MATH 104
TUTORIAL – Chain Rule, Tangent Line, Derivative Tests

Question1. Use the Chain Rule,

a) If $y = u^2 - 2u$ and $u = x^2 - x$, find $\frac{dy}{dx}$

b) If $z = u^2 + \sqrt{u} + 9$ and $u = 2s^2 - 1$, find $\frac{dz}{ds}$

Question2. Find an equation of the tangent line to the curve at the given point.

a) $y = \frac{\sqrt{7x+2}}{x+1}, \quad \left(1, \frac{3}{2}\right)$

b) $y = (2x+3)^2, \quad (-1,1)$

Question3. a)Find all values of x for which the curve $y = x^2 + 6x - 4$ has a horizontal tangent line.

b)Find the slope of the curve $y = \left(x^2 - 7x - 8\right)^3$ at the point (8,0).

Question4. Determine when the function is increasing or decreasing, and determine when relative maxima and minima by using first derivative test or second derivative test.

a) $y = -\frac{x^3}{3} - 2x^2 + 5x - 2$

b) $y = -5x^3 + x^2 + x - 7$

c) $y = x^4 - 4x^2 + 4$

Question5. Find the absolute extrema of the given function on the given interval.

a) $f(x) = \frac{1}{3}x^3 - x^2 - 3x + 1, \quad [-1,2]$

b) $f(x) = -2x^3 - 6x + 5, \quad [-3,2]$

c) $y = x^4 - 2x^2 + 4, \quad [-4,2]$

d) $y = \left(x^2 + 7x + 10\right)^2, \quad [-4,0]$

e) $f(x) = 6x^4 - x^6, \quad [-1,2]$

Question6. Determine concavity and the x-values where points of inflection by using the second derivative .

a) $y = -\frac{5}{2}x^4 - \frac{1}{6}x^3 + \frac{1}{2}x^2 + \frac{1}{3}x - \frac{2}{3}$

b) $y = \frac{1}{20}x^5 - \frac{1}{4}x^4 + \frac{1}{6}x^3 - \frac{1}{2}x - \frac{2}{3}$