Department of Mathematical Sciences
Carnegie Mellon University

Fall 2001

21-121 Calculus 1 (IM/Econ)

Assignment 5

Solutions to *all* the following problems should be written up and hand in to your TA.

Due in recitation on Thursday, October 4, 2001

Section 3.5: Problems 10, 11, 18, 26, 54
Section 3.6: Problems 10, 12, 30
Section 3.7: Problems 10, 30

Supplementary Problems*: A monopolist who employs m workers finds that they produce

$$q = 2m(2m+1)^{\frac{3}{2}}$$

units of product per day. The total revenue r (in dollars) is given by

$$r = \frac{50q}{\sqrt{1000+3q}}.$$

(a) What is the price per unit (to the nearest cent) when there are 12 workers?

(b) Determine the marginal revenue when there are 12 workers.

(c) Determine the marginal revenue product when $m = 12$.

Supplementary Information*:

The **demand function** $p = f(q)$ describes the relationship between the price p per unit of a product and the number of units q of that product that consumers will buy at that price. Given the demand function, one can determine the revenue function. Since $p = f(q)$ is the price paid when q units are sold, the revenue function must be

$$r = pq = qf(q).$$

Notice that the price p may be determined if the revenue r is given. We find that

$$p = \frac{r}{q}.$$

If the total number of units produced $q = f(m)$ is given in terms of the number of employees m and the total revenue function $r = g(q)$ is given in terms of the number of units produced, then we can think of r in terms of m through the composition $g \circ f$. That is $r = (g \circ f)(m)$. Thus, we may consider the rate of change of r with respect to m. This derivative is called the **marginal revenue product**:

$$\text{marginal revenue product} = \frac{dr}{dm}.$$

*Problems and information taken from *Introductory Mathematical Analysis for Business, Economics, and Life Sciences*, Ernest F. Haeussler, Jr. & Richards S. Paul (Eighth Edition)