(1) When the tangent line exists at an inflection point, does it definitely cross the graph of the function? Why? 10%

(2) Let \( f(x) = \sqrt{|x - 1|} \). Discuss whether \( f \) is continuous or differentiable at \( x = 1 \)? 10%

(3) Find the slope of the tangent at \((-2, 2)\) of a curve \( y^2 = \frac{20 - x^2}{2x} \). 10%

(4) The demand equation is given by \( p = \sqrt[3]{9 - x^3} \) where \( p \) is the unit price at which \( x \) units of the product are demanded. Define the price elasticity of demand as \( \eta = \frac{p}{x} \frac{dp}{dx} \).
   
   (i) Is the demand elastic (\( |\eta| > 1 \)), inelastic (\( |\eta| < 1 \)), or of unit elastic (\( |\eta| = 1 \)) at \( x = 1 \)? Give an economic interpretation for your answer. 10%
   
   (ii) Find the expression for the total revenue and compute the values of \( x^* \) and \( p^* \) that maximize the total revenue. 10%
   
   (iii) Show that the demand at \( x^* \) is of unit elastic. Moreover, on the interval \((x^*, 3)\) the demand is inelastic and the total revenue is decreasing. 10%

(5) The concentration \( C \) (in milligrams per milliliter) of a drug in a patient’s bloodstream \( t \) hours after injection into muscle tissue is modeled by \( C = \frac{3t}{27 + t^3} \).
   
   (i) Find the change in the concentration when \( t \) changes from \( t = 1.5 \) to \( t = 2 \). 5%
   
   (ii) Use differentials to approximate the change. 5%

(6) Let \( f(x) = \frac{1}{x^2 + 1} \).
   
   (i) Find all critical numbers, relative extrema and points of inflection. 10%
   
   (ii) Determine (with reasons) whether \( f \) has vertical or horizontal asymptotes. 10%
   
   (iii) Sketch the graph of \( f \). 10%