Chapter 2

Describing Change: Rates

Measures of Change over an Interval

Formulas

Let f be a function with input values x_1, x_2 such that $x_1 < x_2$.

Change

Percent Change

Average Rate of Change (AROC)

When giving interpretations, we have four considerations:

- **When** is this event happening? Be sure to specify the interval.
- **What** is happening? Specify the quantity which is changing.
- **How** is it changing? Specify whether or not the quantity is increasing or decreasing.
- By **how much** is it changing? Include proper units.

Example 2.1.1. If f denotes the number of students enrolled in Math 1743 and x is the number of academic years after the 2000-2001 academic year, interpret the expression $f(10) = 1552$.

Examples

Example 2.1.2. The average temperature in Norman during the last week of September is given in the table below:

Time	**Temperature** (° F)	**Time**	**Temperature** (° F)
7am	49	1pm	80
8am	58	2pm	80
9am	66	3pm	78
10am	72	4pm	74
11am	76	5pm	69
noon	79	6pm	62

(a) Give the average rate of change in temperature between 11am and 4pm. Write a sentence interpreting your result.

(b) Find the percent change in temperature between 9am and noon, and round your answer to the nearest hundredth. Write a sentence interpreting your result.

Example 2.1.3. Airtran posted a revenue of \$603.7 million dollars in the second quarter of 2009 compared with revenue of \$693.4 million during the second quarter of 2008. Write a sentence interpreting each of the following:

(a) Find the change in revenue between the second quarter of 2008 and the second quarter of 2009.

(b) Find the percent change between the second quarter of 2008 and second quarter end of 2009.

(c) Find the average rate of change between the second quarter of 2008 and the second quarter of 2009.

Example 2.1.4. The American Indian, Eskimo, and Aleut populations in the United States was 362 thousand in 1930, and 4.5 million in 2005. Write a sentence interpreting each of the following, and round to two decimals if necessary:

(a) Find the change in population between 1930 and 2005.

(b) Find the percent change between between 1930 and 2005.

(c) Find the average rate of change between 1930 and 2005.

Example 2.1.5. OU Parking Services commissioned a projection of its profit (in thousands of dollars) when commuter parking passes are set certain prices.

Price (dollars)	200	250	300	350	400	450
Profit (thousand dollars)	2080	2520	2760	2820	2700	2380

(a) Find a model for the data.

(b) Calculate the average rate of change of profit when the parking pass price rises from \$200 to \$350.

(c) Calculate the average rate of change of profit when the parking pass price rises from \$350 to \$450.

(d) Calculate the percent change for parts (b) and (c).

Example 2.1.6. The CDC modeled the number of Zika cases diagnosed in Brazil between January and July of 2016 with the formula

$$z(t) = 2.75(1.04^t) \text{ thousand cases}$$

where t is the number of months since January 2016.

(a) Calculate and write a sentence of interpretation for the average rate of change in the number of Brazilians diagnosed with Zika between January 2016 and July 2016.

(b) Calculate the percentage change in part (a).

Example 2.1.7. The function $c(t)$ represents the number of students in line at Chick-Fil-A, t hours after 11:00am, and $q(t)$ represents the number of students in line at Quizno's, t hours after 11:00am. Write a sentence interpreting the following expressions.

(a) $c(3) = 15$

(b) $q(1) = 8$

(c) $(c + q)(0) = 12$