Name _____

MATH 180B Calculus and Analytic Geometry I Fall 2008 Exam #2

Instructions: You can work on the problems in any order. Do your work on separate paper. You do not need to write answers on the question sheet.

This exam is a tool to help me (and you) assess how well you are learning the course material. As such, you should report enough written detail for me to understand how you are thinking about each problem. (100 points total)

---

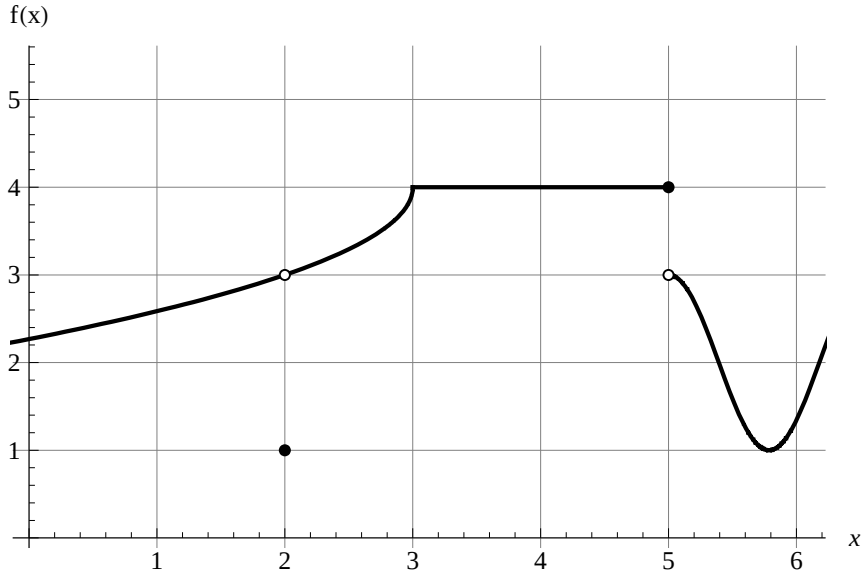
1. For each of the following, give a definition equivalent to that used in the text or in class. (4 points each)

   (a) f is *continuous* at $x = a$

   (b) the *derivative* f' of f

2. Sketch a plot that illustrates the geometric meaning of the difference quotient $\dfrac{f(x+h) - f(x)}{h}$. (5 points)

3. Consider the function with graph plotted here:



   (a) Analyze continuity for this function for the interval $(0, 6)$. That is, determine where this function is continuous and where it is not continuous. Indicate or explain how your reach your conclusion. (4 points)

   (b) Analyze differentiabilty for this function for the interval $(0, 6)$. That is, determine where this function is differentiable and where it is not differentiable. Indicate or explain how your reach your conclusion. (4 points)

4. Compute the derivative of $f(x) = 7x^2$ starting from the definition of derivative. (7 points)

5. For each of the following, compute the derivative of the given function. (7 points each)

   (a) $f(x) = 5x^3 - 4x^2 + x - 10$

   (b) $y = x^2 e^x$

   (c) $y = xe^{x^2}$

   (d) $p = \left(\dfrac{q+3}{q^2+1}\right)^3$

   (e) $w(z) = 4\cos(5z)$

   (f) $f(\theta) = \dfrac{\sin\theta}{\theta^3}$

6. Compute the second derivative of $f(x) = \sin(x^2)$. (8 points)

7. Find all values of x for which the function $f(x) = x^5 - 20x^3$ has a horizontal tangent line. (10 points)

8. Use the derivative results for $\sin x$ and $\cos x$ (that you should know) to determine the derivative of $\tan x$. (6 points)

9. In physics, something called the *kinetic energy* K of an object is related to the mass m and velocity v of the object by the formula

$$K = \frac{1}{2}mv^2.$$

   Compute the rate of change in kinetic energy with respect to velocity, assuming the mass is constant. (6 points)