

1. Let  $y = \tan^{-1}(x)$ . Use implicit differentiation to find  $dy/dx$ .

2. Find and classify all critical points of  $f(x) = x/\ln(x)$ .

3. Find the derivative:

(a)  $\sin(x)^x$

(b)  $\log_7(x^2 + 1)$

(c)  $(3x^2 + 4x)^{18}$

(d)  $\cos^{-1}(\sqrt{x})$

4. Let  $f(x) = e^{2x-1}$ . Find  $(f^{-1})'(1)$ .

5. Let

$$f(x) = \frac{x^3}{3} + x^2 - 3x + 1.$$

(a) Find and classify all critical points. (b) On what intervals is  $f(x)$  increasing? (c) On what interval is  $f(x)$  decreasing?

6. A joyous calculus student throws her calculus textbook into the air in a fit of exuberance. She is standing on the roof of BSB, which is 50 feet in the air. The height of the book at time  $t$  is given by

$$h(t) = -15t^2 + 25t + 50.$$

(a) Find the velocity of the book at  $t$  seconds. (b) When is the book at its highest point? (c) When does the book hit the ground?

7. Consider the function  $f(x) = -x^4 + 2x^2 - 3$ . Does it have an absolute maximum? Absolute minimum?

8. Draw the graph of a function satisfying ALL of these properties: (i)  $f(0) = 0$ . (ii)  $f'(0) = 1$ . (iii)  $f'(2) = 0$ . (iv)  $x = 4$  is an absolute maximum.

9. A differentiable function  $f(x)$  satisfies  $f(0) = 0$ ,  $f(\pi) = 3$ ,  $f'(\pi) = 2$ ,  $f'(0) = 4$ . Find the equation of the line tangent to  $f(\sin(x))$  at the point  $x = \pi$ .