Geometry 13.5
Find probabilities of independent and dependent events
Find probabilities of events given the occurrence of other events
(conditional probability)

compound (composite) event 2 +
independent events Separate outcomes
dependent events 1st → changed 2nd

Conditional

Quiz 13.3-13.4 Mon.

Does the first outcome change the options for the second event?

no, same options (independent)

yes, something has changed (dependent)

Example 1 Identify Independent and Dependent Events

Determine whether the events are *independent* or *dependent*. Explain your reasoning.

a. One coin is tossed, and then a second coin is tossed. I

The outcome of the first coin toss in no way changes the probability of the outcome

b. In the class presentation example above, one student's name is chosen and not replaced, and then a second name is chosen. D

c. Wednesday's lottery numbers and Saturday's lottery numbers. I

GuidedPractice

1A. A card is selected from a deck of cards and put back. Then a second card is selected.

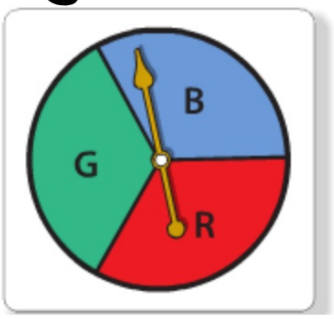
T

1B. Andrea selects a shirt from her closet to wear on Monday and then a different shirt to wear on Tuesday.

D

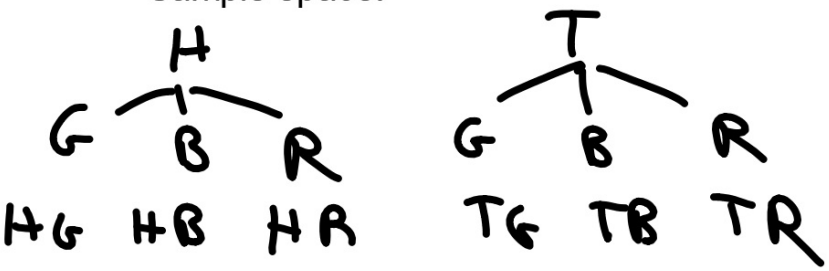
Coin flip + spinner:

2 3



Independent or dependent

Sample space:



$\frac{1}{6}$

How many different outcomes?

6

KeyConcept Probability of Two Independent Events

Words	The probability that two independent events both occur is the product of the probabilities of each individual event.
Symbols	If two events A and B are independent, then $P(A \text{ and } B) = P(A) \cdot P(B)$.

$\frac{1}{2} \cdot \frac{1}{3} = \frac{1}{6}$

This rule can be extended to any number of events.

Independent or dependent? (do options change?)

GuidedPractice

Find each probability. I $\frac{1}{2} \cdot \frac{1}{6} = \frac{1}{12}$

2A. A coin is tossed and a die is rolled. What is the probability that the coin lands heads up and the number rolled is a 6?

2B. Suppose you toss a coin four times. What is the probability of getting four tails?

I $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{16}$

Real-World Example 2 Probability of Independent Events

TRANSPORTATION Marisol and her friends are going to a concert. They put the slips of paper shown into a bag. If a person draws a yellow slip, he or she will ride in the van to the concert. A blue slip means he or she rides in the car.

3B 5Y T 8

Suppose Marisol draws a slip. Not liking the outcome, she puts it back and draws a second time. What is the probability that on each draw her slip is blue?

$\frac{3}{8} \cdot \frac{3}{8} = \frac{9}{64}$ 1ST $\frac{3}{8}$ 2ND $\frac{3}{8}$

$\frac{3}{8} \cdot \frac{2}{7} = \frac{6}{56}$

Car Van

First result changes the options for the second choice.

KeyConcept Probability of Two Dependent Events

Words

The probability that two dependent events both occur is the product of the probability that the first event occurs and the probability that the second event occurs *after* the first event has already occurred.

Symbols

If two events A and B are dependent, then

$$P(A \text{ and } B) = P(A) \cdot P(B|A).$$

$\frac{1}{n} \cdot \frac{1}{m}$

This rule can be extended to any number of events

The notation $P(B|A)$ is read *the probability that event B occurs given that event A has already occurred*. This is called **conditional probability**.

52

13♥ 13♢ 13♤ 13♧

R R B B

GuidedPractice

3. Three cards are selected from a standard deck of 52 cards. What is the probability that all three cards are diamonds if neither the first nor the second card is replaced?

2-10

J Q K face

A

D: $\frac{13}{52} \cdot \frac{12}{51} \cdot \frac{11}{50}$ $\frac{1716}{132,600}$

Does the first event change the options for the next event? $\frac{11}{850}$

Does the first event change the options for the next event?

TRANSPORTATION **Refer to Example 2. Suppose Marisol draws a slip and does not put it back. Then her friend Christian draws a slip. What is the probability that both friends draw a yellow slip?**

$\frac{5}{8} \cdot \frac{4}{7} = \frac{20}{56} = \frac{10}{28} = \frac{5}{14}$

"given"

$P_{8|even} = \frac{5}{18}$

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

$P_S = \frac{4}{36} = \frac{1}{9}$

$P_6 = \frac{5}{36}$

$P_D = \frac{6}{36} = \frac{1}{6}$

$P_{8|D} = \frac{1}{6}$

already "given"
reduced sample space

$P_{6 \mid \text{not odd}}$

$P_{6 \mid \text{even}}$ $\frac{1}{3}$

$P_{2 \mid \text{even}}$ $\frac{1}{3}$

13, 5 B, 9 5 1
7 – 17 odd
18, 19