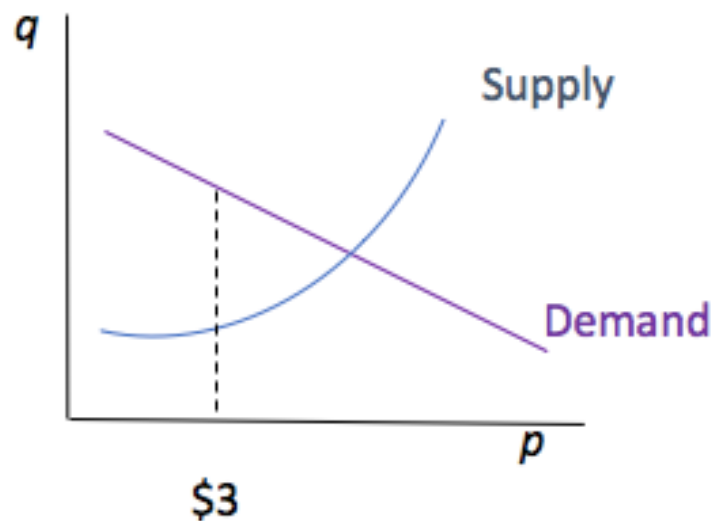


Final Exam Review

Unit 4 – Modeling a Business

Supply & Demand

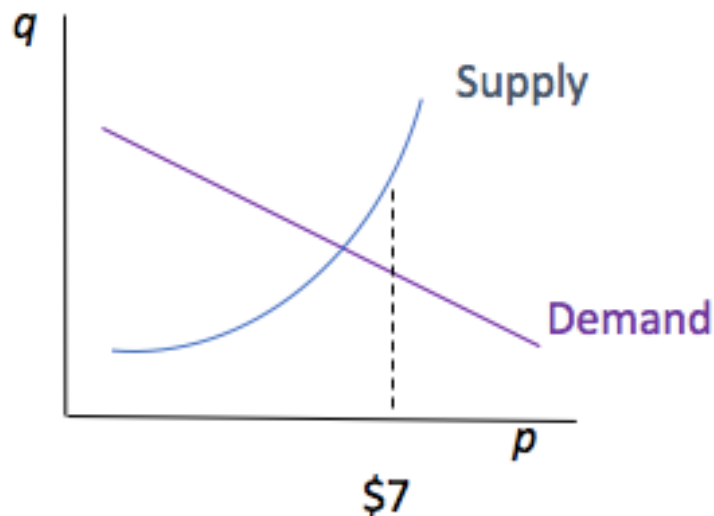
Situation #1: Price = \$3



If an item is priced too low, manufacturers won't be able to meet the demand. (This is bad because they're not making as much money as they could be making). This is called a **shortage**.

Supply & Demand

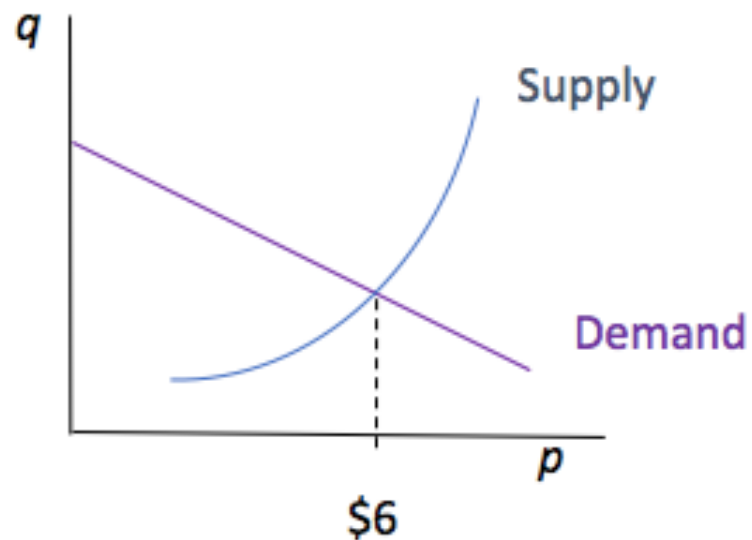
Situation #2: Price = \$7



If an item is priced too high, manufacturers will have too much of that item and will not be able to sell it. (This is bad because they wasted money creating unwanted products) This is called a **surplus**.

Supply & Demand

Situation #3: Price = \$6



When the supply and demand functions intersect, everyone is happy. 😊 This is called **equilibrium**.

Fixed & Variable Expenses:

- Variable expenses: exact amount is unknown. Variable expenses depend on the number of items produced.
- Fixed expenses: exact amount is known and does not rely on the number of items produced.
- Total Expense equation:
 - $Total\ Expenses = Fixed\ Expenses + Variable\ Expenses$
- The revenue is the income a business receives from selling its product.
 - $Revenue = price\ of\ the\ product \times quantity\ of\ products\ sold$
- When revenue = expenses, that is your breakeven point.

Fixed and Variable Expenses

Example:

The art students have researched all of their potential expenses for their assigned projects. The fixed expenses are \$17,600. The labor and materials required for each item produced costs \$7.53. Represent the total expenses as a function of the quantity produced, q .

$$\text{total expenses} = \text{variable expenses} + \text{fixed expenses}$$

$$\text{total expenses} = \text{variable expenses} + \$17,600$$

$$\text{total expenses} = (\$7.53 \times q) + \$17,600$$

Fixed and Variable Expenses

Example:

Raymond Ski Supply manufactures hand warmers for skiers. Their expense function is $E = 1.18q + 12,000$. Find the cost of producing 50,000 pairs of hand warmers.

$$E = 1.18q + 12,000$$

$$E = 1.18(50,000) + 12,000$$

$$E = \$71,000$$

Fixed and Variable Expenses

Example:

Wally's Widget World created a monthly expense equation, $E = 1.10q + 4,200$. Wally's Widget World plans to sell its widgets to retailers at a wholesale price of \$2.50 each.

a) What is its revenue function?

Revenue = price x quantity

$$R = 2.50q$$

Fixed and Variable Expenses

Example:

Wally's Widget World created a monthly expense equation, $E = 1.10q + 4,200$. Wally's Widget World plans to sell its widgets to retailers at a wholesale price of \$2.50 each.

b) How many widgets must be sold to reach the breakeven point?

$$E = R$$

$$1.10q + 4,200 = 2.50q$$

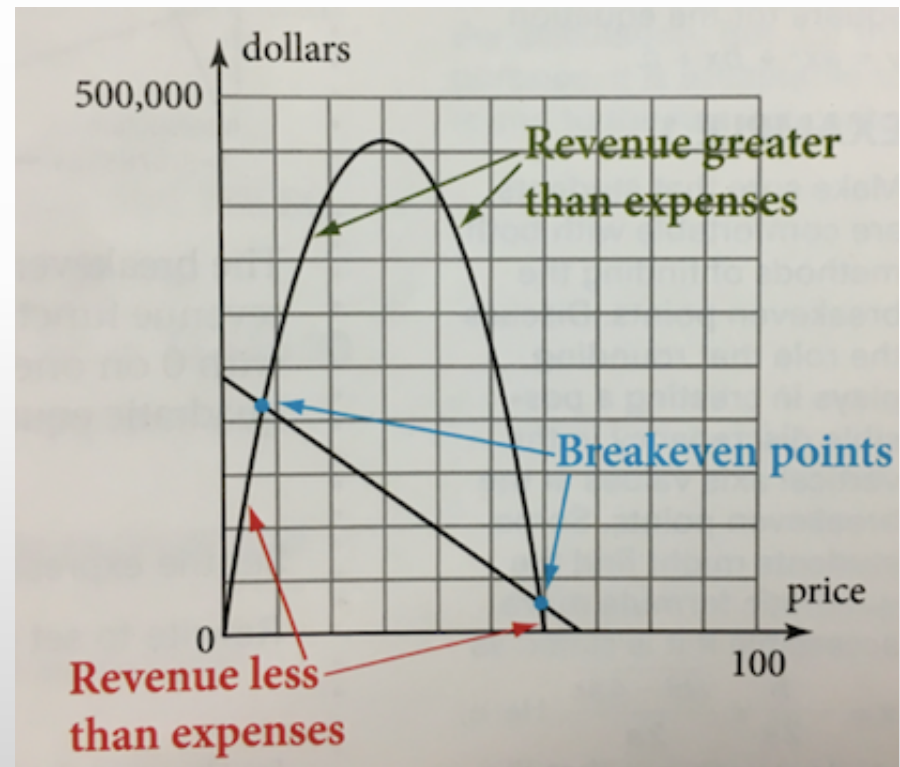
$$4,200 = 1.40q$$

$$3,000 = q$$

Break-Even Analysis

When the revenue function is a **quadratic function**, you need to use the **quadratic formula** to solve for the breakeven points.

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



Break-Even Analysis

Example: Determine the prices at the breakeven points for a certain product.

Expense Function

$$E = -3,500q + 238,000$$

Revenue Function

$$R = -500q^2 + 30,000q$$

$$E = R$$

$$-3,500q + 238,000 = -500q^2 + 30,000q$$

$$500q^2 + -33,500q + 238,000 = 0$$

Now use the quadratic formula to solve for q .

Break-Even Analysis

$$500q^2 + -33,500q + 238,000 = 0$$

$$a = 500 \quad b = -33,500 \quad c = 238,000$$

$$q = \frac{-(-33,500) \pm \sqrt{(-33,500)^2 - (4 \times 500 \times 238,000)}}{2 \times 500}$$

$$q = \frac{33,500 \pm \sqrt{1,122,250,000 - (476,000,000)}}{1,000}$$

$$q = \frac{33,500 \pm \sqrt{646,250,000}}{1,000}$$

$$q = \frac{33,500 \pm 25421.45}{1,000}$$

$$q = \frac{33,500 + 25421.45}{1,000} = \frac{58,921.45}{1,000} = \boxed{58.92}$$

$$q = \frac{33,500 - 25421.45}{1,000} = \frac{8078.55}{1,000} = \boxed{8.08}$$

Mathematically Modeling a Business

Example: Determine the expense, E for production of an item when the price p , is \$60 given $E = 50q + 80,000$ and $q = 80p + 100,000$.

$$p = \$60;$$

$$E = 50q + 80,000$$

$$q = 80p + 100,000$$

$$q = 80p + 100,000$$

$$q = 80(60) + 100,000$$

$$q = 4800 + 100,000$$

$$q = 148,000$$

$$E = 50q + 80,000$$

$$E = 50(148,000) + 80,000$$

$$E = 7,400,000 + 80,000$$

$$E = 7,480,000$$