MATH 1426 SPRING 2009

Problem Solving: Worksheet 4

NAME:________________________

Study Technique 5 On getting a test returned, go over the questions that you did incorrectly and make sure you understand how to do those questions. Keep the test, and, a day or so before your next test, rework the test while simulating a test atmosphere (no lecture notes, no phone calls, no TV, no radio, etc). If you run out of time, draw a line across at the "time up" mark, and continue to work the test, and write down how much extra time was needed to finish the test. This will give you an idea of how fast you will need to work in order to finish the real test. Ideally, you will have time to enact such a simulation a few times with different practice tests, and so get adjusted to the test atmosphere.

Due at the start of lecture on Thurs Feb 26, 2009.

Answer the following questions in groups of two, but turn in one solution sheet per student. Write neatly and orderly as points will be deducted for messy work. No work shown $\Rightarrow$ partial/full credit not possible, so show as much work as possible.

1. The time for a chemical reaction, T (in minutes), is a function, f, of the amount, a (in milliliters), of catalyst present, so $T = f(a)$.

   (a) If $f(5) = 18$, what are the units of 5? What are the units of 18? What does this statement tell us about the reaction?

   (b) If $f'(5) = -3$, what are the units of 5? What are the units of 3? What does this statement tell us?

2. Suppose that for some function, g, with domain $\mathbb{R} = (-\infty,\ \infty)$, we know that $\displaystyle\lim_{h\to 0} \frac{g(x+h) - g(x)}{h} = \frac{4}{3}\, x^{-2/3}\,(x+1)$.

   (a) Find the x-coordinates of all points on the graph of $y = g(x)$ where the tangent line is horizontal; if no such points exist, explain why not.

   (b) Find the x-coordinates of all points on the graph of $y = g(x)$ where the tangent line is vertical; if no such points exist, explain why not.

3. (a) As you know, many lines pass through the origin. Give equations for three specific lines that pass through the origin. Give an equation for an arbitrary (i.e., nonspecific) line that passes through the origin.

(b) The derivative of $\frac{1}{x}$ at $x = a$ is $-\frac{1}{a^2}$. Find an equation for the tangent line to the graph of $y = \frac{1}{x}$ at $x = a$.

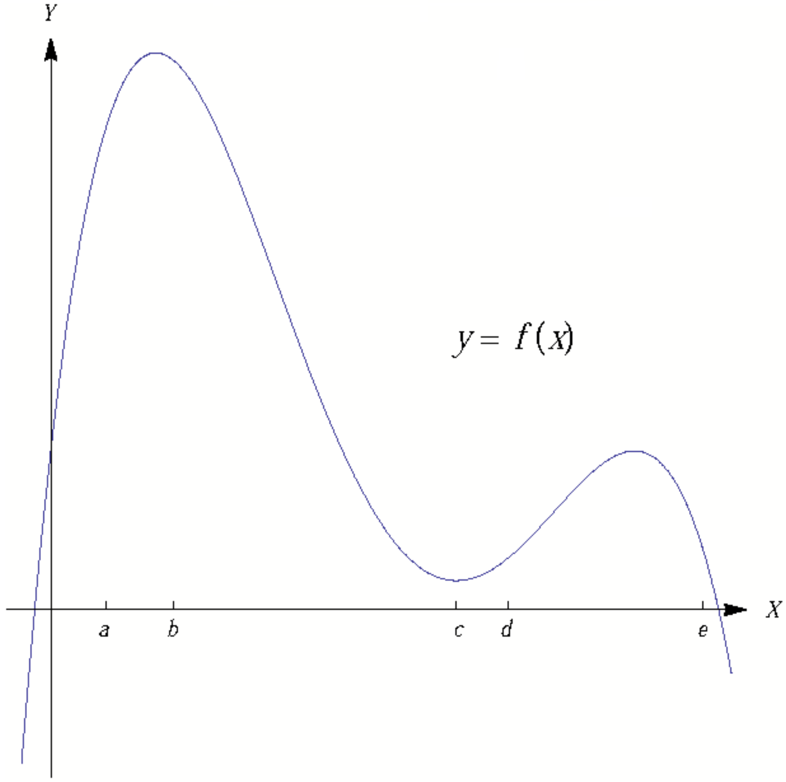
(c) Show that no line that is tangent to the graph of $y = \frac{1}{x}$ passes through the origin. Hint: recall (a) & (b).

4. (a) As you know, many lines pass through the point $(5, 0)$. Give equations for three specific lines that pass through $(5, 0)$. Give an equation for an arbitrary (i.e., nonspecific) line that passes through $(5, 0)$.

(b) The derivative of x^2 at $x = a$ is $2a$. Find all points on the graph of $y = x^2$ with tangent lines passing through the point $(5, 0)$.

5. Use the definition of the derivative to show that the derivative of $f(x) = \sqrt{x-1}$ is $f'(x) = \frac{1}{2\sqrt{x-1}}$.

6. The figure below shows the graph of $y = f(x)$. Match the derivatives in the table with the points a, b, c, d, e. Explain your reasoning.



x	$f'(x)$
	0
	0.5
	2
	–0.5
	–2

7. Label points A, B, C, D, E, and F on the graph of $y = f(x)$ in the figure below.
   a. Point A is a point on the curve where the derivative is negative.
   b. Point B is a point on the curve where the value of the function is negative.
   c. Point C is a point on the curve where the derivative is largest.
   d. Point D is a point on the curve where the derivative is zero.
   e. Points E and F are different points on the curve where the derivative is about the same.
   f. Graph another function (of your choice) and label points A-F that satisfy the conditions in parts a-e for your function.