Goal: Calculate probabilities for events in which sample space is small.

Warm Up: A drawer contains 7 red socks, 8 blue socks, and 12 white socks. Assume that you draw a sock randomly from the drawer.
   a. What is the probability that it is red?

   b. What is the probability that is not white?

   c. What is the probability that it is green?

The Outcome and Sample Space of an Experiment

An *experiment* is any situation that can have _____ _____. *Probabilities* are measures of how _____ the results occur. Each result is called an _____. The set of all possible outcomes is called a _____. What are the possible sample spaces of the following?

Experiment	Sample Space
Flipping a coin	
Tossing a six-sided die	
Taking an antibiotic for sore throat	
Choosing an integer from 1 to 100	

Example 1: Two six-sided dice, one red and one green are thrown, and both numbers are recorded. List all the possible outcomes. How many outcomes are in the sample space?
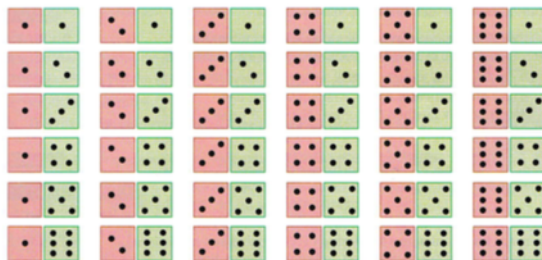
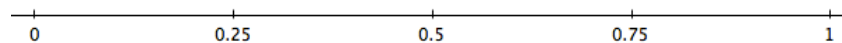| Questions	
	<u>Example 2:</u> A small pink box with a rose painted on the cover contains 30 purple clips, 30 blue clips and 25 yellow clips. Two clips are extracted from the box using pliers. List all the possible outcomes for this experiment. How many outcomes are in the sample space?

 Events and Probabilities

When two dice are thrown, a casino-goer (that is, one who goes to a casino), might be trying to get a sum of 7. Or, when flipping a coin twice, a person might want tails twice. Each of these is called an_____, because it happens.

If a red die and a green die are tossed. List the possible events and outcomes below.

Event Description	Outcomes in Event
Tossing "doubles"	
Tossing a sum of ten	
Tossing a 3 on the red die	
Tossing a sum of 1	

Where would you place these terms on the spectrum: certain, equally likely, impossible, unlikely, likely?

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  +--------------+--------------+--------------+--------------+
  0             0.25          0.5           0.75            1
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If the probability of an event E, written as $P(E)$, is 25%, then _____,
_____, _____ are some possible equivalent ways to write it. We would also say that it is _____.

Questions

Definition of Probability of an Event

Let E be an event in a finite sample space S. Let $N(E)$ and $N(S)$ be the numbers of elements in E and S, respectively. If each outcome in S is equally likely, then the probability that E occurs, called the **probability of E** and denoted **P(E)**, is given by

$$P(E) = \frac{N(E)}{N(S)} = \frac{\text{number of outcomes in event}}{\text{number of outcomes in the sample space}}.$$

Another way to say this is $P(E) = \dfrac{\text{\# of favorable}}{\text{\# of possible}}$.

Example 3: In the two-dice situation from Example 1, find the following:

a. $P(\text{doubles}) =$ b. $P(\text{sum of } 10) =$

c. $P(\text{sum of } 1) =$ d. $P(\text{sum of not } 10) =$

Example 4: An experiment consists of tossing two fair coins (*fair* means _____) and counting the number of heads. Consider the events 1 head in all, 2 heads in all and 0 heads in all. Are these events equally likely?

a. Make tree diagram

b. Count possible outcomes and favorable outcomes

c. Compute probabilities

Questions

In 1-4, two fair 8-sided dice with faces numbered 1-8, are rolled.
Find each probability.

1. $P($ the sum is even$)$ _____

2. $P($the sum is odd but not 7$)$ _____

3. $P($the difference is less than 3$)$ _____

4. $P($the difference is a prime number$)$ _____

Consider an experiment in which a 6-sided die and a 4-sided die are rolled, and the results are recorded.

5. List the elements in the experiment's sample space.

6. List the outcomes in the event "the number rolled on the six-sided die is even".

7. What is $P($ the six-sided die is even$)$?

8. What is $P($both dice are even$)$?

Summary: