CHAPTER 7: SLOPE AND ASSOCIATION

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Lesson:

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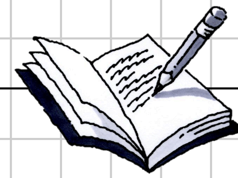

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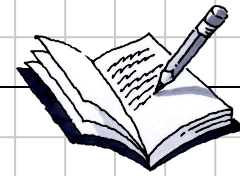

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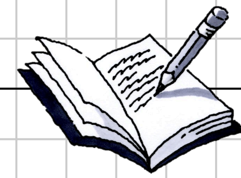


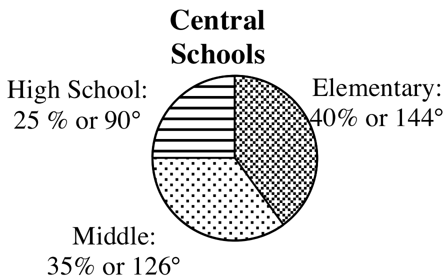
MATH NOTES

Notes:

CIRCLE GRAPHS

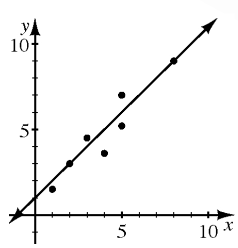
A **circle graph** (sometimes called a **pie chart**) is similar to a bar graph in that it deals with categorical data (such as make of car or grade in school) and not continuous data (such as age or height).

Each category of data is put into its own sector of the circle. The measure of the central angle bounding the sector is proportional to the percent of elements of that type of the whole. For example, if Central Schools has 40% of its students in elementary school, 35% in middle school, and 25% in high school, then its circle graph would have a central angle of 144° (0.4 times 360°) for the sector showing the elementary school, 126° for the sector showing the elementary school, and 90° for the sector showing the high school.



LINE OF BEST FIT

A **line of best fit** is a straight line drawn through the center of a group of data points plotted on a scatterplot. It represents a set of data for two variables. It does not need to intersect each data point. Rather, it needs to approximate the data. A line of best fit looks and "behaves" like the data, as shown in the example at right.

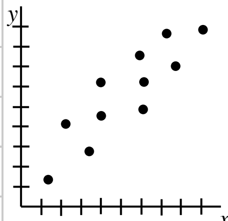


Notes:

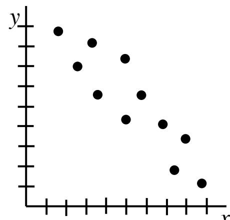
DESCRIBING ASSOCIATION – PART 1

An association (relationship) between two numerical variables can be described by its form, direction, strength, and outliers.

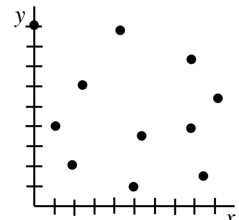
If one variable increases as the other variable increases, there is said to be a **positive association**. If one variable increases as the other variable decreases, there is said to be a **negative association**. If there is no relationship between the variables, then the points in the scatterplot have **no association**. An example of each situation is illustrated below.



Positive Association

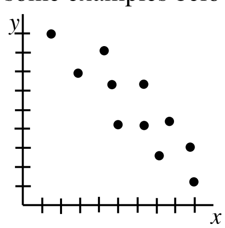


Negative Association

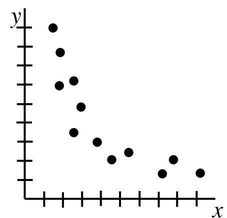


No Association

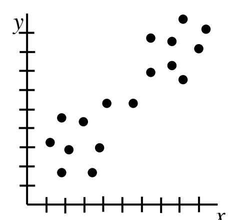
When there is a positive or negative association, the shape of the pattern is called the **form** of the association. Associations can have a **linear form** or a **non-linear-form**, and the form can be made up of **clusters** of data. See some examples below.



Negative **linear** association (for example, gas mileage decreases as the weight of cargo on a truck increases)



Negative **non-linear** association (for example, temperature of a cup of coffee decreases over time)



Positive **linear** association with **clusters** (for example, height increases as shoe size increases; one cluster is mostly girls and the other cluster is mostly boys)

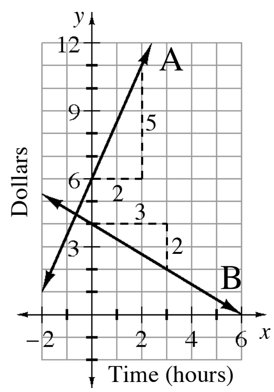
SLOPE OF A LINE

Notes:

The **slope** of a line is the ratio of the change in y to the change in x between any two points on the line. To find slope, you compute the *ratio* that indicates how y-values are changing with respect to x-values. Essentially, slope is the unit rate of change, because it measures how much y increases or decreases as x changes by one unit. If the slope is positive (+), the y-values are increasing. If it is negative (–), the y-values are decreasing. The graph of a line goes up for positive slopes and down for negatives slopes as the line moves across the graph from left to right.

$$\text{slope} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{change in } y\text{-values}}{\text{change in } x\text{-values}}$$

Some textbooks write this ratio as $\frac{\text{rise}}{\text{run}}$.

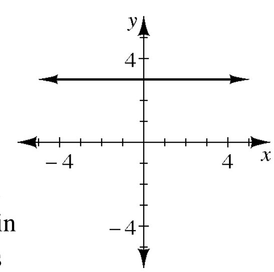


In the graph at right, the slope of line A is $\frac{5 \text{ dollars}}{2 \text{ hours}}$ because for every 2 hours the line increases horizontally, the line increases 5 dollars vertically. Since y increases by $\frac{5}{2}$ dollars when x increases by 1 hour, the unit rate is $\frac{\frac{5}{2} \text{ dollars}}{1 \text{ hour}}$ or 2.5 dollars per hour.

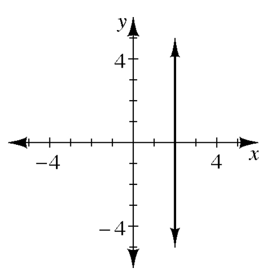
To find the slope of line B, notice that when x increases by 3 hours, y *decreases* by 2 dollars, so the vertical change is –2 dollars and the slope is written as $-\frac{2 \text{ dollars}}{3 \text{ hours}}$ or $-\frac{2}{3}$ dollars per hour.

It is important to notice that horizontal lines do not increase or decrease vertically, so they are described with a slope of 0. The slope of a vertical line is undefined. This is because the horizontal change is 0, resulting in a slope of $\frac{y}{0}$, which is undefined.

slope = 0



slope is undefined



Notes:

PROPORTIONAL EQUATIONS

A proportional relationship can be seen in a table or a graph, as you saw in Section 1.2 of Chapter 1. The equation for a proportion is $y = kx$, where k is the **constant of proportionality**, or the slope of the line. The starting point of the linear equation is always zero, because a proportional relationship always passes through the origin.

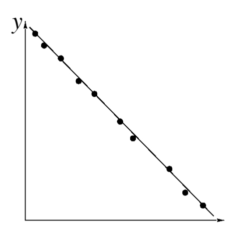
The constant of proportionality, when written as a fraction with a denominator of 1, is the **unit rate**.

For example, if the constant of proportionality (the slope) is $\frac{\$7.00}{3 \text{ pounds chicken}}$, then the equation relating weight to cost is $y = \frac{7}{3}x$, where x is the weight (lbs) and y is the cost ($).

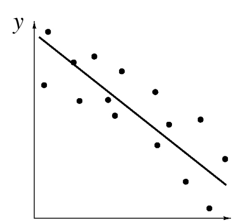
The unit rate is $\frac{\$\frac{7}{3}}{1 \text{ pound chicken}} \approx \$2.33$ per pound.

DESCRIBING ASSOCIATION – PART 2

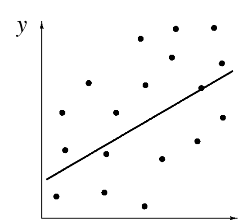
Although considering the direction of an association (positive or negative) is important in describing it, it is just as important to consider the **strength** of the association. Strength is a description of how much scatter there is in the data away from the line of best fit. Examples are shown below.



strong negative association



moderate negative association



weak positive association

An **outlier** is a piece of data that does not seem to fit into the pattern. There is one obvious outlier in the association on the graph at right.