10-10:50am

Midterm Exam 1

Spring 2012 Math 0220

100 points total **Your name:** _____

No calculators. Show all your work (no work = no credit). Explain every step. Write neatly.

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1. (a) (5 points) Determine whether $f(x) = x \tan x$ is even, odd or neither.
   (b) (5 points) Find the domain of the function $f(x)$.

2. (10 points) Graph the function

$$f(x) = \frac{1}{2}\tan\left(x + \frac{\pi}{4}\right)$$

by hand, not by plotting points, but by starting with the graph of one of the standard functions and then applying the appropriate transformations. Mark all essential points on the axes.

3. (15 points) Evaluate the limit, if it exists. If it does not exist explain why.

$$\lim_{x \to 5} \frac{\sqrt{x-1}-2}{3x-15}$$

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

4. (a) (10 points) Does the function $f(x) = \dfrac{x^2 + x - 6}{3x + 9}$ have removable discontinuity at -3. Support your answer.

(b) (5 points) If the discontinuity is removable, find a function $g(x)$ that agrees with $f(x)$ for $x \neq -3$ and is continuous at -3.

5. (10 points) Using the definition of the derivative find $f'(x)$ if

$$f(x) = \sqrt{1 + 2x}$$

No credit be given if the derivative will be found without using the definition.

6. (15 points) Find an equation of the normal line to the curve $y = x\sqrt{x}$ at the point which x-coordinate is 4.

7. (10 points) For the function $f(x) = \dfrac{3x^2}{x+1}$ find $f''(1)$.

8. (15 points) Find $\dfrac{dy}{dx}$ by implicit differentiation if $7 + x = \cos(xy^2)$.

bonus problem [8 points extra] Two curves are orthogonal if their tangent lines are perpendicular at each point of intersection.
Show that the curves $x^2 + y^2 = 5$ and $x + 2y = 0$ are orthogonal.