

1. Consumer demand for the Roland portable hair dryer is given by

$$D(p) = \frac{1}{5}(225 - p^2) \quad (0 \leq p \leq 15)$$

measured in units of a hundred, where p is the unit price in dollars.

- Calculate the elasticity of demand.
- If the unit price is lowered slightly from \$10, will the revenue increase or decrease?
- If the unit price is increased slightly from \$8, will the revenue increase or decrease?

2. Find the derivative of each function. You do not need to simplify.

(a) $f(x) = \log_2(4 - 5x^3)$

(b) $g(x) = e^{\sqrt{8x^2-4}}$

(c) $h(x) = 7^{4x^2-9x}$

(d) $k(x) = e^{3x+1} - e^{2x/3}$

(e) $f(x) = \ln e^{8-9x}$

3. Find the derivative of each function. You do not need to simplify.

(a) $f(x) = x^2e^x - 2 \ln x + (x^2 + 1)^3$

(b) $g(x) = \ln(5x^3 - 7x^2 + 6)^4$

(c) $h(x) = \frac{\ln \sqrt{5x+3}}{x^4}$

(d) $k(x) = x^3 \ln(4e^{-x} - 2e^{2x})$

(e) $f(x) = (\ln 5x)^3 + 3x^2e^{-7x}$

4. How long will it take \$10,000 to grow to \$15,000 if the investment earns an interest rate of 12% per year compounded quarterly?

5. Let $f(t) = 350\sqrt[3]{2t+5}$.

- Find the relative rate of change.
- Evaluate the relative rate of change at $t = 2$.

6. A Middle Eastern oil producing country estimates that the demand for oil (in millions of barrels) is $D(p) = 28e^{-0.04p}$, where p is the price of a barrel of oil. To raise its revenues, should it raise or lower its price from its current level of \$30 per barrel?

7. If a college education costs \$75,000, how large a trust fund, paying 5% compounded continuously, must be established at a child's birth to ensure sufficient funds at age 18?

8. A \$25,000 automobile depreciates by 32% per year. Find its value after 5 years.

9. True or False.

(a) $\ln x = \frac{1}{x}$

(b) $\ln e = 0$

ANSWERS

1. (a) $\frac{2p^2}{225 - p^2}$
(b) revenue increases
(c) revenue decreases
2. (a) $f'(x) = \frac{-15x^2}{(\ln 2)(4 - 5x^3)}$
(b) $g'(x) = e^{(8x^2-4)^{1/2}} \cdot \frac{1}{2}(8x^2 - 4)^{-1/2}(16x)$
(c) $h'(x) = (\ln 7) \cdot 7^{4x^2-9x}(8x - 9)$
(d) $k'(x) = 3e^{3x+1} - \frac{2}{3}e^{2x/3}$
(e) $f'(x) = \frac{-9e^{8-9x}}{e^{8-9x}} = -9$
3. (a) $f'(x) = x^2e^x + 2xe^x - \frac{2}{x} + 3(x^2 + 1)^2(2x)$
(b) $g'(x) = \frac{4(15x^2 - 14x)}{5x^3 - 7x^2 + 6}$
(c) $h'(x) = \frac{x^4 \cdot \frac{5}{2(5x+3)} - (\ln(5x+3)^{1/2})(4x^3)}{x^8}$
(d) $k'(x) = x^3 \left(\frac{-4e^{-x} - 4e^{2x}}{4e^{-x} - 2e^{2x}} \right) + 3x^2 \ln(4e^{-x} - 2e^{2x})$
(e) $f'(x) = 3(\ln 5x)^2 \cdot \frac{1}{x} - 21x^2e^{-7x} + 6xe^{-7x}$
4. time is approximately 3.43 years
5. (a) relative rate = $\frac{2}{3(2t+5)}$
(b) $\frac{2}{27}$
6. $E(20) = 1.2 > 1$; elastic, hence lower prices
7. $P = \$30,492.72$
8. $V = \$3,634.83$
9. (a) False; $\frac{d}{dx} \ln x = \frac{1}{x}$; but $\ln x \neq \frac{1}{x}$
(b) False; $\ln e = 1$