SHOW ALL WORK

1. Find the derivatives of the following functions. DO NOT simplify the answers.
   
   (a) \( y = \frac{1}{\sqrt[3]{1-x^2}} \)
   
   (b) \( f(x) = \cos^2(3x^2) \)

2. Find the equations of the tangent line and the normal line to the curve \( x^2 - 3xy^2 + y^2 = 11 \) at the point \((-2, 1)\).

3. Given \( x^2 + y^2 = 13 \), use implicit differentiation to find \( \frac{dy}{dx} \). Make sure to simplify your answer completely.

4. When a circular plate of metal is heated on an oven, its radius increases at the rate of 0.05 cm/min. At what rate is the plate's area increasing when the diameter is 20 cm?

5. Find the derivatives of the following functions. Simplify the answers.
   
   (a) \( f(x) = \frac{x+1}{x-1} \)
   
   (b) \( y = x\sqrt{x^2-1} \)

6. A ladder 15 feet long is leaning against the wall of a house. The base of the ladder is pulled away from the wall at a rate of 3 feet per second. Consider the triangle formed by the side of the house, the ladder, and the ground. Find the rate at which the area of the triangle is changing when the base of the ladder is 5 ft from the wall. Provide the exact answer.

7. Consider the function \( f(x) = 3x^4 - 4x^3 \) on \([-1, 2]\).
   
   (a) Which theorem guarantees that \( f \) has absolute extrema on the given interval? State this theorem in precise terms.
   
   (b) Find those absolute extrema (by hand).

8. Consider the function \( f(x) = \frac{x}{x+1} \) on \([0, 8]\).
   
   (a) Which theorem guarantees that there are tangent lines to the graph of \( f \), that are parallel to the secant line joining the end points of the graph of \( f \)? State this theorem in precise terms.
   
   (b) Find the equations of those tangent line(s) described in part (a).

9. Given \( f(x) = -x^3 + x^2 + x + 5 \), find the critical points, intervals on which the functions is increasing/decreasing, and local extrema.

10. Repeat the question 9 for the function \( y = (2x+1)^2(2-x)^3 \).