

Name _____

Please show all work to receive full credit.

1. Find $\frac{dy}{dx}$ for each of the following: (7 each)

a. $y = 3x^4 \sqrt[3]{2x^2 + 5x + 1}$

b. $y = x^3 e^{3x} + \ln(x^2 - 2x)$

c. $2xy^2 + 3x - 4y = 5x^2$

2. Integrate each of the following: (7 each)

a. $\int (3x^2 - \frac{2}{x} + 3\sqrt[3]{x} + 4) dx$

b. $\int (e^{.05x} - \frac{3}{x})dx$

c. $\int \frac{x^2 + 4x + 3}{x + 1} dx$

3. The marginal profit function for a cash register manufacturer is $MP(x) = 1375 - 1.5x$. Determine the profit function $P(x)$ if the company loses \$2425 when 0 registers are produced and sold. (7 points)
4. A car wash company estimates its demand function to be $D(p) = 500e^{-0.2p}$ where p is the price of a car wash in dollars. If the current price of a car wash is \$4, use the elasticity of demand to determine how a price increase will affect the total revenue (7 points)

5. For the function $f(t) = 60\sqrt{t+1}$, find the RELATIVE rate of change at $t=3$. (7 points)
6. Gas is being released from a balloon on a cross-country trip in order to lose altitude. The balloon is approximately spherical in shape. The radius of the balloon is decreasing at the rate of .75 yard per minute. Approximately how fast is the volume of the balloon decreasing when the radius is 25 yards? (The volume of a sphere is given by $V = \frac{4}{3}\pi r^3$) (7 points)
7. If the reproduction function for bay scallops is $f(p) = -0.03p^2 + 13p$, where p and $f(p)$ are in thousands, find the population that gives the maximum sustainable yield, and the size of the yield. (7 points)
8. A rectangular lot is to be bounded by a fence on 3 sides and by a wall on the fourth side. Two kinds of fencing will be used, with heavy duty selling for \$4 per foot on the side opposite the wall. The 2 remaining sides will use standard fencing selling for \$3 per foot. If \$6,600 is available for fence, determine the maximum area of the rectangle that can be enclosed by the fence. (7 pts)

9. The number of subscribers to a new magazine t months after initial publication is $n(t) = \frac{10,388}{3.5t + 7}$.

a. How many subscribers are there after 2 months? (3 points)

b. After 2 months, at what rate is the number of subscribers changing? (4 points)

10. Given $f(x) = 2x^2 + 3x - 1$, find the following:

a. the slope of the tangent line at the point $(1, 4)$ (4 points)

b. find the equation of the tangent line at that point (3 points)

11. If \$1753 is invested at 4.5% annual interest compounded continuously, how much will accrue in 7 years? (7 points)