

This test consists of 100 points and 5 pages, none of which is intentionally left blank. Take a few seconds right now to be sure you have all the pages. The point value of each question is to the left of the question number. Show all your work in the space provided. If you run out of room for an answer, continue working on the back of the page. Your answers must be justified by your work.

1. Find the derivative of each of the following functions.

(5) (a) $f(x) = x^4 - 4x^2 + x^{-2}$

(5) (b) $g(x) = (x^2 + x)(2x^3 - 5x + 1)^2$

(5) (c) $h(x) = \ln(\sec(x) - \tan(x))$

(5) (d) $f(x) = \sqrt{x + \sqrt{x + \sqrt{x}}}$

Question 1 continued:

(5) (e) $f(x) = \tanh(2x)$

(5) (f) $f(x) = x^e + e^x + e^e + x^x$

(10) 2. Use implicit differentiation to find y' if y is defined implicitly by the equation

$$\sqrt{x^2 + y^2} = x + \sqrt{x + y}$$

- (10) 3. Use logarithmic differentiation to find the derivative of

$$f(x) = \frac{(x^2 + 3)^3(x^3 - 2x + 1)^2}{(2x - 6)^4\sqrt{x + 5}}$$

- (10) 4. Find an equation of the line tangent to the graph of $f(x) = \sqrt{x^2 + 25}$ at the point (12, 13).

- (10) 5. Find an equation of the tangent to $f(x) = \sqrt[3]{x}$ that passes through the point (2, 0)

- (10) 6. Evaluate the following limit. You might find the fact that $\lim_{x \rightarrow 0} \frac{\sin(x)}{x} = 1$ to be useful.

$$\lim_{x \rightarrow 0} \frac{\sec(x) - 1}{x}$$

- (10) 7. Using a linear approximation, compute an approximate value for $(2.001)^5$

- (10) 8. A 15 foot ladder is leaning against a vertical wall. If the bottom of the ladder is moved away from the wall at a rate of 2ft/min, how fast is the top sliding down the wall when the bottom is 9 feet from the wall?