

TEST 2
Math 111 - 2, 4

Name _____

1. (8 points) Give me an example of a function that is continuous, but not differentiable. Explain why it is not differentiable. (Draw the graph of the function)

Extra credit (4 points): Give me another example, but this time make sure the reason that the function is not differentiable is different than for the above example. (I will be picky on this one)

2. (8 points) Translate the following sentence into the language of derivatives:

The height of a baby is increasing, but at a slower and slower rate.

(The baby grows more in the first year than in the second and so on)

(Make sure you tell me every letter you use stands for)

3. (15 points) Using the limit definition of derivative, find the derivative of f : (Make sure your answer is correct by taking the derivative using the rules we learned too)

$$f(x) = x^2 - 1$$

4. (15 points) Find the slope of the tangent line at $(2, \frac{\pi}{3})$ for the graph of the equation:

$$x^2 \cos y = 2$$

5. (24 points) Find the following derivatives, simplify your results:

(a) $\frac{d}{dx} (\sin(\cos(\sin(\pi x))))$

(b) $\frac{d}{dt} \left(\frac{3t^2 - 1}{2t - 7} \right)$

(c) $D_y ((\sin y)(\cos y^2))$

6. (15 points) An electron is moving along a horizontal coordinate line according to the formula:

$$s(t) = -2t^3 + 6t - 5$$

Answer the following:

- (a) When is the electron moving to the right?
- (b) When is the electron moving to the left?
- (c) When is the acceleration positive?
- (d) When is the acceleration negative?
- (e) Draw a schematic diagram showing the motion of the electron.

7. (15 points) The gravel pit north of Salt Lake is piling gravel up at a rate of 10 cubic feet per second. The pile is forming a nice cone. As the gravel is dumped on the top of the pile, the height of the pile is always $\frac{1}{7}$ the radius of the base of the pile.

(a) How fast is the height of the pile increasing when the pile is 1 foot high?

(b) How fast is the height of the pile increasing when the pile is 3 feet high?

(Hints: Draw a picture. What is changing? What is not changing? When do you use the 1 foot and the 3 feet? Volume of a cone is: $V = \frac{1}{3}\pi r^2 h$)