

## Applied Calculus Fall 2015 Final Exam

Each problem is worth 20 pts. There are no calculators allowed. You must show all work to get full credit.

1 Find the indicated limit if it exists, for the following functions.

(a)  $\lim_{x \rightarrow -1} (x^2 + 1)$

(b)  $\lim_{x \rightarrow 3} \frac{9-x^2}{x-3}$

(c)  $\lim_{x \rightarrow -\infty} (2 + \frac{1}{x^2})$

2 Find the derivatives of the following functions:

(a)  $f(x) = 1 + 3x^4 + \frac{2}{\sqrt{x}}$

(b)  $g(x) = \sqrt{24 - 6x^5}$

3 Find the equations of the lines tangent to its graphs of the following functions at the given points.

$$f(z) = 3z^2 + 12z - 18 \text{ at } z = 0$$

4 Use implicit differentiation to find  $y'$  for

$$x + 2y = 2xy^2 + 4.$$

5 Given that  $p(x) = 45 - x$  describes the unit price (dollars) at which all  $x$  units will be sold. Find

- (a) The marginal revenue. Use your results to answer the following.  
(b) Estimate the revenue from the sale of the 11<sup>th</sup> unit.

6 For the function  $f(x) = x^3 - 12x + 10$ :

- (a) Find  $f'(x)$  and  $f''(x)$   
(b) Find the intervals where  $f(x)$  is increasing and decreasing. (Use interval notation.)  
(c) Find and identify all relative maxima and minima.  
(d) Find the intervals where  $f(x)$  is concave up and concave down (in interval notation).

7 Find the absolute minimum and maximum values of the following function for the stated interval.

$$f(x) = \frac{x^3}{3} + x^2 - 8x + 1 \text{ on } 0 \leq x \leq 3.$$

8 Find all the antiderivatives.

(a)  $\int (e^t + 2) dt$

(b)  $\int x^2(x^3 + 1)^{3/4} dx$

9 (a) Evaluate the definite integral  $\int_1^4 (3 + 2x + \frac{4}{x}) dx$

(b) Find the area of the region under the graph of  $f(x) = xe^{x^2}$  and bounded on the sides by  $x = 1$  and  $x = 2$ .

10 (a) Evaluate the integral using integration by parts:  $\int xe^{3x} dx$ .

(b) For the function  $f(x, y) = x^2y^3 + e^{2x+3y}$  find both partial derivatives,  $f_x(x, y)$  and  $f_y(x, y)$ .