
Math 130 Exam 2 Sample 2

Directions: Do not simplify unless indicated. Non-graphing calculators are permitted. Show all work as appropriate for the methods taught in this course. Partial credit will be given for any work or words which are relevant to the problem. Units should be included for all real-world problems.

Please put problem 1 on answer sheet 1

1. Calculate each of the following derivatives:

- (a) $\frac{d}{dt} \frac{t+1}{2t-3}$. Simplify.
 - (b) $\frac{d}{dx} \sqrt{x^2 + 4x - 1}$
 - (c) $\frac{d}{dq} \ln\left(\frac{q-1}{q^2 - e^q}\right)$
 - (d) $\frac{d}{ds} (s^2 + 1) \cos(3s^2 + \sqrt{s-1})$
 - (e) $\frac{d}{dx} 2^{4x^2+x-1}$
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Please put problem 2 on answer sheet 2

- 2. (a) Find the equation of the line tangent to the graph of $f(x) = \log_2(x^2 - 8)$ at $x = 4$.
 - (b) Find and justify the inflection point for the following population growth function $P(t) = \frac{3000}{1+20e^{-0.02t}}$. Give an exact value and an approximation to two decimal digits.
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Please put problem 3 on answer sheet 3

- 3. (a) Suppose the population of bacteria in a culture after t days is given by $P(t) = \frac{300}{1+2e^{-0.02t}}$. Find and interpret $P(7)$ and $P'(7)$. Give exact answers and approximations to two decimal places.
 - (b) Suppose $m(t)$ gives the amount of medicine in a patient in mg after t hours. For each of the following write a sentence which explains what is happening:
 - i. $m(3) = 5$, $m'(3) = 0.4$ and $m''(3) = +$.
 - ii. $m(3) = 2$, $m'(3) = -0.4$ and $m''(3) = +$.
 - iii. $m(3) = 10$, $m'(3) = 1.1$ and $m''(3) = -$.
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Please put problem 4 on answer sheet 4

- 4. (a) Find the largest open interval on which $f(x)$ is increasing and the largest open interval on which $f(x)$ is decreasing for

$$f(x) = \sqrt{(x-4)^2 + 5}$$

- (b) Find the x -value of all point(s) where the function $g(x)$ has a relative maximum or minimum. Identify each.

$$g(x) = x^2 + \frac{16}{x}$$

Please put problem 5 on answer sheet 5

5. Consider the function with derivatives as given:

$$f(x) = \left(\frac{x+2}{x-1}\right)^2 \quad f'(x) = \frac{-6x-12}{(x-1)^3} \quad f''(x) = \frac{12x+42}{(x-1)^4}$$

Find and use all of: y -intercept, increasing/decreasing, relative extrema, and concavity to sketch the graph of $f(x)$.
