

Objective

Model relationships between events using random drawings from a bag.

Common Core State Standards

- 7.SP.7a Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.
- 7.5P.8a Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.

Statistics and Probability

Modeling Probability: Relationships Between Events

Once students have a basic grasp of probability concepts, they can extend their understanding. They can reason, for example, about relationships between events, such as the probability that an event will occur and the probability it will not occur. Random drawings from a bag are a good way to model real relationships, such as between randomly selected people.

Try It! Perform the Try It! activity on the next page.

Talk About It

Discuss the Try It! activity.

- Ask: What is the sum of the probability that an event will occur and the probability the event will not occur?
- Reiterate the idea that picking a blue duck and picking a green duck cannot happen at the same time. Explain that this point is not as trivial as it seems. Ask students whether picking a blue tile and picking a square tile can happen at the same time. Mention to students that sometimes they will need to deal with questions like this.

Solve It

Reread the problem with students. Have them do the activities and explain how they determined the probabilities. Have them identify other probabilities that add up to 1.

More Ideas

For other ways to teach about relationships between events-

- Give spinners to pairs of students. Have students find probabilities such as the probability of spinning a 5 and the probability of not spinning a 5, or the probability of spinning a 4 or a 5.
- Have pairs of students use polyhedral dice to determine the probabilities, for example, of rolling and not rolling a multiple of 3 and the probability of rolling a prime number or a 4.

Formative Assessment

Have students try the following problem.

A bag contains 3 blue tiles, 4 green tiles, 1 yellow tile, and 2 red tiles. What is the probability of drawing a green or red tile from the bag?



Try It! 25 minutes | Groups of 4

Here is a problem about relationships between events.

Eve picks a prize from a bag filled with 3 blue ducks, 2 yellow ducks, 6 green ducks, and 1 red duck. What is the probability that Eve picks a yellow duck and what is the probability that she does not pick a yellow duck? What is the probability that Eve picks either a blue duck or a green duck?

Introduce the problem. Then have students do the activity to solve the problem. Distribute the materials.

Materials

- Color Tiles (6 blue, 4 yellow, 2 red, and 12 green per group)
- paper (1 sheet per group)



1. Say: Use Color Tiles to model the ducks in the bag. **Ask:** What is the probability of drawing a yellow tile? Have students model the possibilities and then count and record the favorable outcomes and the total outcomes. Have them express the probability as a fraction in simplest form.



3. Ask: Can drawing a yellow tile happen at the same time as drawing a non-yellow tile? Can drawing a blue tile happen at the same time as drawing a green tile? Have students model the events to show that both cannot occur at the same time.



2. Ask: What is the probability of drawing a tile that is not yellow? Have students show the non-yellow tiles. **Say:** Find and record the probability by listing and counting outcomes and then by subtracting from 1 the probability of drawing a yellow tile.



4. Ask: What is the probability of drawing either a blue or a green tile? Have students model the number of favorable selections— 3 blue plus 6 green. Help them conclude that P(blue or green) is $\frac{9}{12}$, or $\frac{3}{4}$. Elicit, further, that this is the same as P(blue) + P(green) that is, $\frac{3}{12} + \frac{6}{12} = \frac{9}{12} = \frac{3}{4}$.





Use Color Tiles to model a set with 3 yellow, 3 red, 4 blue, and 3 green. Find the probability of each event.





Using Color Tiles, model the set described. Then find the probability of each event.

 Bag with 4 red tiles, 5 blue tiles, 6 green tiles, and 2 yellow tiles.

<i>P</i> (yellow or blue)				
<i>P</i> (red)	<u>4</u> 17			
P(green, red	l, or blue) _		<u>15</u> 17	

3. Bag with 5 red tiles, 3 blue tiles, and 3 yellow tiles.



Find each probability given the set described.

4. Bag with 10 red marbles, 12 blue marbles, 8 white marbles, 6 green marbles, and 4 yellow marbles.



5. Bag with 1 red marble, 1 blue marble, 1 white marble, 8 green marbles, and 10 yellow marbles.



Answer Key

Challenge! If you have 20 items in a set and 4 of the items are red, what do you know about the probability of red and the probability of not red? Show your work.

Challenge: (Sample) The sum will be 1. Red is 4 out of 20 or $\frac{1}{5}$ and not red is 16 out of 20, or $\frac{4}{5}$; $\frac{1}{5} + \frac{4}{5} = 1$.





Use Color Tiles to model a set with 3 yellow, 3 red, 4 blue, and 3 green. Find the probability of each event.

1.	
	$\langle \rangle$
	G B B R P R
	Y Y G

P(Y)
P(not Y)
P(Y or G)
P(G or R)
<i>P</i> (not G and not B)

Using Color Tiles, model the set described. Then find the probability of each event.

 Bag with 4 red tiles, 5 blue tiles, 6 green tiles, and 2 yellow tiles.

P(yellow or blue) _____

P(red)_____

P(green, red, or blue) _____

Find each probability given the set described.

4. Bag with 10 red marbles, 12 blue marbles, 8 white marbles, 6 green marbles, and 4 yellow marbles.

P(not yellow) _____

P(not red and not white) _____

P(green or blue) _____

P(not green) _____

P(not green and not blue) _____

P(green) _____

3. Bag with 5 red tiles, 3 blue tiles, and 3 yellow tiles.

P(not blue and not red) _____

P(yellow) _____

P(red or yellow) _____

5. Bag with 1 red marble, 1 blue marble, 1 white marble, 8 green marbles, and 10 yellow marbles.

P(blue) _____

P(red) _____

P(green) _____

P(white) _____

P(red, blue, white, green,

P(not yellow) _____

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Challenge! If you have 20 items in a set and 4 of the items are red, what do you know about the probability of red and the probability of not red? Show your work.