

QUESTION 3:

(12 Marks)

Find $\frac{dy}{dx}$ for the following :

1. $y = x^4 + x^{-3} + 2$

2. $y = \cos(3x^2)$

3. $y = \log_3(x^2 + 5)$

4. $y = \pi^{x \tan x}$

5. $x^2 - y^2 = e^{3y}$

6. $y = x^x$

QUESTION 4:

(10 Marks)

Consider the function $f(x) = \frac{x-1}{x-3}$ to find the following:

- Discuss the continuity of $f(x)$.
- The horizontal asymptote(s) of $f(x)$, (if any).
- The interval(s) on which $f(x)$ is decreasing, (if any).
- The interval(s) on which $f(x)$ is concave up / concave down, (if any).
- Sketch the graph of $f(x)$.

QUESTION 5:

(8 Marks)

- Use the limit definition of derivatives to find $f'(x)$ For $f(x) = 5x^2$
- Let $y = 1 + 3u^2$ and $u = \sqrt[3]{x}$. Find $\frac{dy}{dx}$
- Verify that the function $f(x) = \sin(2x)$ satisfies the hypotheses of Rolle's Theorem over the interval $[0, \pi]$. Then find all possible values of C that satisfy the conclusion of the theorem.
- Find two nonnegative real numbers whose sum is 15 with the property that the product between one of them and the square of the second is largest.

Good Luck

QUESTION 1:

(12 Marks)

Evaluate each of the following limits, (if exist):

1. $\lim_{x \rightarrow 3} x^2 - 2x + 1$

2. $\lim_{x \rightarrow 2} \frac{2x^2 - 8}{x^2 + x - 6}$

3. $\lim_{x \rightarrow 0} \frac{1 - \cos^2 x}{3x^2}$

4. $\lim_{x \rightarrow 2} \frac{-1}{(x - 2)^2}$

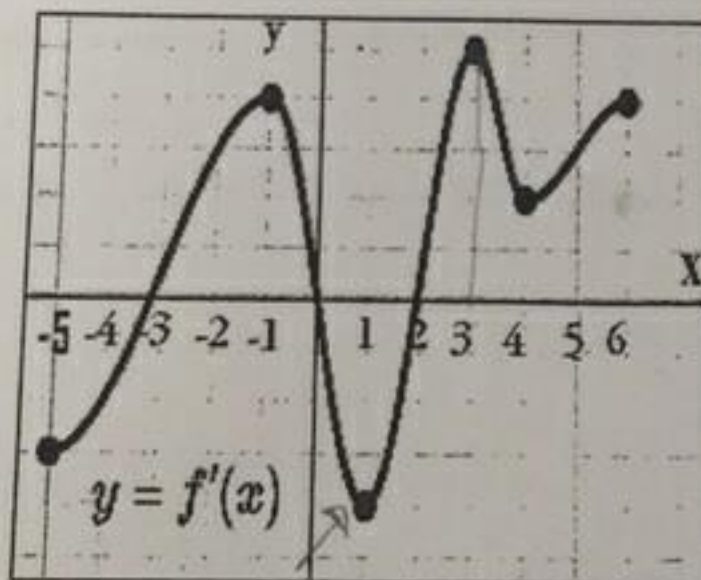
5. $\lim_{x \rightarrow 0} (x^2 \cos(\frac{1}{x}))$

6. $\lim_{x \rightarrow \infty} (x \sin(\frac{\pi}{x}))$

QUESTION 2:

(8 Marks)

Use the graph of $y = f'(x)$ to Find the following:



- The interval(s) on which $f(x)$ is increasing and decreasing.
- The critical numbers of $f(x)$.
- The x - coordinates on which f has a relative maximum and a relative minimum.
- The interval(s) on which $f(x)$ is concave up/ concave down.