12-12:50pm

Midterm Exam 1

Fall 2012 Math 0220

100 points total **Your name:** _____

No calculators, no notes, no books. Show all your work (no work = no credit). Write neatly. Simplify your answers.

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1. (10 points) Find an equation of the tangent line to the curve $y = \dfrac{2}{(x-1)^2}$ at the point $(2, 2)$. Write the answer in the slope-intercept form.

2. (10 points) Evaluate the limit, if it exists. If it does not exist explain why.

$$\lim_{t \to -6} \frac{t+6}{2\,|t+6|}$$

In your work mention what Rules, Laws, Theorems or Formulas you use.

3. (10 points) Sketch the graph of an example of a function $g(x)$ if it satisfies all the given conditions

$$g(0) = 2, \quad g'(0) = -1, \quad \lim_{x \to 1^-} g(x) = 1, \quad \lim_{x \to 1^+} g(x) = -\infty,$$
$$g(3) = 1, \quad g'(3) = 1, \quad g'(5) = -1/2 \text{ and } \lim_{x \to \infty} g(x) = 0.$$

Mark all the essential points on the axes.

4. (10 points) Find the derivative of the function

$$f(x) = \frac{\sqrt{\cos x}}{2x^2 - 1}$$

Do not simplify your answer. In your work mention what Rules, Laws, Theorems or Formulas you use.

5. (10 points) A particle moves according to a law of motion $s(t) = 3t^2 - 12t + 2$, $t \geq 0$, where t is measured in seconds and s in feet.

   (a) (5 points) What is its velocity after 3 seconds?

   (b) (5 points) When is the particle at rest?

   (c) (5 points) Find the total distance traveled during the first 5 seconds.

6. (10 points) Find all horizontal asymptotes of the curve

$$y = \frac{\sqrt{9x^2 + 5}}{x + 6}$$

Justify your answer by calculating corresponding limits. [Use $\sqrt{x^2} = -x$ when $x < 0$.]

7. (15 points) A camera is located 40 feet away from a straight road along which a car is traveling with a constant speed of 70 feet per second. The camera turns so that it is pointed at the car at all times. In radians per second, how fast is the camera turning as the car passes closest to the camera?

8. (10 points) Use a linear approximation to estimate the number $(1.007)^8$.

9. (15 points) Use differentials to estimate the amount of paint needed to apply a coat of paint 0.02 cm thick to a hemispherical dome with diameter 120 cm.

bonus problem [10 points extra] Find the 21st derivative $f^{(21)}(x)$ of the function $f(x) = \sin x \cos x$.