

Lesson 4.1.2: Comparing Change

Theme: Personal Finance and Citizenship

Specific Objectives

Students will understand

- that linear models are appropriate when the situation has a constant rate of increase/decrease or can be approximated by a constant rate.
- that the rate of change (slope) has units in context.
- the difference between a positive slope and a negative slope.
- that the linear models for authentic situations have limitations in using them to make predictions.

Students will be able to

- make a linear model when given data or information in context.
- calculate a slope given data or information in context.
- estimate the value that makes two linear models equivalent.

Problem Situation 1: Milk and Soft Drink Consumption

Over the last 60 years, the U.S. per-person consumption of milk and soft drinks has changed drastically. For example, in 1950, the number of gallons of milk consumed per person was 36.4 gallons; in 2000 that number had decreased to 22.6 gallons. Meanwhile, the number of gallons of soft drinks consumed per person in 1950 was 10.8 gallons. By 2000, this number had increased to 49.3 gallons per person.¹

Is there a time when the consumption (per person) of milk equaled or will equal the consumption (per person) of soft drinks? If so, find when they were equal or when they will be equal. For this problem, assume that the change in consumption is linear.

Problem Situation 2: Moving Truck Rental

Suppose you and your roommates need to move, so you look into renting a moving truck for the day. U-Haul (www.uhaul.com) charges the following amounts for three different trucks. The dimensions for the trucks are given in length x width x height.

- \$19.95 plus \$0.79 per mile for a cargo van with inside dimensions: 9'2" x 5'7-1/2" x 4'5"
- \$29.95 plus \$0.99 per mile for a 14' truck with inside dimensions: 14'6" x 7'8" x 7'2"
- \$39.95 plus \$0.99 per mile for a 20' truck with inside dimensions: 19'6" x 7'8" x 7'2"

You estimate that you and your roommates have three rooms full of furniture and boxes, equivalent to about 1,000 cubic feet. Your new apartment is about 10 miles (one way) from your old apartment.

As a group, decide which vehicle size is a better deal to rent. Provide work to support your answer.

¹Retrieved from www.ers.usda.gov/data/foodconsumption/spreadsheets/beverage.xls

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Making Connections

Record the important mathematical ideas from the discussion.

Further Applications

(1) In Lesson 3.2.2, you probably created a table of values like the one below for the relationship between the velocity of a car in miles per hour (mph) and the braking distance in feet.

(a) Calculate the slope between each of the two points in the table. The first answer is shown as an example.

Velocity (mph)	Braking Distance (ft)	Slope Between Two Points
5	0.98	
15	8.84	The slope between (5, 0.98) and (15, 8.84) is 0.786.
20	15.72	Find the slope between (15, 8.84) and (20, 15.72).
30	35.37	Find the slope between (20, 15.72) and (30, 35.37).
50	98.24	Find the slope between (30, 35.37) and (50, 98.24).

(b) Is this a linear relationship? Explain your answer.

(c) Which of the following is the best explanation for the meaning of the first slope in the table?

- (i) At speeds between 5 and 15 miles per hour, the braking distance increases *exactly* 0.786 feet for every increase of 1 mile per hour in speed.
- (ii) On average, at speeds between 5 and 15 miles per hour, the braking distance increases 0.786 feet for every increase of 1 mile per hour in speed.
- (iii) At speeds between 5 and 15 miles per hour, the braking distance decreases *exactly* 0.786 feet for every increase of 1 mile per hour in speed.
- (iv) On average, at speeds between 5 and 15 miles per hour, the braking distance decreases 0.786 feet for every increase of 1 mile per hour in speed.

(d) Use the trend of the data in the table to make predictions about the braking distance for speeds between 50 and 70 mph. Which of the following is a correct statement?

- (i) The braking distance between 50 and 70 mph will increase by about 3.144 feet per mile.
- (ii) The braking distance between 50 and 70 mph will increase by exactly 3.144 feet per mile.
- (iii) The braking distance between 50 and 70 mph will increase by more than 3.144 feet per mile.
- (iv) The braking distance between 50 and 70 mph will increase by less than 3.144 feet per mile.

(e) Explain your answer to Part (d).