

Q1)

(10 marks)

1) Find the domain and range of $f(x) = 3 + \sqrt{x - 2}$ (2)

2) Let $f(x) = x^2 + 3$ and $g(x) = \sqrt{x}$, Find $(f \circ g)(x)$ (2)

3) The slope of the tangent line to the curve $y = x^2 + 1$ at (2,5) (2)

4) Let $y = e^{2t} - \ln(t^2 + 5)$ find y' (2)

5) If $\sin y = x^2$. Find $\frac{dy}{dx}$ (2)

(20 marks)

Q2)

1) Compute the following Limits

a) $\lim_{x \rightarrow \infty} \frac{3x^4 - 3x^2 + 7x}{5x^4 + 9}$ (2)

b) $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$ (2)

2) Determine whether the function $f(x) = \begin{cases} x^2 + 5, & x < 2 \\ 3 + 3x, & x \geq 2 \end{cases}$

Is Continuous at $x = 2$ (4)

3) Use chain rule to find $\frac{dy}{dx}$ if $y = \tan(t + 1)$ and $t = 4x^2 + x$ (4)

4) Use implicit differentiation to find $\frac{dy}{dx} : y^2 + x^2 = x$ (4)

5) Let $y = x^{\sin x}$ find $\frac{dy}{dx}$ (4)

Q3) (20 marks)

a) Let $f(x) = x^3 - 3x^2 + 1$ find:

1) The critical points (2)

2) Intervals of increasing and decreasing (2)

3) The relative extrema (relative maximum, relative minimum) (2)

4)The intervals of concavity (2)

5) The inflection points (2)

b) Show that the function $f(x) = x^3 + x^2$ satisfies the hypotheses of Rolle's theorem on $[-1,0]$ and find the value of c . (4)

c) Find $\frac{dy}{dx}$:

1) $y = \sin^{-1} x^2$ (2)

2) $y = \cos(\sin x)$ (2)

3) $y = \sqrt{x+4} + \cosh(x^3 + 2)$ (2)