

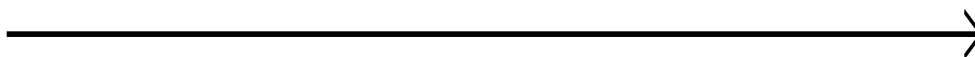
Review Problems

1. A company's marginal profit is $MP(x) = 3(x^2 - 14x + 40)$ dollars/unit if they make x units of their product ($0 \leq x \leq 15$)

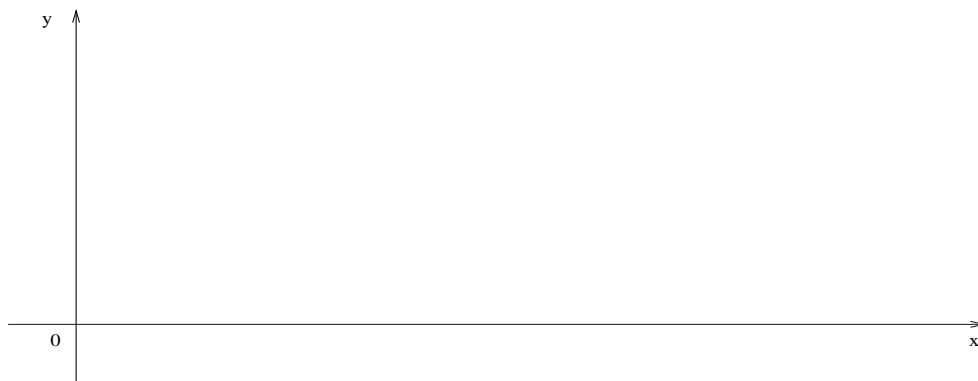
- (a) Find the interval in which $p(x)$ is an increasing and a decreasing function of x , and display them on the number line below.



- (b) Find the intervals in which the graph of $y = P(x)$ is concave upward and concave downward, and display these and any point of inflection on the line below.



- (c) Sketch the graph of $y = P(x)$ for $x \geq 0$, given the above data and the fact that $P(x) > 0$ whenever $x \geq 0$.



- (d) The company's profit from selling 3 units is \$198. What is their approximate profit if they sell 3.1 units? [Do Not use a calculator]
2. A producer of fashion watches determines that the monthly revenue R for one of its models (in \$) is related to the selling price p (in \$) by the equation

$$R = 1000p - 4p^{7/4} - 252$$

- (a) Find the marginal revenue at price level $p_0 = \$81$. (Include the correct units in your answer.)
- (b) Use linear approximation to estimate the revenue resulting from an increase in price from $p_0 = \$81$ to $p = \$83$.
- (c) The company would like its monthly revenue from this model of watch to be \$75,000. Approximately how much should they charge per watch, according to your work in part b)?
- (d) Explain briefly why it would be more difficult to answer part c) without linear approximation.
3. The demand x (in gallons) for a very expensive fuel offered for sale in a certain market is related to the price p per gallon (in \$) by the formula $x^2 + 2xp + 3p^2 = 1800$.

- (a) At what rate is x changing when p is increasing at the rate of \$3 per day, $p=10$, and $x = 30$? (State the correct units in your answer.)
- (b) At what rate is x changing per dollar increase in p when $p = 10$ and $x = 30$?
- (c) Based on your answer to part **b**), what is the approximate demand for fuel if the price is \$10.50 per gallon? State the appropriate units in your answer, and give the answer to 2 decimal places.
4. A manufacturer of men's shoes experiences a total cost of $C(x) = 200 + 15x + (x^3/4)$ dollars in producing x pairs of shoes per day ($4 \leq x \leq 12$). If the manufacturer receives \$90 for each pair of shoes produced, what production levels yield maximum and minimum profit?
(Solve this problem by using calculus, *not* by trial and error.)
5. Find $\frac{dy}{dx}$. DO NOT SIMPLIFY your answer.
- (a) $y = x^2 e^{[x^3 - 2x]^3}$
- (b) $y = [\ln(x^2 + 3)]e^{(x^2 + 5x + 1)^6}$
- (c) $y = (2x + 3)^e + e^{3x+4} + (4x + 5)^{6x+7}$
6. A finance student, R.V. Winkle, decided to invest \$ 100 in an account and then take a 100 year nap, after which there would be \$ 100,000 in the account. Assuming that the interest rate does not change during that nap, what NAR (nomial annual rate) of interest, compounded continuously, would Winkle want?
7. When a foreign substance is introduced into the body,the body's defense mechanisms move to break down the substance and excrete it. The rate of excretion is usually proportional to the concentration in the body,and the half-life of the resulting exponential decay is referred to as the *biological half-life* of the substance.
If,after 12 hours,15 % of a massive dosage of a substance has been excreted by the body,what is the biological half-life of the substance?
8. $x^2 + y^3 - 2x^3y^2 = -596$.
- (a) Find $\frac{dy}{dx}$ when $x = 2$ and $y = 10$.
- (b) Use calculus to find the approximate value of y when $x = 1.9$.
9. Your chunky-style ketchup factory has just purchased a giant funnel in the form of a stainless steel cone,to store ketchup prior to dispensing it(from the tip).The volume of ketchup in this cone is $V = 3h^3$ cubic feet,where h is the height of the ketchup above the tip the cone,in feet.
The cone is being filled at a steady 40 cubic feet per minute,and is now filled to a height of 10 feet.At what rate is the gooeey mass now rising in the cone?(State the appropriate units)
10. The demand Q for a product is related to its price per ton by $Q = 90 - (0.4)p$. At what price(s) is the demand neither elastic nor inelastic?
11. A manufacturer's marginal cost function is

$$MC(x) = 100 + 4x$$

and the total cost at production level $x = 100$ is \$35,000.
Find the total cost function.