

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

$$(a) f(x) = \ln \left| 3x^2 - 2 \right|$$

$$(d) f(x) = \ln \left| \sec(x) + \tan(x) \right|$$

$$(b) f(x) = \frac{x}{\ln(x)}$$

$$(e) f(x) = \sqrt{1 + e^{2x}}$$

$$(c) f(x) = x \ln(x) - x$$

$$(f) f(x) = e^x \ln(x) + xe^{3x-1}$$

2. Use logarithmic differentiation to find y' for

(a) $y = \ln\left(\frac{(3x-2)^3(x+1)}{\sqrt{1-x^2}}\right)$

(b) $y = \frac{\sqrt{x^2-36}(x^2-x-6)}{x^2+7x+12}$

3. Show that $f(x) = (x-2)^2 + 5$ is not one-to-one.

4. (a) Prove that $g(x) = \frac{3x-2}{x+3}$ is one-to-one.

(b) Find the inverse function for g .

5. (From the 200? AP Calculus AB exam) The twice-differentiable function f is defined for all real numbers and satisfies the following conditions:

$$f(0) = 2, f'(0) = -4, \text{ and } f''(0) = 3.$$

The function g is given by $g(x) = e^{ax} + f(x)$ for all real numbers, where a is a constant. Find $g'(0)$ and $g''(0)$ in terms of a . Show the work that leads to your answers.

6. (From the 200? AP Calculus AB exam) A particle moves along the x -axis with position at time t given by $x(t) = e^{-t} \sin(t)$ for $0 \leq t \leq 2\pi$.

(a) Find the time t at which the particle is farthest to the left. Justify your answer.

- (b) Find the value of the constant A for which $x(t)$ satisfies the equation $Ax''(t) + x'(t) + x(t) = 0$ for $0 < t < 2\pi$.

7. (From the 200? AP Calculus AB exam) Let f be the function defined by $f(x) = k\sqrt{x} - \ln(x)$ for $x > 0$, where k is a positive constant.

(a) Find $f'(x)$ and $f''(x)$.

(b) For what value of the constant k does f have a critical point at $x = 1$? For this value of k , determine whether f has a relative minimum, relative maximum, or neither at $x = 1$.

(c) For a certain value of the constant k , the graph of f has a point of inflection on the x -axis. Find this value of k .