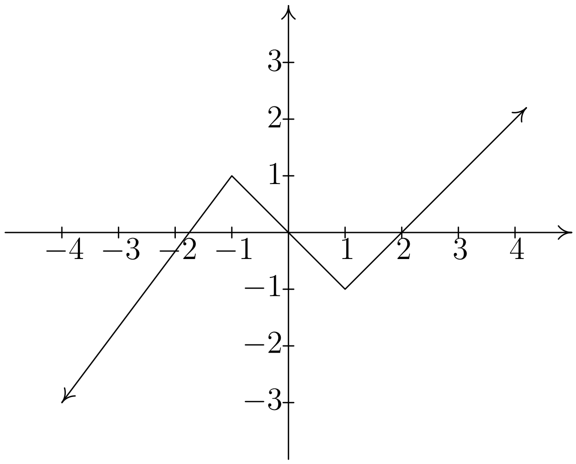
   (c) $y = \sec\dfrac{x}{5}$

(d) $h(x) = \sqrt{\dfrac{1+x}{1-x}}$

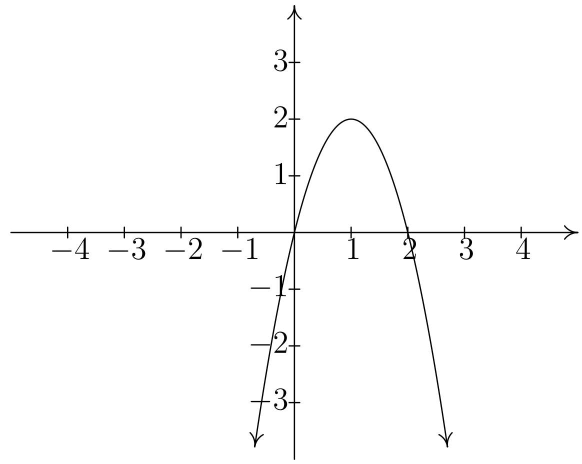
(e) $k(x) = \cos(\sin x)$

2. (6 points) Find $\dfrac{dy}{dx}$ if $xy + y^2 = 5x + 2$. You do *not* need to simplify your answer.

3. (5 points each) Consider the following graphs for functions f and g. Using the graphs, evaluate each of the following expressions. If an expression does not exist, write DNE.



Graph of f



Graph of g

(a) Find $g(1)$.

(b) Find $f'(2)$.

(c) Find $f'(1)$

(d) Find $g'(1)$.

(e) Suppose $h(x) = f(g(x))$. Find $h'(1)$.

4. (6 points) Suppose f is a differentiable function such that $f(2) = -1$ and $f'(2) = 1/2$. Use a tangent line to approximate the value of $f(1.9)$.

5. (6 points) The shock-waves from an earthquake on the ocean floor radiate out in the form of a circle on the surface of the ocean from its epicenter. If the radius of the shock-waves is increasing at a rate of 2 miles per second, what is the rate of change of the area enclosed by the radiating shock-waves when the radius is 5 miles? Give an exact answer. Your answer should be labeled with appropriate units.

6. (6 points) Find all critical numbers of the following function.

$$f(x) = 5x^{2/3} + x^{5/3}$$

7. (6 points) Use appropriate calculus techniques to find the absolute maximum and absolute minimum values of the function $f(x) = x^3 - 3x^2 - 9x + 5$ on the interval $[1, 4]$. Sufficient work must be shown.

8. (6 points) A truck driver handed in a ticket at a toll booth showing that in 2 hours he had covered 158 mi on a toll road with speed limit 70 mph. The driver was cited for speeding. Use the Mean Value Theorem to explain why. State the assumptions that we have to make about the position function $p(t)$ of the truck to be able to apply the Mean Value Theorem.

9. (5 points each) Provide an example of each of the following. You do *not* need to justify your answers.

   (a) An *equation* of a function f that is continuous everywhere, but not differentiable at $x = 1$.

   (b) An *equation* of a function g such that g has a critical number at $x = 0$, but g does not have a local maximum or local minimum at $x = 0$.

   (c) An *equation* of a function h such that h has a local maximum at $x = 0$, but $h'(0) \neq 0$.