

Show Me How To Do The Following

1. A single injection of a drug is given to a patient. The amount Q in the body then decreases at a rate proportional to the amount present, and for this drug the rate is 4% per hour. Thus

$$\frac{dQ}{dt} = -0.04Q, \quad Q(0) = Q_0$$

, where t is time in hours. If the initial injection is 3 milliliters, how many milliliters are in the body after 10 hours?

2. Approximate $\int_0^4 \frac{x^2}{x^2 + 2} dx$ using five rectangles and left endpoints.

3. Evaluate the following definite integrals:

(a) $\int_0^2 x\sqrt{4-x^2} dx$

(b) $\int_1^e \frac{\ln t}{t} dt$

(c) $\int_{-2}^{-1} \frac{x^2 + 1}{x} dx$

(d) $\int_0^4 x\sqrt{4+x} dx$

4. An oil well starts out producing oil at the rate of 60,000 barrels per year, but the production rate decreases by 4,000 barrels per year. Thus if $P(t)$ is the total production (in thousands of barrels), then $P'(t) = 60 - 4t$. Write a definite integral that will give the total production over the first 15 years of operation and evaluate it.
5. Suppose that the inventory of a certain item t months after the first of the year is given by $I(t) = 10 + 36t - 3t^2$. What is the average inventory for the second half of the year?
6. Find the area between two curves.
7. The quantity demanded x of a company's Snow Tires each week is related to the price by $p = D(x) = 144 - x^2$ where p is in dollars and x is thousands of tires. The company will supply x thousand tires if the price is $p = S(x) = 48 + \frac{1}{2}x^2$. Determine the consumers' surplus when the market price is set at the equilibrium price.
8. The price p (in dollars) and demand x for a product are related by

$$2x^2 + 5xp + 50p^2 = 80,000.$$

- (a) If the price is \$30 and the demand is 100 find the dx/dp and interpret it.
- (b) Now assume that the price and demand are both functions of time. If the price is increasing at a rate of \$2 per month when the price is \$30 and the demand is 100, find the rate of change of the demand per month.
9. A weather balloon is rising vertically at a rate of 5 meters per second. An observer is standing on the ground 300 meters from the point where the balloon is released. At what rate is the distance between the observer and the balloon changing when the balloon is 400 meters high?
10. For the function $f(x, y) = \frac{3x^2 - y^2}{x^2 + 5y^2}$

(a) Evaluate $f(2, 1)$.

(b) Find $f_x(x, y)$

(c) Find $f_y(2, 1)$

11. A company spends \$ x per week on newspaper advertising and \$ y per week on television advertising. Its weekly sales were found to be given by

$$S(x, y) = 10x^{0.4}y^{0.8}.$$

(a) Find $S_x(3000, 2000)$ and $S_y(3000, 2000)$ and interpret the results.

(b) The is spending \$3000 on newspaper and \$2000 on television advertising. If it is going to spend a little more on advertising to increasing sales, should it invest more in newspaper or television advertising. Explain.