14.1 Notes Key

What is the probability of an event occurring?

★ Where have you heard probability being used in the real world?

- Weather : 60% chance of rain
- winning | losing : 1 in 256 chance of winning
  7 out of 10 free throws made
  etc.
- Flipping a coin : 50% or 1/2 of flipping H or T

★ Probability is the likelihood of an event occurring

Theoretical Probability vs. Experimental Probability

★ Probability an event will occur ★

$$P(\text{event}) = \frac{\text{total \# of ways event can occur}}{\text{total \# of equally likely outcomes}}$$

★ Found by collecting data ★

$$P(\text{event}) = \frac{\text{\# of times event occurs}}{\text{total \# of trials}}$$

EXPERIMENTAL PROBABILITY

Sometimes theory and logic are unable to provide probabilities for events. In such cases, only the collection of data can provide the information needed to determine probabilities. In this Activity, you will collect data that involves the opening of paper clips.

1. Hold a paper clip, and open it up as shown below. Did it break?

Paper clips are not intended to be opened all the way. But suppose that is their purpose. If one breaks, we could say that it is defective.

2. A common sample size for inspection is *five*. Test five clips, and record the number of defective ones.
3. Now repeat your test on 10 more samples of size five. Record your results in a table similar to the one below. The third column should contain the total number of defective clips found in all samples up to that point. The fourth column should contain the percent of defective clips up to that point.

3. Sample answer:

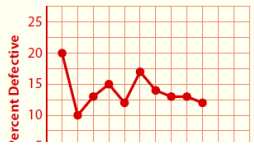
Sample Number	Number of Defects in Sample	Cumulative Number of Defects	Cumulative Percent of Defects
1	1	1	1 ÷ 5 = 20%
2	0	1 + 0 = 1	1 ÷ 10 = 10%
3	1	1 + 1 = 2	2 ÷ 15 = 13%
4	1	2 + 1 = 3	3 ÷ 20 = 15%
5	0	3 + 0 = 3	3 ÷ 25 = 12%
6	2	3 + 2 = 5	5 ÷ 30 = 17%
7	0	5 + 0 = 5	5 ÷ 35 = 14%
8	0	5 + 0 = 5	5 ÷ 40 = 13%
9	1	5 + 1 = 6	6 ÷ 45 = 13%
10	0	6 + 0 = 6	6 ÷ 50 = 12%

4. Construct a line graph of the percent of defects versus the total number of clips tested.

As the number of paper clips tested increases, your graph should begin to level off. The height of the graph as it levels off provides an approximate value for the probability that a given clip is defective. This type of probability is called an **experimental probability**.

Experimental Probability

4. Sample graph:



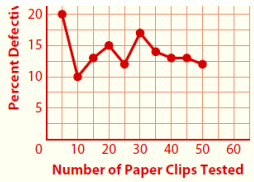
approximate value for the probability that a given clip is defective. This type of probability is called an **experimental probability**.

Experimental Probability

The experimental probability that a particular event will occur is found by collecting data.

$$\text{Probability of an event} = \frac{\text{number of times the event occurs}}{\text{total number of trials}}$$

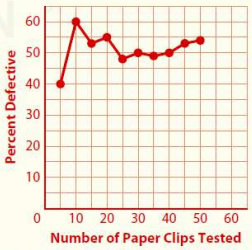
5. Estimate the probability of a defective paper clip. Express your answer as a percent, a decimal, and a fraction.
6. Now repeat Questions 2–5 for a different brand of paper clip.



5. Sample answer: 12%, 0.12, $\frac{12}{100}$

6. Sample answer:

Sample Number	Number of Defects in Sample	Cumulative Number of Defects	Cumulative Percent of Defects
1	2	2	40%
2	4	6	60%
3	2	8	53%
4	3	11	55%
5	1	12	48%
6	3	15	50%
7	2	17	49%
8	3	20	50%
9	4	24	53%
10	3	27	54%



The probability of a defective paper clip is about 54%, or 0.54, or $\frac{27}{50}$.

Law of Large Numbers:

if an experiment is repeated many times, the experimental probability tends to be close to the theoretical probability of that event.