## Applications

1. Decide whether the possible resulting events are equally likely. Explain.

<table>
<thead>
<tr>
<th>Action</th>
<th>Possible resulting events</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. You roll a number cube.</td>
<td>You roll an even number, or you roll an odd number.</td>
</tr>
<tr>
<td>b. A young child grows.</td>
<td>The child is left-handed, or the child is right-handed.</td>
</tr>
<tr>
<td>c. You toss a marshmallow.</td>
<td>The marshmallow lands on its end, or the marshmallow lands on its curved side.</td>
</tr>
<tr>
<td>d. You choose a card from a standard deck of 52 playing cards with no jokers.</td>
<td>The card is a heart, the card is a club, the card is a diamond, or the card is a spade.</td>
</tr>
<tr>
<td>e. You toss a coin three times.</td>
<td>You get three heads, two heads and a tail, a head and two tails, or three tails.</td>
</tr>
</tbody>
</table>

2. Lori’s little sister Emily tore the labels from ten cans of vegetables. Now all the cans look exactly the same. Three cans are corn, two are spinach, four are beans, and one is tomatoes. Lori picks a can at random. Find each probability.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( P(\text{corn}) )</td>
<td>b. ( P(\text{beans}) )</td>
</tr>
<tr>
<td>c. ( P(\text{not spinach}) )</td>
<td>d. ( P(\text{beans or tomatoes}) )</td>
</tr>
<tr>
<td>e. Is each vegetable equally likely to be in the can?</td>
<td>Explain.</td>
</tr>
</tbody>
</table>

### What Do You Expect?

For: Multiple-Choice Skills Practice

[Web Code: ana-7154]
3. Jacob has a probability party. He serves three items, each item selected at random from two options. Each guest gets a hamburger or a hot dog, cole slaw or potato salad, and an apple or an orange.
   a. Make a tree diagram to show all possibilities.
   b. What is the probability that Samantha gets a hot dog, cole slaw, and an orange?
   c. Rick does not like hot dogs. What is the probability that he will not be served a hot dog?

4. José is going to a party. He decides to wear his jeans and a sweater, but he hasn’t decided what else to wear. The tree diagram shows the possible outfits he can make if he chooses sneakers or loafers; a pair of blue, red, or white socks; and a green, red, or plaid cap, at random.

   a. What is the probability that José will wear loafers, blue socks, and a plaid cap?
   b. What is the probability that José will wear sneakers, either red or blue socks, and a green cap?
   c. What is the probability that José will wear neither red socks nor a red cap?
For Exercises 5–9, Monita and Kyan are analyzing a game involving two different spinners. A turn is one spin on each spinner. They make this tree diagram of equally likely outcomes to find theoretical probabilities.

5. **Multiple Choice** Choose the spinner that could be Spinner X.

   A. ![Spinner A]

   B. ![Spinner B]

   C. ![Spinner C]

   D. None of these is correct.

6. List all possible outcomes of spinning each spinner, Spinner X and Spinner Y, once.

7. Which color and number combination has the greatest probability of occurring?

8. What is the probability of getting red on Spinner X and 3 on Spinner Y?

9. What is the probability of *not* getting a 3 on Spinner Y?
10. In the Gee Whiz Everyone Wins! game show, members of the audience choose a block at random from the bucket shown at the right. If a blue block is chosen, the contestant wins $5. If a red block is chosen, the contestant wins $10. If the yellow block is chosen, the contestant wins $50. The block is replaced after each turn.
   a. What is the probability of choosing each color? Explain your method.
   b. Suppose 24 contestants choose and replace a block. How much money can the game show expect to pay out?

11. In Raymundo’s Prime Number Multiplication Game, a player rolls two number cubes. Player A gets 10 points if the product is prime. Player B gets 1 point if the product is not prime. Raymundo thinks this scoring system is reasonable because there are many more ways to roll a non-prime product than a prime product.

   a. If the cubes are rolled 100 times, how many points would you expect Player A to score? How many points would you expect Player B to score?
   b. Is Raymundo’s game a fair game? Explain.

12. Rachel says that if she rolls two number cubes 36 times, she will get a product of 1 exactly once. Mariana said that she cannot be sure this will happen exactly once, but it will probably happen very few times. Who is right? Explain your reasoning.

13. Rachel told Mariana that if she rolls two number cubes 100 times, she will never get a product of 23. Mariana told her that she can’t be sure. Who is right? Explain.
Connections

14. The probability of an event is a number between 0 (0%) and 1 (100%). The larger the probability, the greater the chances the event will occur. If an event is impossible, the probability that it will occur is 0 (or 0%). If an event is certain to happen, the probability that it will occur is 1, or 100%.

Copy the scale below. Place the letter of each event a–i on the scale at the spot that best describes its probability.

a. You get a head when you toss a coin.
b. You run 20 miles in one hour.
c. You roll a 6 on a number cube.
d. Your neighbor’s cat has four legs.
e. The sun will rise tomorrow.
f. You toss a coin twice and get two heads.
g. You toss a coin twice and get at least one head.
h. You listen to a CD today.
i. You spin the spinner below, and it lands on red.

15. Multiple Choice  What fraction of this diagram is shaded?

F. 1/2  G. 2/5  H. 1/3  J. 4/9
16. Write three fractions equivalent to the fraction you chose in Exercise 15.

17. **Multiple Choice** What fraction of this diagram is shaded?

```
  \[
  \begin{array}{|c|c|c|}
    \hline
    & & \\
    \hline
    & & \\
    \hline
  \end{array}
  \]
```

A. \(\frac{20}{100}\)  
B. \(\frac{4}{8}\)  
C. \(\frac{1}{2}\)  
D. \(\frac{1}{4}\)

18. Write three fractions equivalent to the fraction you chose in Exercise 17.

19. Fala spins this spinner several times. The table shows the results.

- **Yellow**
  - 1
- **Blue**
  - 4

a. How many times did Fala spin the spinner?
b. What percent of the spins landed in the blue region? What percent landed in the yellow region?
c. According to the theoretical probabilities, what is the percent of the spins expected to land in the blue region over the long run? In the yellow region?
d. Compare the experimental probability of the spinner landing in each region with the theoretical probability. If the probabilities are different, explain why.
20. If you drop a tack on the floor, there are two possible outcomes: the tack lands on its side (point down), or the tack lands on its head (point up). Kalifa dropped a tack 100 times. The table shows the results.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Number of Times It Occurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tack lands point up</td>
<td>58</td>
</tr>
<tr>
<td>Tack lands point down</td>
<td>42</td>
</tr>
</tbody>
</table>

a. Suppose you drop Kalifa’s tack 500 times. How many times do you expect it to land point up?

b. Is it equally likely that the tack will land point up or point down? Explain.

c. Is it possible to determine theoretical probabilities for this situation? Why or why not?

21. Juanita is deciding whether to play a game at an amusement park. It takes one ticket to play the game. A player tosses two plastic bottles. If both bottles land standing up, the player wins ten tickets to use for rides and games. Juanita watches people play and records the results.

<table>
<thead>
<tr>
<th>Both land on side</th>
<th>One lands on side and one lands standing up</th>
<th>Both land standing up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Based on Juanita’s results, what is the experimental probability of winning the game?

b. Suppose Juanita plays this game 20 times. How many times can she expect to win?
c. How many tickets can Juanita expect to be ahead or behind after playing the game 20 times? Explain your reasoning.

d. Is it possible to find the theoretical probability of winning this game? Why or why not?

22. A bucket contains 60 marbles. Some are red, some are blue, and some are white. The probability of drawing a red marble is 35%. The probability of drawing a blue marble is 25%. How many marbles of each color are in the bucket?

23. Hannah’s teacher brought in a bucket containing 72 blocks. The blocks are red, yellow, or blue. Hannah wants to figure out the number of blue blocks without emptying the bucket.

Hannah chooses a block from the bucket, records its color, and then replaces it. Of her 14 draws, she records blue 5 times. Based on Hannah’s experiment, how many of the blocks are blue? Explain.

24. Suppose you roll two number cubes. What is the probability that the product of the numbers will be a multiple of 5?

25. If you roll two number cubes 100 times, about how many times can you expect the product of the numbers to be a multiple of 5?

26. Suppose you roll two number cubes. What is the probability that the product of the numbers is a multiple of 7?

27. If you roll two number cubes a million times, about how many times can you expect the product of the numbers to be a multiple of 7?

28. Suppose you roll two number cubes and multiply the numbers. Find each probability.

   a. $P($product is a multiple of 3 and 4$)$
   b. $P($product is a multiple of 3 or 4$)$
   c. $P($product has a factor of 5 and 3$)$
   d. $P($product is a prime number$)$
   e. $P($product is greater than 10$)$
   f. $P($product is less than 18$)$
Extensions

29. Tricia wants to determine the probability of getting two 1’s when two number cubes are rolled. She makes a tree diagram and uses it to list the possible outcomes.

```
<table>
<thead>
<tr>
<th>Cube 1</th>
<th>Cube 2</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1-1</td>
</tr>
<tr>
<td>not 1</td>
<td>1</td>
<td>1-not 1</td>
</tr>
<tr>
<td>not 1</td>
<td>not 1</td>
<td>not 1-not 1</td>
</tr>
</tbody>
</table>
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She says that, because there are four possible outcomes, the probability of getting 1 on both number cubes is $\frac{1}{4}$. Is Tricia right? Explain.

30. Juan invented a two-person game in which players take turns rolling three number cubes. If the sum is even, Player A gets a point. If the sum is odd, Player B gets a point. Is Juan’s game a fair game? Explain.

For Exercises 31–33, a computer places a dot at random on each dartboard below.

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<p>| | | |</p>
<table>
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31. For each dartboard, what is the probability that a dot will be in a region marked A? A region marked B? A region marked C?

32. For Board 1, what is the probability that a dot will be in a region marked A or B?

33. For Board 2, what is the probability that a dot will not be in region C?