Math 17A
Kouba
Discussion Sheet 9

1.) Do detailed graphing (See instruction sheet from class.) for each function

a.) $y = x(x-4)$ on the interval $[0,5]$ b.) $y = x(x-5)^4$

c.) $f(x) = \dfrac{3x^2}{x-4}$ d.) $f(x) = 4\sqrt{x} - x$

e.) $y = \sin x + \cos x$ on the interval $[0, 2\pi]$ f.) $y = x(x-4)^3$

g.) $f(x) = \dfrac{x^2}{x^2-4}$ h.) $f(x) = 3x^{1/3} - x$

2.) Let $f(x) = \begin{cases} 2 + x^2 , & \text{if } 0 \le x \le 1 \\ 2x^3 + 1 , & \text{if } 1 < x \le 2 \end{cases}$

a.) Sketch the graph of f .

b.) Show that f does NOT satisfy the assumptions of the Mean Value Theorem on the interval $[0, 2]$.

3.) Consider the function $y = \sqrt{3}\cos x - \sin x$ for $0 \le x \le 2\pi$. Determine all points (x, y) corresponding to the absolute and relative extrema and inflection points for f.

4.) Let $f(x) = \begin{cases} -x^2 , & \text{if } -1 \le x \le 0 \\ x^2(x-1) , & \text{if } 0 < x \le 2 . \end{cases}$

a.) Sketch the graph of f .

b.) Show that f satisfies the conditions of the Mean Value Theorem (MVT) over the interval [-1, 2], including special attention at $x = 0$, and determine all values of c guaranteed by the MVT.

5.) Assume that the derivative of $y = f(x)$ is $f'(x) = x^2(5-x)^3$. Determine the x-values for inflection points on the graph of f.

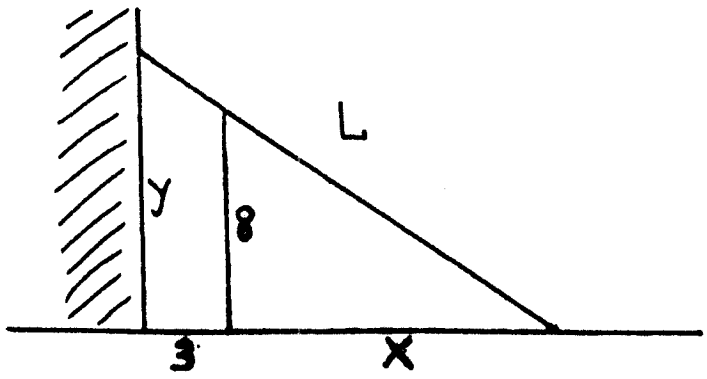
6.) An open cylindrical can is to hold 64π in.^{3} . What radius, r, and height, h, will require the least amount of material ?

7.) A farmer has 600 ft. of fencing to construct a rectangular pigpen divided into four equal-sized, parallel, rectangular sections. What dimensions will result in the largest possible total area of the pigpen ?

8.) A hiker is 6 miles directly west of a North-South road and her cabin is 10 miles North of the point on the road nearset to her. If she can walk at 4 mph off the road and at 5 mph on the road, find the least amount of time for her to reach the cabin.

9.) Find the dimensions of the rectangle of largest area which can be inscribed in a circle of radius 6 .

10.) Determine the length of the shortest ladder which will reach over an 8-ft. high fence to a large wall which is 3 ft. behind the fence.



11.) There are 100 peach trees in an orchard. Each tree produces 500 peaches. For each additional group of 10 trees planted in the orchard, the output per tree drops by 20 peaches. How many trees should be added to the existing orchard in order to maximize the total output of peaches ?

12.) Find the point (x, y) on the graph of $y = x^2$ which is nearest the point $(0, 9/2)$.

13.) Find the point $P = (x, 0)$ on the x-axis which minimizes the sum of distances from $(0, 4)$ to P and from P to $(3, 2)$.

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The following problem is for recreational purposes only.

14.) Two bicyclists are twelve miles apart. They begin riding toward each other, one pedaling at 4 mph and the other at 2 mph. At the same time a bumblebee begins flying back and forth between the riders at a constant speed of 10 mph. What is the total distance the bumblebee travels by the time the riders meet ?