Old Calculus I Exam2

2/19/2009

1 Differentiation

Finfd $\frac{dy}{dx}$ for each of the following:

- $y = 3x^2\sqrt{4-x^2}$,
- $1 - xy = 2\sin y$
- $f(x) = (\cos(x^2)(\sin(x^2)$
- $f(x) = (\cos(x^2)(\sin(x^2)$
- $y = 3\sqrt{x} + \frac{1}{\sqrt{x}}$
- $y = \sin(2x)$
- $y = \sqrt{\tan(x)}$
- $y = \sin(x^3)$
- $y = [\frac{x^2-1}{x^2+1}]^2$
- $x^4 - y^3 - 3x^2 = 1$,

2 increasing/decreasing functions

Determine where the following are increasing/decreasing:

- $f'(x) = \frac{5x}{x+1}$
- $y = x^3 - 3x^2 + 3x$

3 concave up/down functions

Determine where the following are concave up/down:

- $f'' = x^2 - 4$
- $y = x^3 - 3x^2 + 3x$

4 local max/min

Determine where the following have local max/min:

- $f(x) = -4x^3 + 3x^2 + 18x + 1$
- $y = 9x^4 + 8x^3 - 5$

5 related rates

- Two cars start moving from the same point. One travels south at 50MPH, and the other travels east at 25MPH. You wish to find the rate at which the distance between them increasing 3 hours later.
  1. Draw a picture, labeling your variables.
  2. What rate(s) are you given?
  3. What rate do you wish to find at what instance in time?
  4. How can you relate your variables in parts (b) and (c)?
- Suppose that a liquid is to be cleared of sediment by pouring it through a cone shaped filter. Assume that the height of the cone is 16 inches and that the diameter of the cone is 8 inches. If the liquid is flowing out of the cone at a rate of 2 in^3/min, when the level is 8 inches deep, how fast is the depth of the liquid changing at that instant? (The volume of a cone is given by $V = \frac{1}{3}\pi r^2 h$.)