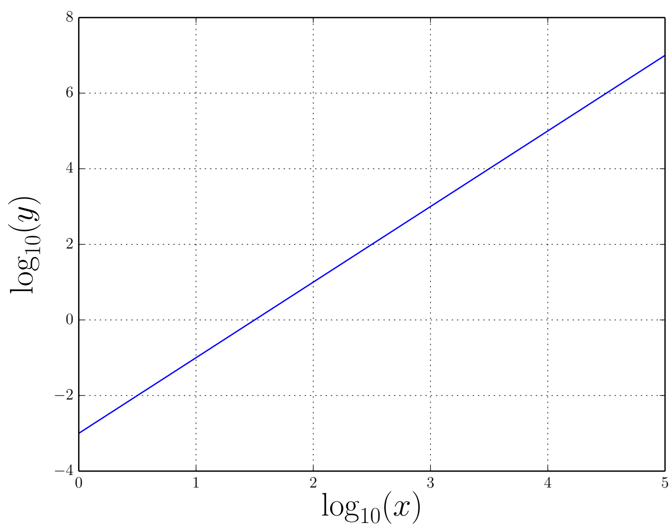
Applied Calculus

Midterm Exam III

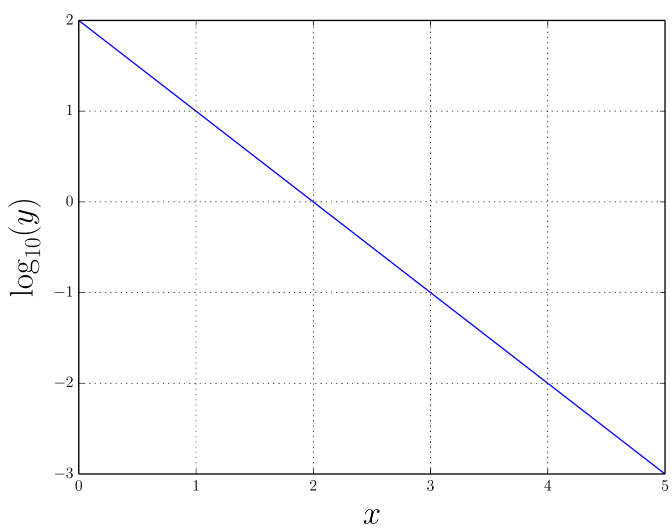
November 5, 2015

1. For each graph, determine y as a function of x.

(a)



(b)



(10+10)

2. Find first and the second derivative of the function

$$f(x) = \ln(\sin x)\,.$$

Simplify your result by recalling from class that $\sin^2 x + \cos^2 x = 1$. (5+5+5)

3. Find the minimum and the maximum value of the function

$$f(x) = x^3 - 3x^2 + 3x - 1$$

on the interval $0 \le x \le 2$. (10)

4. Consider the function

$$f(x) = \ln(4 - x^2)$$

For which values of x is the function defined? Find the vertical and horizontal asymptotes (if any), find and classify all critical points, determine where the function is concave up or concave down, find all points of inflection, and sketch the graph into the coordinate system provided. (5+5+5+5+5)

5. The marketing department has determined that demand D (defined as the number of units sold) for a new product is decreasing exponentially with price p, i.e.,

$$D(p) = N\,e^{-rp}$$

for some constants N and r. How much should you charge to maximize revenue? Does your solution formula depend on N? State a reason for this in economic terms. (15)

6. A box with a square base and open top must be constructed using no more than $2\,\mathrm{m}^2$ of material. Find the dimensions of the box that maximize its volume. (15)