

At the top of your bluebook, in BOLD letters, write EXAM 2 MAKEUP. On the front of your bluebook, write : your name, student ID, section, instructor, and a grading key. This exam is worth 100 points and has ?? questions. Show all work! Answers with no justification will receive no points. Please begin each problem on a new page. No notes, calculators, or electronic devices are permitted.

1. (15 points) True or False. If the statement is true, write out the word TRUE and *explain why it is true*. If the statement is false, write the word FALSE and *explain why it is false*.
  - (a) Suppose  $f'(c) = 0$  and  $f''(c) = 0$  as well. Then  $f(x)$  has a point of inflection at  $x = c$ .
  - (b) Let  $f(x) = x^3 + 3x + 1$ . If we were use Newton's Method to estimate the zero of  $f(x)$  with  $x_0 = 0$  then  $x_1 = 1/3$ .
  - (c) If  $f'(x) = g'(x)$  then  $f(x) = g(x)$ .
2. (18 points) Find the requested information.
  - (a) Find  $\frac{dy}{d\theta}$  when  $y = \left(\frac{\tan \theta}{1 + \sec \theta}\right)^3$  (Do not simplify your answer.)
  - (b)  $\lim_{x \rightarrow 0} \frac{x^2 - x - \sin(3x)}{2x}$
  - (c) Find  $\frac{dy}{dx}$  in the equation  $x + \sin y = xy$ .
3. (15 points) A conical tank of height  $h = 10$  ft and base radius  $r = 4$  ft is tipped over (apex down) and full of water. The water drains from the tank at the rate of  $5 \text{ ft}^3/\text{min}$ . How fast is the water level,  $h$ , dropping when  $h = 6$  ft?
4. (22 points) Suppose you know the following information about a function  $f(x)$ : (1)  $f'(x) = \frac{4 - x}{x^{1/3}(6 - x)^{2/3}}$ , (2)  $f''(x) = \frac{-8}{x^{4/3}(6 - x)^{5/3}}$ , and (3)  $f(x)$  has  $x$ -intercepts at  $x = 0$  and  $x = 6$ . Answer the following questions about the original function  $f(x)$ .
  - (a) On what interval(s) is  $f(x)$  increasing?
  - (b) Give the  $x$  coordinate of any local maxima or minima of  $f(x)$  that might exist.
  - (c) On what interval(s) is  $f(x)$  concave down?
  - (d) Give the  $x$  coordinate of any inflection point.
  - (e) Sketch the graph  $y = f(x)$ .
5. (15 points) Use linearization to find an approximation for the cube root of 26. Do you think it will be a good approximation? Why or why not?
6. (15 points) I plan to build a rectangular fenced in area in the back yard adjacent to my house. The area must be  $180 \text{ m}^2$  in order to provide enough room for my dog. What dimensions should the rectangle have so that I can use the least amount of fencing? No fencing is needed along the house. Check that your answer is indeed a minimum.