Math 34B Practice Final

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Problem 1

My shiny Eevee has movement speed $v(t) = 2t+13$ at a given time t (measured in miles per hour). How many hours would it take her to travel from to Vaniville Town to Luminose City, a distance of 140 miles?

Problem 2

This problem will focus on the following trigonometric function:

$$y(x) = 7\sin(2x) + 1.$$

(a) Graph this sine wave on the x-y coordinate plane on the interval from $x = 0$ to $x = \pi$.

(b) Label the maximum point on your graph. Be sure to note both the x and y value.

(c) Using calculus methods (i.e. first derivative and second derivative test), confirm your findings from part (b).

(a)

(b)

(c)

Problem 3

Someone placed a bottle of water in a freezer. The freezer is set to a temperature of $-15°$ Fahrenheit, and the water bottle is initially $50°$ Fahrenheit. The water cools to $40°$ Fahrenheit after being in the freezer for 30 minutes. Assuming the water abides by Newton's Law of Cooling, how cold will it be after sitting in the freezer for one hour?

Problem 4

Bacteria is growing in a petri dish (with maximum capacity 200 mg) at a rate given by the logistic equation. Initially, there are 10 mg of bacteria. This amount increases to 50 mg after one day.

(a) Write the differential equation that describes this scenario. Be sure to solve for any variables.

(b) How much bacteria is there in the petri dish after 2 days?

(a)

(b)

Problem 5

A water tank has a square base with sides of length 3 meters. It is 8 meters deep. Initially it is full of water. The water is then drained out so that after t hours, water is leaving the tank at a rate of $4t\ m^3/hr$.

(a) Write an expression that represents the volume of the water in the tank after k hours.

(b) What is the depth of the water after k hours?

(c) How many hours until the tank is empty?

(a)

(b)

(c)

Problem 6

This problem will focus on the following two-variable function:

$$f(x, y) = 6x + 2xy - 11y + 3.$$

(a) Find $f_x(x, y)$.

(b) Find $f_y(x, y)$.

(c) Find $f_{xy}(x, y)$.

(d) Use parts (a) and (b) to find the critical point of $f(x, y)$.

(e) Say the height of a point (x, y) on a hill is given by $f(x, y)$.

(i) What is the approximate difference in height between the points $(1, 2)$ and $(1.02, 2.01)$ on this hill?

(ii) More generally, what is the approximate difference in height between the points $(1, 2)$ and $(1 + \Delta x, 2 + \Delta y)$ on this hill?

(a)

(b)

(c)

(d)

(e) (i)

(ii)