

## 12.5 Working with Samples

Calculate a sample proportion

Calculate the margin of error

Find an interval that represents a true sample population given  
the margin of error



## Sample

Gathers information from only part of a population

Using any sample, you can find a **sample proportion**.

The **sample proportion** is the ratio  $\frac{x}{n}$

$x$  ← # of times an event occurs  
 $n$  ← sample size

**1 EXAMPLE** In a sample of 500 teenagers, 328 had never attended a popular music concert. Find the sample proportion for those who have never attended a concert. Write the answer as a percent.

$$\begin{aligned}\text{sample proportion} &= \frac{x}{n} && \text{Write the formula.} \\ &= \frac{328}{500} && \text{Substitute 328 for } x \text{ and 500 for } n. \\ &= 0.66 && \text{Simplify.}\end{aligned}$$

The sample proportion of teenagers who have never attended a popular music concert is about 66%.

In a poll of 1085 voters, 564 favor Candidate A. Find the sample proportion for those who favor Candidate A.



$$\longrightarrow 564/1085 = .519 = 52\%_{\text{b}}$$

In general, **samples** vary in how well they reflect the entire population.

**Random Sample** – are all members of the population are equally likely to be chosen.

**Bias** - when a part of a population is over represented or underrepresented in a sample



A news program reports on a proposed school dress code. The purpose of the program is to find out what percent of the population in its viewing area favors the dress code. Identify any bias in each sampling method.

- a. Viewers are invited to call the program and express their preferences.
- b. A reporter interviews people on the street near the local high school
- c. During the program, 300 people are selected at random from the viewing area

**2 EXAMPLE** The Sunnyvale High School student council dance committee is trying to decide whether to have a band or a DJ for the fall dance. They decided that each of the four committee members should survey the students in their homeroom classes. Identify any bias in this sampling method.

This is a “convenience” sample that is convenient for the committee members.

Four homerooms may not accurately reflect the opinions of the entire school, because four homerooms is probably a low percentage of all the school’s homerooms.

This sampling method has a bias and is not random.

A survey was developed to estimate the average number of hours per week that adults spend exercising. Every third person entering a large fitness complex was surveyed, with a total of 2,500 people being surveyed. The data showed that the mean number of hours spent exercising was 3.2 hours per week. Which characteristic of the survey could create a bias in the results?

- [1] the size of the sample
- [2] the method of analyzing the data
- [3] the method of choosing the people who were surveyed
- [4] the size of the population





## **Margin of error**

A sample proportion should be reported with an estimate of error.

The margin of error is based on the standard deviation.

The larger the sample size the smaller the margin of error.

## Margin of Error Formula

When a random sample of size  $n$  is taken from a large population, the sample proportion has a margin or error of approximately

$$\pm \frac{1}{\sqrt{n}}$$

**4 EXAMPLE**

An opinion poll about the popularity of the mayor has a margin of error of  $\pm 5\%$ . Estimate the number of people who were surveyed.

$$\text{margin of error} = \pm \frac{1}{\sqrt{n}}$$

Write the formula.

$$\sqrt{n} = \pm \frac{1}{\text{margin of error}}$$

Rewrite the equation.

$$\sqrt{n} = \pm \frac{1}{0.05}$$

Substitute 0.05 for margin of error.

$$\sqrt{n} = \pm 20$$

Simplify.

$$n = 400$$

Square each side.

The poll surveyed about 400 people.

**5 EXAMPLE** A survey of 528 high school seniors found that 65% already had career plans after high school.

- a. Find the margin of error for the sample.

$$\text{margin of error} = \pm \frac{1}{\sqrt{n}}$$

Write the formula.

$$= \pm \frac{1}{\sqrt{528}}$$

Substitute.

$$\approx \pm 0.0435$$

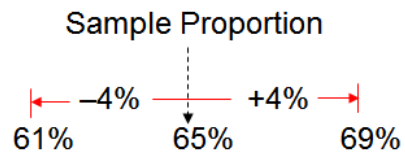
Use a calculator.

The margin of error is about  $\pm 4\%$ .

**5 EXAMPLE** (continued)

- b. Use the margin of error to find an interval that is likely to contain the true population proportion.

The margin of error forms an interval with the sample proportion at its midpoint.



The proportion of seniors who already have career plans is likely to be from 61% to 69%.

Applying all of these concepts.....

In a random sample of 602 students, 450 want school to start at 9am.

a) Find the sample proportion.

$$\rightarrow 450/602 = .747 = 75\%$$

b) Find the margin of error.

$$\rightarrow \pm \frac{1}{\sqrt{602}} = .04 = 4\%$$

c) Find the interval likely to contain the true population proportion.

$$\begin{aligned} \rightarrow 75\% + 4\% &= 79\% \\ \rightarrow 75\% - 4\% &= 71\% \end{aligned}$$



GO COUGARS!



HW12.5 p. 680 #1-20 (omit 7, 8)

SAT  
Pg 95 #1-19 odd