

Math 124 Midterm 1 Autumn 2005

Name:

TA Section:

1. There are FOUR questions in all. The test ends on page 6.
2. Read the questions carefully.
3. Show all your work to get full credit. Give all units.
4. There is a blank sheet at the end that you can tear out and use for scratch work.
5. You may use a scientific calculator. No notes or graphing calculators are allowed.

Problem #1	Problem #2	Problem #3	Problem #4	Total Points

Problem 1. (10 points) When a camera flash goes off, the batteries immediately begin to recharge the flash's capacitor which stores electric charge given by

$$Q(t) = Q_0(1 - e^{-t/a}).$$

Assume a is a positive number.

(a) What is the significance of Q_0 ?

(b) Explain why the function Q can be inverted.

(c) Find the inverse function.

(d) How long does it take to recharge the capacitor to 50% of capacity if $a = 3$?

Problem 2. (10 points) Show all steps and give reasons for your calculations.

(a) Let $f(x) = \frac{|x|}{x} - \frac{1}{2+x}$. Calculate $\lim_{x \rightarrow 0} f(x)$ if it exists.

(b) Calculate the horizontal asymptote of the function $f(t) = \frac{t+2}{\sqrt{9t^2+1}}$ as $t \rightarrow \infty$ if it exists.

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(c) Find the rate of change of the function $f(x) = \frac{1}{\sqrt{5-2x}}$ at the point $(a, f(a))$.

Problem 3. (10 points) (a) Find the number p such that the following limit exists.

$$\lim_{x \rightarrow -2} \frac{2x^2 + px + p + 3}{x^2 + x - 2}$$

(b) Using the value of p found above, calculate the limit.

(c) Again using the value of p found in part (a) find all values of x at which the function $y = \frac{2x^2 + px + p + 3}{x^2 + x - 2}$ is continuous.

Problem 4. (10 points) A golf ball is hit toward the cup from a distance of 50 feet.

Assume that the distance of the ball from the cup at time t seconds is given by the function

$$d(t) = 50 - 20t + 2t^2.$$

(a) Using limits, calculate the derivative $d'(t)$. Give units.

(b) What is the physical interpretation of $d'(t)$?

(c) At what time is the slope of the tangent line to the graph of $d(t)$ parallel to the line $d(t) = t$?

SCRATCH PAPER