Math 1520

Course Notes

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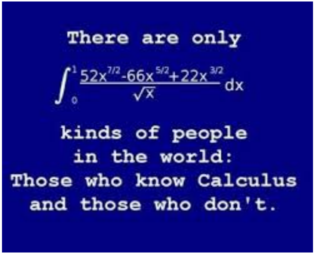


Topic 1 Outline

1. Linear Functions
   - What is a Linear Function?
   - Slopes and Equations of Lines
   - Applications of Linear Functions

Topic 1 Learning Objectives

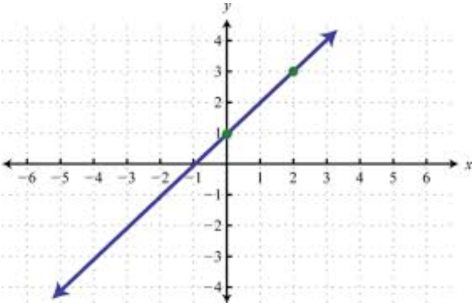
1. define a linear function visually, numerically, and algebraically
2. calculate and interpret slope of a line
3. understand and use the various equations for lines
4. solve problems involving linear functions
5. define the cost function

What is a Linear Function?

A **linear function** is a relationship defined by $Ax + By = C$ (where A, B, and C are real numbers).

Visually, it can be graphed on the *Cartesian Co-ordinate System* as a straight line.

Numerically, it can be represented as a list of ordered pairs, (x, y) (where x is the **independent variable** and y is the **dependent variable**.



Slope

The slope of a line represents its *steepness*, and can be thought of as $\frac{rise}{run}$.
What is the slope of the line in the last slide?
We can calculate it from two ordered pairs (x_1, y_1) and (x_2, y_2) using the formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Example: Find the equation of the line that passes through the point $(1, 0)$ and is parallel to the line $3x + y = 6$.

Equations of Lines

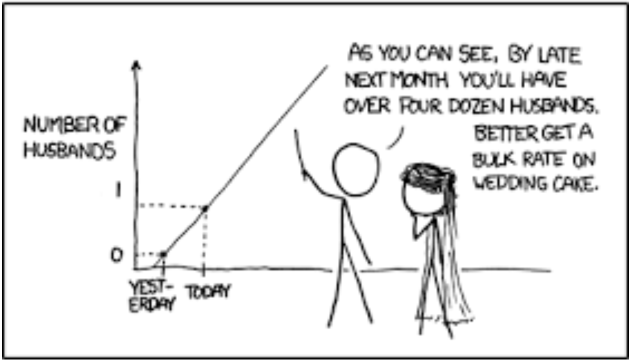
Slope-Intercept Form: $y = mx + b$

Point-Slope Form: $y - y_1 = m(x - x_1)$

Applications of Linear Equations

We can model some real-world situations using **mathematical models** to examine trends and make preditions in situations when 2 quantities are related in a linear way.

MY HOBBY: EXTRAPOLATING



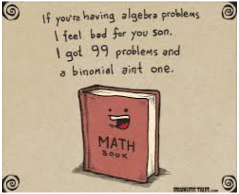
Examples

A Bank account pays 6% simple interest per year. How much interest would you make in 1 year? 10 years?

Examples

Suppose an economist has studies the supply and demand for vinyl siding and has determined that the price per square yard p and the quantity demanded monthly q are related by the linear function $p = 60 - \frac{3}{4}q$ (this is the DEMAND function).
While the price and supply s are related by $p = \frac{3}{4}q$ (this is the SUPPLY function).

1. Find the demand at a price of \$45 and \$18.
2. Find supply at a price of \$60 and \$12.
3. Graph both functions on the same axis and examine the ordered pairs. What happens where the supply and demand curves cross?
4. Can you find this spot without graphing?



Cost

The cost of manufacturing consists of a **fixed cost** (also called the **marginal cost** for a linear function) and a **cost per item**.
Example: The fixed cost to make x units of feed is \$20 and the company changes \$24. The cost to produce 10 units is \$300.

1. Find the cost function $C(x)$.
2. How many units must be sold for the firm to break even?

Five in Five!

Solve the following in 5 minutes or less!

1. Graph the function $2x + 4y = 12$
2. What are the x- and y-intercepts of the function $y = 5x + 20$
3. What is the slope of the line that goes through the points $(0, 0)$ and $(-4, 1)$?
4. What is the equation of the line with a y-intercept of 7 and no x-intercept?
5. What is the slope of the line that is perpendicular to the line $x + y = 1$?

Flex the Mental Muscle!

I am considering renting a car from either Dirty Dar's Rental Cars or Silly Milly's Rental Cars. Dirty Dar charges a \$100 flat rate and \$0.2 per km to rent a car, whereas Silly Milly charges \$150 for the rental, but only \$0.1 per km.

1. Which company should I choose if I am driving 100km?

2. Which company should I choose if I am driving 1000km?

3. At what amount of km would the price for each company be exactly the same?