1) (15 points) Mark the following statements "True" or "False". (Do not guess: -2 points for each wrong answer!)
(a) If \( f(x) \) is increasing at \( a \) and \( f'(a) \) exists, then \( f'(a) > 0 \).
(b) If \( f'(a) = 0 \), then \( a \) is an extreme point for \( f \).
(c) \( \frac{d}{dx} g(f(x)) = f'(x) g'(f(x)) \).
(d) \( \frac{d}{dx} e^{x^2} = x^2 e^{x^2-1} + 2x \).
(e) \( \frac{d}{dx} (x+1) e^{-x} = -xe^{-x} \).

Please enter answers here ("T", "F", or "Pass")

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2. (16 points) (a) For \( f(x) = \frac{x}{(x+1)^2} \), find \( f'(x) \) (in simplified form), and determine if \( f(x) \) is increasing or decreasing at \( a = -2 \).

(b) Determine all critical points of \( y = x^4 e^{-x^2} \). (You must again compute \( \frac{dy}{dx} \) correctly in a form that makes this determination possible.)
(3) (18 points) (a) If \( f(x) = x(x^2+1) \) and \( g(x) = \sqrt{x} \), compute \( \frac{d}{dx} f(g(x)) \) by the Chain Rule.

(b) If \( h(x) = \frac{f(x^2)}{x} \), find an expression for \( h'(x) \).

(c) Find \( \frac{dy}{dx} \) at a point \((x, y)\) on the curve \( e^y + xy^2 = 1 \).
4. (16 points) (a) Sketch the graph of \( y = f(x) = 1 + 3x^2 - x^3 \).
(You need not find the \( x \)-intercept(s).)

(b) On the closed interval \([-2, 3]\), what is the global maximum of \( f(x) \), and at what point (or points) is this maximum attained? Answer the same question for the global minimum.
(15 points) A cylindrical soup can of volume 1 is to be designed. Find the values of \( x \) and \( h \) for which the amount of metal needed is as small as possible. Show that, for these "optimizing values" \( x \) and \( h \), we'll have the relation \( h = 2x \).