

1. Find the derivative of the following functions.

(a) $F(x) = (3x^2 + 2x)^4 \ln\left(5x - \frac{1}{x}\right)$

(b) $G(x) = \frac{e^{7x^2-x}}{\sqrt{x^2+5}}$

(c) $H(x) = \sqrt[3]{\frac{x^2-3x}{x^4+6x}}$

2. Give an equation for the tangent line to the curve

$$2(x^2 + y^2)^2 = 25(x^2 - y^2)$$

at the point $(3, 1)$.

3. Suppose you deposit \$600 into a savings account with an annual interest rate of 3.25% that is compounded monthly.

(a) How much will your savings be worth after 5 years?

(b) How long will it take your savings to double?

4. Suppose a population of bacteria triples every 7 hours. If the population at 5pm is 3200, what was the population at noon (5 hours earlier)?

5. Suppose a sample of radioactive material is observed to decay to 84% of its original mass after 35 years. Find the half-life of this material.

6. A baseball diamond is a square with side 90 ft. A batter hits the ball and runs toward first base with a speed of 24 ft/s. At what rate is her distance from second base decreasing when she is halfway to first base?

7. Water is being pumped into an inverted conical tank at a constant rate. The tank has height 6 m and the diameter at the top is 4 m. If the water level is rising at a rate of 0.2 m/min when the height of the water is 2 m, find the rate at which water is being pumped into the tank.

8. Find the critical numbers for the function $f(x) = x^{4/5}(x - 4)^2$.

9. Find the absolute maximum and minimum values of

$$f(x) = x\sqrt{4 - x^2}$$

over the closed interval $-1 \leq x \leq 2$.

10. Let $f(x) = (x^2 - 1)^3$.

- (a) Find the intervals on which f is increasing/decreasing.
- (b) List any/all local maximums and minimums.
- (c) Find the intervals on which f is concave up/down.
- (d) List any/all inflection points for the graph $y = f(x)$.
- (e) Use the information from parts (a)-(d) to sketch (roughly) the graph $y = f(x)$.