Online Homework System

Assignment Worksheet
12/15/20 - 4:25:08 PM EST

Name: ______________________________
Class #: ______________________________
Instructor: Mihai Nica

Class: Calculus 1 - MATH*1200 - F20
Section #: ______________________________
Assignment: Practice Final Exam

Question 1: (0 points)

Instructions:

-In all problems, explain your work carefully. A correct final answer that is not carefully explaineed will NOT recieve full marks. You must demonstrate your knowledge and skill with the course topics to get full marks.

-You are allowed to bring in 10 one sided pages of notes to the exam with you

-You are not allowed to use a calculator. Since you do not have a calculator, you are not expected to simplify your final answers. For example, $10 + \frac{2}{3} + \sin(40)$ is a perfectly fine final answer to a question.

-During the real exam you must be on the Zoom call with your video turned on during the exam. For the practice exam, there is no Zoom call.

-If you are printing the exam, you will be given 5 minutes before the exam starts to print the exam.

-If you are not printing the exam, you must use the proctored version of the Mobius along with Zoom in the background during the test.

-Note that the practice exam does NOT include all possible topics that could appear on the exam (in a 2 hour test, it is impossible to fit all the topics in). Be sure you have looked at the full list of topics announced in class before the real exam.

Q1a) Evaluate $\lim_{x\to 1} \frac{x^2-3x+2}{x-1}$. Explain your work carefully and indicate where you used any of the limit laws.

Q1b) Evaluate $\lim_{x\to\infty} \frac{\sqrt{x^3}-x^{1/5}}{x^{1/4}}$. Explain your work carefully and indicate where you used any of the limit laws.

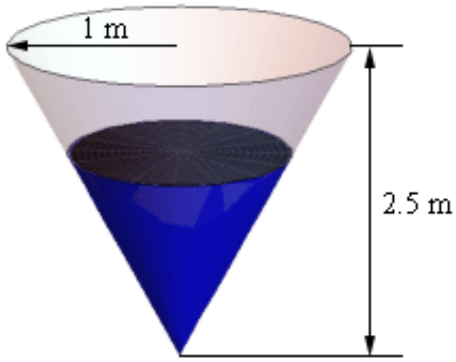
Q2a) Let $f(x) = x^2$. Write down the limit definition for the derivative $f'(x)$.

Q2b) Use the limit definition from part a) and an epsilon-delta proof to prove that $f'(x) = 2x$.

Q3a) Let $g(t) = t^2 \ln(t)$. Find $\frac{d^2 g}{dt^2}$.

Q3b) Let f be a differentiable function that satifisfies $f(x^2) = f(x) + x^2$. Use implicit differentiation to find $f'(1)$. Explain your work carefully.

Q4 A tank of water is in the shape of a cone (assume the “point” of the cone is pointing downwards) and is leaking water at a rate of 35 cm^3/sec. The base radius of the tank is 1 meter and the height of the tank is 2.5 meters. When the depth of the water is 1.25 meters at what rate is the depth of water in the cone changing? Be sure to carefully set up the variable, functions and relationships being used in this problem. Explaining your work is worth more marks than the final answer.



(Hint #1: You should use the formula for the volume of a cone $V = \frac{1}{3}\pi r^2 h$ where h is the height of the cone and r is its radius.Hint #2: The slope of the side of the cone is always constant. This fact will help you relate the height of water to the depth of water in the cone.)

Q5 Find the values of the constants a and b such that the function $f(x) = ax^3 + bx^2 + 5x$ has a horizontal tangent at $x = 1$ ad a point of inflection at $x = 2$. Explain your work carefully.

Q6 Find the minimum and maximum of the function $f(x) = e^x + 5e^{-x}$ on the interval $[-\ln(2), \ln(5)]$. Explain your work carefully.

Q7a) Evaluate $\int (x+2)\sqrt[3]{4x+3}dx$. Explain your work carefully.

Q7b) Evaluate $\int \sqrt[4]{e^{5t} + e^{4t}}dt$. Explain your work carefully. (Hint: Factor first!!!)

Q8 Let $F(x) = \int_2^{2x} e^{-t^2}\, dt$. This integral is impossible to find a formula for; do NOT attempt to find a formula for this integral. Even though there is no formula, it is possible to work with F in some ways.

Q8a) Find $F(1)$. Explain your work carefully.

Q8b) Find $F'(1)$. Explain your work carefully.

Q9 Let $f(x) = x^2$ and $g(x) = 3x + 2$

Q9a) Draw a sketch of the graphs of f and g. (Hint: You can do this because f and g are very simple functions; no calculation is needed here). Label the points where the functions intersect.

Q9b) Calculate the area of the region between f and g using vertical rectangles.

Q9c) Calculate the area of the region between f and g using horizontal rectangles.

Q10 At $t = 0$ seconds, Chandelle begins downloading a file, which transfers at a rate of $24 + 12\sin(t)$ MB per second.

Q10a) What is the total amount of data transferred after 10 seconds have passed, assuming that the download is not yet finished? Explain your work carefully.

Q10b) What is the average download rate over the first 10 seconds?