

Exam I

Math 021 Section Z1

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- The exam is out of 60 points. There are a total of 6 questions, 10 points each.
 - **Do not discuss the contents of this exam with anyone. (including Google!)**
 - *You must show all work to receive full credit.*
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Name_____

Problem 1: Continuity.

a: Using interval notation, give the interval where the function is continuous:

$$f(x) = \frac{\ln(x^2 - 4)}{x^2 - 16}$$

b: Find the value of k that makes the function continuous: $f(x) = \begin{cases} kx^2 + 1 & \text{if } x \leq 2 \\ x + k & \text{if } x > 2 \end{cases}$

Problem 2: Evaluate the following limits.

a: $\lim_{x \rightarrow -2} \frac{x^3 - 3x^2 - 10x}{x^2 + 2x}$

b) $\lim_{x \rightarrow 81} \frac{\sqrt{x} - 9}{x - 81}$

c: $\lim_{x \rightarrow \infty} \frac{8 - 4x^3}{5x^2 + 7x + 10}$

d: $\lim_{x \rightarrow \infty} \frac{\sqrt{5x + 3x^4}}{6 + 7x + 4x^2}$

Problem 3: Suppose the position function of a skier during a run can be modeled by the function: $s(t) = 3t^2 + 4t$. Where t is time measured in seconds, the position $s(t)$ is measured in meters from the base lodge.

a) Find the velocity function, $v(t) = s'(t)$, using the formal definition of the derivative

$$s'(x) = \lim_{h \rightarrow 0} \frac{s(x+h) - s(x)}{h}$$

b) Find the average velocity between $t_1 = 1$ and $t_2 = 3$ seconds. (Hint: This is an average rate of change, or the slope of the secant line between these two points : $s_{avg} = \frac{s(t_2) - s(t_1)}{t_2 - t_1}$)

Problem 4: For each of the following functions find the derivative with respect to x .

a) a: $\frac{d}{dx}[x^5 + 3\pi^2x^3 + \ln(6)]$

b) $\frac{d}{dx}\left[\frac{x^2 + \sqrt{x}}{x}\right] =$

c) $\frac{d}{dx}\left[3x^{\frac{1}{3}} + 2\sqrt{x} - \frac{1}{x}\right] =$

d) Let $f(x) = x^3 + 4x^2 + 5$. Find $f'(x)$. Then find the equation of the tangent line when $x = 1$ i.e. at the point $(1, f(1))$

Problem 5: For each of the following functions find the derivative with respect to x .

a: $f(x) = (\sqrt{x^3 + 1})(x + 5)^5$

b: $f(x) = \frac{\ln(x^2)}{x^2 + 1}$

c: $f(x) = e^{x^3}(x^2 + 1)$

Problem 6: For each of the following functions find the derivative with respect to x .

a)

$$f(x) = (2x^5 + 3x^3 + 3x + 5)^{10}$$

b)

$$g(x) = e^{(3x^2 + \sqrt{x})^3}$$

c)

$$f(x) = \ln(4x^2 + 3)^{4/5}$$