

Worksheet #22 - Applications using Linear Models

Spring 2007

Objectives

- Understand how certain applications use a linear model to describe behavior.
- Understand that the intercepts of a line have special meaning depending on the application.
- Understand that the intersection of two functions (perhaps linear functions) might have special meaning within the application.

Linear Application from Economics

- Comparing cost functions (Rental car company)
 - Do problem 14 from page 12.
 - Model each company's rental rates as a linear function.

$$C_1 = 40d + .15m$$

$$C_2 = 50d + .10m$$

If $d = 1$, then the cost function could be simplified to:

$$C_1 = 40 + .15m$$

$$C_2 = 50 + .10m$$

Notice that the rate of change of the cost function for Company 1 is greater than that of Company 2. This means that the cost of using Company 1 is growing faster and will eventually exceed that of Company 2. Now, find the intersection to determine the number of miles for which the cost would be the same.

$$40 + .15m = 50 + .10m$$

$$0.05m = 10$$

$$m = 200$$

For mileage over 200 miles, Company 1 will cost more.

- What do the slopes of the lines represent?

The slopes represent the rate of change of the cost functions. The units of the slopes are dollars per mile.

- What does knowing the intersection of the graphs tell you?

The intersection tells you the mileage in which both companies would be charging you the same amount.

- Cost and Revenue functions and finding the break even point

- Write the definition of a cost function $C(q)$. What does

$$C(200) = 30000$$

mean in terms of a product that you might be producing?

The cost of producing 200 items is \$30,000.

- Write the definition of a revenue function $R(q)$. What does

$$R(200) = 50000$$

mean in terms of a product that you might be producing?

The revenues that you would receive from selling 200 items is \$50,000.

- What is the definition of profit? Is revenue and profit the same thing?

Profits are the revenues minus the costs. Revenue and profit are not the same. Your revenues will be a positive amount. Your profits will be positive only if your revenues are greater than your costs.

- Do problem 11 from page 30.

- Depreciation of large equipment

- Do problem 16 from page 30.

- What is the sign (plus or minus) of the slope in a depreciation problem? Understand why this is always the case?

The sign of the slope in a depreciation problem will be negative. A negative slope or a negative rate of change tells you that whatever you are measuring is decreasing over time. The meaning of depreciation is that something is losing value or its value is decreasing.

- What do the intercepts of the depreciation graph mean in terms of time and value of the object (such as a truck)?

Intercepts are locations on the graph where one of the variables is zero. So, the horizontal intercept is where the value of the truck is zero and the time variable would indicate when the truck was considered worthless. And the vertical intercept represents the value of the truck when $t = 0$ or its initial value.

- Purchasing multiple items with budget constraints
 - The Papa Jazz problem and Coke-Wings problem from the worksheet are budget constraint problems.
 - In words, what is a budget constraint ?
 - For a different type of problem, do problem 30 from page 32.
- Supply and Demand curves
 - Read pages 26 through 28 concerning the supply and demand curves.
 - Write the definitions of the supply curve and the demand curve. Think of supply and demand curves as measuring the market at any given point in time.
 - Why is the slope of the demand curve negative? Explain in terms of the price of a product versus the number of people willing to buy the product.
 - What is the importance of the intersection of the supply curve and the demand curve?
 - Do problem 26 from page 32.
 - If the curves are measuring the market at any given point in time, how might a demand curve change over time?