
Serial No:

Student No.:

Name:

- 1. SHOW ALL WORK. NO CREDITS FOR ANSWERS NOT SUPPORTED BY WORK.**
2. CALCULATORS ARE NOT ALLOWED.

Problem 1 (20 Points): If the limit exists find it. If it does not exist, say so; use ∞ and $-\infty$ when appropriate.

(a) $\lim_{x \rightarrow 1} \frac{x^2 - 2x + 1}{x^2 - 1} =$

(b) $\lim_{x \rightarrow \infty} \frac{x^2 - 2x + 1}{x^2 - 1} =$

(c) $\lim_{x \rightarrow 1^-} \left[1 + \frac{1}{x - 1} \right] =$

(d) $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ where $f(x) = \sqrt{2x+1}$

Problem 2 (30 Points):

(a) Consider the function whose graph is given in the figure

$$f(x) = \begin{cases} x+2 & \text{if } x \leq 0 \\ 0.75x^2 & \text{if } 0 < x < 2 \\ 2/x & \text{if } 2 < x \end{cases}$$

Find

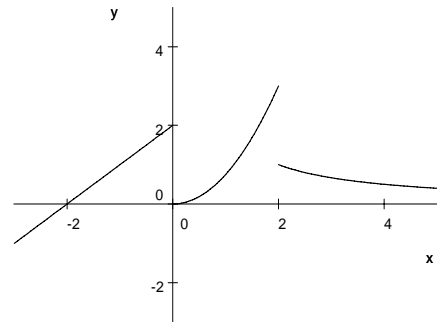
$$\lim_{x \rightarrow 0^-} f(x) =$$

$$\lim_{x \rightarrow 0^+} f(x) =$$

$$\lim_{x \rightarrow 2^-} f(x) =$$

$$\lim_{x \rightarrow \infty} f(x) =$$

$$\lim_{x \rightarrow -\infty} f(x) =$$



(b) The volume V of a spherical cell is given by $V = \frac{4}{3}\pi r^3$, where r is the radius. Find the rate of change of volume with respect to the radius when $r = 3 \times 10^{-2}$ cm. Give your answer in terms of π .

(c) The average cost \bar{c} of producing q units of a product is given by

$$\bar{c} = 0.001q^2 - 0.2q + 11 + \frac{1500}{q}. \text{ Find the marginal cost when } q = 100 \text{ and interpret your result.}$$

Problem 3 (22 Points)

(a) Find the equation of the line tangent to the graph of $y^3 + e^{xy} = x$ at the point $(1, 0)$.

(b) If the saving function is $S = 7 + 0.6I - 0.25\sqrt{I}$, find the marginal propensity to consume when $I = 25$.

(c) The derivative of the revenue function (the marginal revenue function) for a product is given by $R'(x) = \frac{1}{1+x^2}$. Use this information to determine all values of x where the function is continuous.

Problem 4 (28 Points)

(a) Find the value(s) of a which will make the function $f(x)$ continuous.

$$f(x) = \begin{cases} \frac{x^2 - 9}{x - 3} & \text{if } x \neq 3 \\ a - 1 & \text{if } x = 3 \end{cases}$$

(b) If $y = \sqrt{3^x}$, find $y'(0)$.

(c) Find the derivative of $y = \log_2 \sqrt{x^2 + 1}$.

(d) If $y = e^{\ln x^2}$ find y' .