

Math 111-H03, Problem Set #3, 6 Nov 2007

Be sure to carefully show all work. Hand in Problems 4-9.

Problem 1 For what values of c does the equation $3x + c = e^x$ have exactly one solution.

Problem 2 I am skating around a skating rink in an elliptical pattern, tracing out $9x^2 + 25y^2 = 225$. I carry a flashlight and when it gets too dark, I turn on the flashlight. I skate at 10 ft/sec past the point $(5, 0)$. How fast is the angle of my light changing?

Problem 3 The hands of the NJIT Clock Tower are 40 inches and 30 inches long, respectively. How fast are the ends approaching each other at four o'clock?

Problem 4 An airplane loses altitude at the rate of 400 miles/hr. What is the rate of decrease of the visible portion of the surface of the Earth when the plane is one mile above the surface? Take the radius of the Earth to be 4000 miles.

Problem 5 Approximate $\sqrt{189}$ a) using linear approximation, b) using quadratic approximation. Compare the approximations with the answer from your calculator.

Problem 6 A particle is confined to move along the parabola $y = x^2$. (a) at what point on the curve are the x - and y -coordinates changing at the same rate? (b) If the motion is given by $x = \sin t$ and $y = \sin^2 t$, find this rate.

Problem 7 Let

$$y = x(2x - 1)^2(x + 3)^3.$$

Find d^6y/dx^6 and d^7y/dx^7 .

Problem 8 Show that the function

$$y = C_1 \cosh x + C_2 \sinh x,$$

where C_1 and C_2 are arbitrary constants, satisfies the equation $y'' - y = 0$.

Problem 9 Sketch the graph of the function below indicating all the intervals of increase and decrease, as well as the intervals of concavity up and down.

$$y = x(x - 1)^{1/3}.$$