

Word Problem Practice take 3

- An industrial production process costs $C(q)$ million dollars to produce q million units; these units then sell for $R(q)$ million dollars. If $C(2.1) = 5.1$, $R(2.1) = 6.9$, $MC(2.1) = 0.6$, and $MR(2.1) = 0.7$, find the following:
 - The profit earned by producing 2.1 million units.
 - Should the company increase or decrease production to maximize profit?
- In algorithms class you are given an assignment to sort n integers within a given range. You would like to use merge search or bucket sort. The merge sort algorithm's efficiency is dependent on n and in a worse case scenario could take $n \log_2(n)$ steps. Computer scientists would say, that merge sort is "big O" of $n \log_2(n)$. By contrast, bucket sort is big O of n . Generally to determine if one algorithm is better than another, computer scientists consider the limit as n goes to infinity of the ratio of the two big O's. Perform this operation and compute $\lim_{n \rightarrow \infty} \frac{n}{n \log_2(n)}$ and use the answer to determine which algorithm is better.
- A company has been selling 1000 widgets a week at \$440 each. A survey indicated that for each \$15 rebate offered to the buyer, the number of widgets sold will increase by 100 per week. How large a rebate should the company offer the buyer in order to maximize its revenue?
- A widget manufacture has a fixed cost of \$66,000 and another \$125 for each additional widget produced. Find the cost function and then find out how many widgets should be sold to maximize profit if the revenue function is $q \left[\frac{-1}{100}(q - 1000) + 450 \right]$, where q is the number of widgets produced/sold.
- A wall 8 ft tall runs parallel to a tall building at a distance of 4 ft on flat ground. Find the length of the shortest ladder that will reach from the ground over the wall to the wall of the building. Justify your conclusions using calculus!
- Find the x and y coordinate of the point that is both on the line $6x + y = 9$ and is closest to the point $(-2, 1)$.
- A piece of rope 12 m long is cut into two pieces. One piece is folded into a square and the other is looped into a circle. How should the rope be cut so that the total area enclosed is a maximum? minimum?
- A tank intended to store grain will have volume V (not equal to zero) and will be constructed in the shape of a right circular cylinder surmounted by a hemisphere. What dimensions will require the least amount of metal?
- A semi has a minimum speed of 12 mph in high gear. When traveling x mph, the semi burns diesel fuel at the rate of

$$0.003945 \left(\frac{674}{x} + x \right) \frac{\text{gal}}{\text{mile}}$$

Assume that the semi can not be driven over 66 mph and that diesel fuel costs \$3.59 a gallon. What speed should the semi be driven to minimize the cost of fuel used for a 500 mile trip?

10. A semi has a minimum speed of 12 mph in high gear. When traveling x mph, the semi burns diesel fuel at the rate of

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Assume that the semi can not be driven over 66 mph, that diesel fuel costs \$3.59 a gallon, and that the driver is paid \$13 an hour. Find the speed that will minimize the cost of a 500 mile trip.

11. A ranch currently allows 20 steers per acre of land. On the average the steers weigh 2000 lb at market. Estimates published by the Agriculture Department indicate that the average market weight per steer will be reduced by 50 lbs for each additional steer added per 1.5 acres of grazing land. How many steers per acre should be allowed in order for the ranch to get the largest possible total market weight for its cattle?
12. Find an equation for the line that passes through the point (3,5) and that cuts off the least area from the first quadrant.
13. Find the maximum value of f given that f is the piece-wise defined function

$$f(x) = \begin{cases} \frac{1}{4}x(x+1)^2 & \text{if } x \leq 1, \\ \frac{x^2-4x+4}{x} & \text{if } 1 < x \leq 5, \end{cases}$$