1.6: Applications of Functions in Business and Economics
Math 111

Objective:
1. Supply, demand and market equilibrium
2. ~~Monopoly market~~ Break even Analysis.

1. Supply, Demand and Market Equilibrium

Market equilibrium occurs when the quantity of a commodity <u>demanded</u> is equal to the quantity <u>supplied</u>.

Do you think there is a relationship between demand and price? If so what is it?

Demand ↓ when price ↑

Do you think there is a relationship between supply and price? If so what is it?

Supply ↑ when price ↓

If the supply and demand curves for a commodity are graphed on the same coordinate system, with the same units, market equilibrium occurs at the point where the curves intersect. The price at that point is the **equilibrium price**, and the quantity at that point is the **equilibrium quantity**.
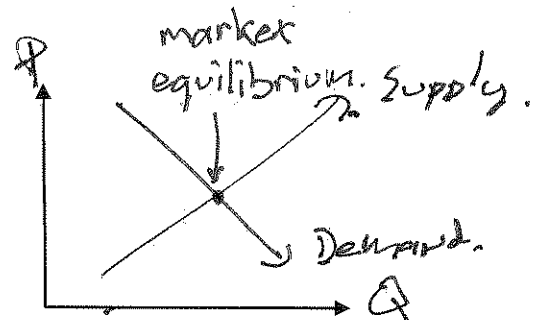
<u>Ex1</u>: Find the market equilibrium for the following supply and demand functions. Explain what it means in everyday language.

Demand: $p = -3q + 36$
Supply: $p = 4q + 1$

Solve to find where supply = demand.

Solve $-3q + 36 = 4q + 1$

$\underline{+3q \quad -1 \qquad +3q \quad -1}$

$35 = 7q$

$\Rightarrow q = 5.$

$p = 4(5) + 1 = 21.$

we have market equilibrium when 5 units are sold for $21/ea.

1

Ex2: Find the market equilibrium for the following supply and demand functions. Explain what it means in everyday language.

Find where the graphs intersect.

Demand: $(p+2)q = 2100 \rightarrow q = \dfrac{2100}{p+2}$

Supply: $4p - q = 42$

$\rightarrow +q = -42 + 4p$

window $(-10, 50] \times [-10, 350]$

intersection @ $(28, 70)$
↑ ↑
p q

we reach market equilibrium when 70 units are sold for $28/ea.

II. Revenue, Cost, Profit, and Breakeven Analysis

What is Revenue (in a business context)? — R

$ that comes in.

What is Cost (in a business context) and what are its two components? — C

$ that goes out (expenses).

- fixed costs
- variable costs

What is Profit? — P

$P = R - C$

Ex3: A manufacturer has fixed costs of $3300 and a variable cost of $5 per item produced.

a.) Define your variables

$N = $ # of items produced.

$C = $ cost

N	C
0	3300
1	3305
2	3310
3	3315

b.) What is the cost function?

$C(N) = 5N + 3300$

c.) What is the cost if no items are produced?

$C(0) = 3300$

we have fixed costs of $3300.

Ex4: Heavenly Cappucino has costs of \$3000/mo if they make and sell 1000 drinks and \$4200/mo if they produce 2000 drinks. Assuming the costs vary in a linear manner:

a.) Define your variables

$$N = \text{\# of drinks} \qquad C = \text{cost.}$$

b.) Find and interpret the slope.

$$(N, C) \rightarrow (1000, 3000)$$
$$(2000, 4200)$$

$$slope = \frac{4200 - 3000}{2000 - 1000} = 1.2$$

For each additional drink, costs increase \$1.20.

c.) Find and interpret the C-intercept

$$C-\text{int} = 1800.$$

There are fixed costs of \$1800.

d.) Find an equation to model the costs.

$$slope = 1.2$$
$$pt = (1000, 3000).$$

$$\boxed{y - y_1 = m(x - x_1)}$$
pt - slope form

$$C - 3000 = 1.2(N - 1000)$$
$$\Rightarrow C - 3000 = 1.2N - 1200$$
$$\Rightarrow C = 1.2N + 1800.$$

e.) Find and interpret the n-intercept

solve $C = 0$

$$\Rightarrow 0 = 1.2N + 1800$$

$$\Rightarrow -1800 = 1.2N$$

$$\Rightarrow N = -1500$$

Destroy 1500 drinks for zero costs.

Ex5: The cost function for Heavenly Cappuccino was found in the previous example. If the average drink sells for \$3.50, how many drinks must they sell to breakeven?

Ex6: Suppose the manufacturer from example 3 has revenue of $R(n) = 385n$.

a.) Find the profit function.

b.) Find and interpret $\overline{MP}$

c.) What is the profit on 351 items?

d.) How many items must be sold to breakeven?

Ex7: The bookstore's quarterly costs are given by $C(n) = 40n + 12000$. If they wish to breakeven after selling only 200 texts, what must be the price of the average textbook?