Final Exam Study Guide

MATH 140 Lab: Section 1

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Student's Name:--

Student's ID:-------------------------

Note: This study guide contains my practice questions that I think will be useful for preparing you for the final exam in Calculus for Life Scientists.

Question 1: Evaluate the following limit:

$$\lim_{k \to \infty} (\ln k + e^k)$$

Question 2: Evaluate the following limit:

$$\lim_{n \to 1} \left(\frac{\tan(n-1)}{(n-1)} \right)$$

Question 3: Evaluate the following limit:

$$\lim_{x \to -\infty} \left(\frac{(2x^2 + 1)^2 - x^4 + x + 1}{1 - x - 2x^2} \right)$$

Question 4: Evaluate the following limit:

$$\lim_{z \to 1} \left(\frac{\tan(z - 1)}{z^3 - 1} \right)$$

Question 5: Find y' without simplifying your final answer:

$$y = \sqrt{\frac{2x^2 e^x (x + 1)}{x^2 + 1}}$$

Question 6: Find y' without simplifying your final answer:

$$y = (\sin(x))^x$$

Question 7: Evaluate the following limit:

$$\lim_{x \to 0^+} \left(\frac{1}{x} - \frac{1}{e^x - 1} \right)$$

Question 8: Evaluate the following limit:

$$\lim_{x \to 0} \left(\frac{x^3}{x - \tan(x)} \right)$$

Question 9: Use L'Hôpital's rule to find the following limit:

$$\lim_{x \to 1} \left(\frac{1 - x + \ln x}{1 + \cos(\pi x)} \right)$$

Question 10: Find $\frac{dy}{dx}$:

$$y = \sin\left(x + \sqrt{x^2 + 5}\right)$$

Question 11: Find $\frac{d^2y}{dx^2}$:

$$xy + x^2 = y^3$$

Question 12: Find the equation of the tangent line at the point $(0,1)$
to the following curve:

$$x^2y + 7y = 3e^x + 4$$

Question 13: Evaluate the following limit:

$$\lim_{x \to \infty} \left(\frac{x + 3}{x} \right)^{2x}$$

Question 14: Given the following function:

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

Part a: Find the x and y intercepts for the graph of f.

Part b: Find the intervals on which the function is increasing and decreasing and locate any local extrema.

Part c: Find the intervals on which the function is concave up and concave down and identify aby inflection points if there are any.

Part d: Sketch the graph of f.

Question 15: Find the indefinite integral for the following:

a. $\int \frac{(x+2)(x-1)}{x} dx$

b. $\int \frac{4x^3+2}{2x^4+4x+1} dx$

c. $\int (\sec x \tan(x) + \cos(3x) - 5) \, dx$

d. $\int \frac{x^4+3}{x} dx$

e. $\int \left(e^{3x} + \frac{1}{\sqrt[3]{x}} \right) dx$

f. $\int x^3 \left(\sqrt{x} - 3 \right)^2 dx$

Question 16: Find the definite integral for the following:

$$\int_1^e \frac{(\ln(x))^2}{x}\,dx$$

Question 17: Find the following integral for the following:

$$\int \cos(\sqrt[3]{x})\,dx$$

Hint: Use substitution and integration by parts

Question 18: Solve the following differential equation:

$$\frac{dy}{dx} = e^{3y+2x}$$

Question 19: Given the following function:

$$y(t) = \frac{a}{k}(1 - e^{-kt})$$

Assume that an antibiotic with half-life $T_{\frac{1}{2}} = 12 \ hour$ is given to a patient intravenously at a rate of $a = 50 \ mg/hour$.

Part a: Find the rate constant k.

Part b: Given that: $\frac{dy}{dt} = a - ky$. What is the steady state solution for the amount of drug delivered by infusion in $\frac{dy}{dt}$.

Question 20: A rectangle has its base on the x-axis and its upper two vertices on the parabola $y = 12 - x^2$. Find the largest area that the rectangle can have?

Good Luck in Final Exam
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