
SECTIONS 2.3 AND 2.4

Problem 1. Find the derivatives of the following functions:

a. $g(x) = x^{3/4} - 2$

b. $h(x) = 3x^{12} - 4x^3 + 44x + 2^{50}$

c. $j(x) = \frac{x^{16} - 8x^8 + 2x^5}{x^8}$

d. $f(x) = x^2 \left(x^3 - \frac{8}{x^3} \right)$

Problem 2. Let $f(x) = \ln(x)$.

a. Find the slope of the graph of $f(x)$ when $x = 1$.

b. Find the equation of the line tangent to $f(x)$ at $x = 1$.

c. Find the instantaneous rate of change of f when $x = 12$.



Problem 3. For which value(s) of x does the graph of $f(x) = x^3 + 9x^2 + 27x + 8$ have a horizontal tangent line?

Problem 4. For which value(s) of x does the graph of $f(x) = 3x^3 - 27x^2 + 47x - 54$ have a slope of 2?



Problem 5. Find $\frac{dy}{dx}$ for the following.

a. $y = 5x^4 \ln(x)$

b. $y = 8x^2 e^x$

c. $y = x^3 \cdot 6e^x \cdot \log_8(x)$



Problem 6. Find $f'(x)$ for the following.

a. $f(x) = \frac{4}{x^3 - 7x + 1}$

b. $f(x) = \frac{3x - 4}{x^3 + 7x + 1}$

c. $f(x) = \frac{x \ln(x)}{3 - x^3}$



Problem 7. Find the value(s) of x where $f(x) = (x^2 - 18)(2x - 3)$ has a horizontal tangent line.

Problem 8. Find the equation of the line tangent to $g(x) = \frac{10x}{x+3}$ at the point $(7, 7)$.



Problem 9. The cost function for a certain brand of cat trees is $C(x) = x^3 + 3x^2 + \ln(x)$.

a. Find the marginal cost function for this brand of cat trees.

b. Estimate the cost of making the 17th cat tree.

c. Find the exact cost of making the 17th cat tree.