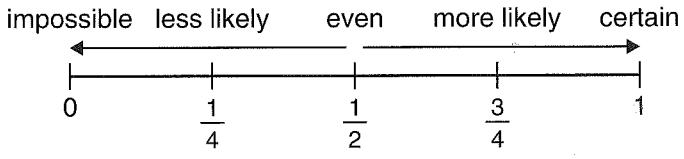
10.1 Exploring Probability

GOAL

Determine the experimental probability of an event.

1. Use words or fractions from the probability scale below to describe the probability of each event.



   a) You will listen to the radio today. _____

   b) If you drop a CD, it will land face up. _____

   c) Your pet will live to be 250 years old. _____

   d) If you drop a coin, it will land on its edge. _____

   e) If you roll a regular six-sided die, it will show an even number. _____

At-Home Help

An **event** is a set of one or more outcomes, or results, in a probability experiment.

For example, the event of rolling an even number with a six-sided die consists of the outcomes of rolling a 2, a 4, and a 6.

Probability is a number that shows how likely it is that an event will happen.

For example, what is the probability of rolling an even number with a six-sided die? There are three even numbers (2, 4, 6) out of six possible numbers (1, 2, 3, 4, 5, 6). The probability is 3 out of 6, which is the same as 1 out of 2, or $\frac{1}{2}$.

2. Liam, Yan, and Max play a game with an ordinary six-sided die. If the die lands on 1, 2, or 3, Liam wins. If it lands on 4 or 5, then Yan wins. If it lands on 6, then Max wins.

   a) Is this a fair game? Explain your answer.

   _____

   _____

   b) Who is the most likely to win? _____

3. You toss a six-sided die. Fill in the blanks to make each statement true.

   The probability of getting a 2 is _____ out of 6.

   The probability of getting a 1 or a 6 is _____ out of 6.

   The probability of getting a 7 is _____ out of 6.

10.2 Representing Probabilities as Fractions and Percents

GOAL

Express probabilities using fractions, percents, and number lines.

1. Oshana tossed a coin 10 times. She got heads 7 times.

   a) What is her experimental probability of tossing heads, written as a fraction? _____

   b) If Oshana calculates the theoretical probability of tossing heads when flipping a coin 10 times, do you think she will get the same answer? Explain.

   _____

   _____

2. Based on the results of each experiment below, what is the experimental probability of getting heads? Write each probability as a fraction.

   a) Max tossed a coin 14 times and got heads 5 times.

   _____

   b) Fiona tossed a coin 30 times and got heads 19 times.

   _____

3. Write each theoretical probability as a fraction and as a percent.

   a) spinning a spinner with 10 equal parts labelled 1 to 10, and getting a 4 _____

   fraction _____ percent _____

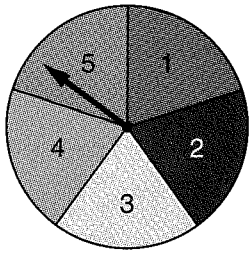
   b) rolling a six-sided die and getting an odd number

   fraction _____ percent _____

4. What is each theoretical probability for the spinner on the right? Write your answer as a fraction and as a percent.

   a) the probability of spinning a 1 _____

   b) the probability of spinning an even number _____



At-Home Help

A **favourable outcome** is the desired result in a probability experiment.

The **experimental probability** in a probability experiment is the ratio of the number of observed favourable outcomes to the number of trials, or repetitions, of the experiment.

For example, if you toss a coin four times in an experiment, you may get heads three times out of four. You can also write this probability as 3 : 4, $\frac{3}{4}$, or 75%.

The **theoretical probability** is the ratio of the number of favourable outcomes to the number of possible equally likely outcomes.

For example, the theoretical probability of getting heads when tossing a coin is $\frac{1}{2}$, 1 : 2, or 50%, since there are two equally likely outcomes and only one is favourable.

10.3 Probability of Independent Events

GOAL

Determine probability by identifying the sample space.

At-Home Help

Two events are **independent events** if the probability of one is not affected by the probability of the other.

For example, if you toss a coin and roll a die, the two events are independent. The result of rolling the die does not depend on the result of tossing the coin.

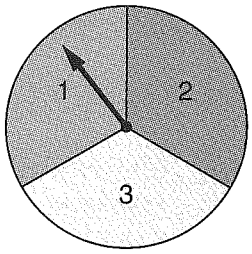
1. Which sets of events are independent? Circle "yes" or "no."

a) Fiona takes a marble out of a bag of five different marbles, and puts it on the table. Then, she takes another marble out of the same bag. yes / no

b) Yan rolls a die to see if she gets a 6. She rolls the die again to see if she gets a 6. yes / no

c) Pavlo takes a pair of socks out of his drawer, and puts them back in without looking. Pavlo pulls another pair of socks out to see if he gets a blue pair. yes / no

2. Fiona flipped a coin and spun a spinner with three equal sections. She made an organized list to show all the possible outcomes. (H stands for heads and T stands for tails.)



H–1	H–2	H–3
T–1	T–2	T–3

a) What is the theoretical probability of getting a heads and a 3? _____

b) What is the theoretical probability of getting a tails and an odd number? _____

c) What is the theoretical probability of getting a heads and any number? _____

3. Liam and Max each roll a die, and record the sum of their rolls.

a) Complete the chart to show all the possible outcomes.

b) What is the theoretical probability that the sum of their rolls will equal 6? _____

Liam's roll

	1	2	3	4	5	6
1	2	3	4			
2	3	4				
3	4					
4						
5						
6						

10.4 Solve Problems Using Organized Lists

GOAL

Solve a problem using an organized list to identify the sample space.

1. A football team can win or lose a game. Assume that each outcome is equally likely.

a) Complete the chart below to determine all of the possible outcomes of the first three games.

1st Game	W	W	W		W	L		
2nd Game	W	W		W			L	
3rd Game	W	L	W					
Total Wins	3	2	2	2	1	1	1	0

b) What is the probability that the team will win two games? _____

c) What is the probability that the team will lose two games? _____

At-Home Help

Making a chart of all the possible outcomes can help you calculate probabilities. Work systematically and look for patterns in the chart, to make sure you have not missed or repeated any of the different outcomes.

2. Matthew has three bills in his wallet. He left the wallet at home, and can't remember whether they are $5 or $10 bills. Both are equally likely. Matthew wants to figure out the probability of having $30 in his wallet, so he starts to make an organized list.

1st Bill	5	5	5		5	10		10
2nd Bill	5	5		5	10			
3rd Bill	5	10	5	5		10		
Total	15	20	20		25		25	30

a) Fill in the blanks in Matthew's chart.

b) How many different combinations are possible? _____

c) How many of these combinations add up to $30? _____

d) What is the probability that Matthew has $30 in his wallet? _____

e) What is the probability that Matthew has $20 or more in his wallet? _____

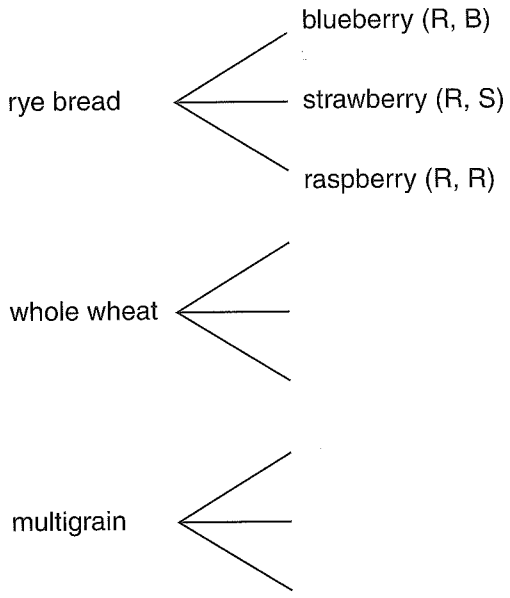
10.5 Using Tree Diagrams to Calculate Probability

GOAL

Determine probabilities using a tree diagram.

1. Liam has three kinds of bread: rye, whole wheat, and multigrain. He also has three kinds of jam: blueberry, strawberry, and raspberry. He ate a piece of bread with jam.

   a) Complete the tree diagram to show all the possible combinations.



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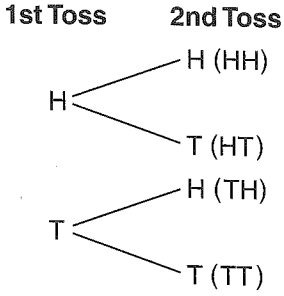
A **tree diagram** is a way to record and count all combinations of events, using lines to form branches to connect the two parts of the outcome.

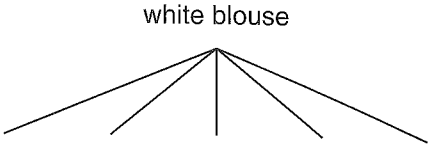
For example, the following tree diagram shows all the combinations that can happen if you toss a coin twice.

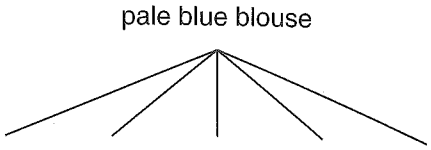


   b) What is the probability that Liam had blueberry jam on his bread? _____

   c) What is the probability that Liam had multigrain bread with strawberry jam? _____

2. Fiona has two blouses: white and pale blue. She has five sweaters: cream, pink, blue, green, and purple.





   a) Complete the tree diagram to show the different combinations she can wear.

   b) If each outfit has an equal chance of being worn, what is the probability of Fiona wearing a blue blouse and a blue sweater at the same time? _____

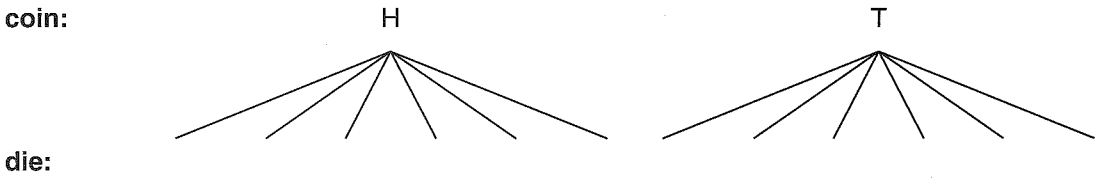
10.6 Comparing Theoretical and Experimental Probabilities

GOAL

Compare theoretical and experimental probability for two independent events.

You will need a coin and a die to complete this activity.

1. Complete the tree diagram to show all the possible outcomes of tossing a coin and rolling a six-sided die.



2. What is the theoretical probability of getting heads and a 3?

_____

3. Toss a coin and roll a die. Repeat the experiment twelve times in total, and record your results in the chart below.
For example, if you get heads on the first toss, and roll a 2, record your result as H–2.

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

4. What is the experimental probability of getting heads and a 3?

_____

5. Compare the theoretical probability of getting heads and a 3 with the experimental probability of getting heads and a 3.

_____

_____

6. Why might your theoretical probability be different from your experimental probability?

_____

_____

Chapter 10 Test Yourself

Circle the letter of the correct answer.

1. Liam tossed a quarter to see if he would get heads or tails. Which event has the highest probability?

   A. He will toss heads.

   B. He will toss tails.

   C. He will toss either heads or tails.

   D. He will toss neither heads nor tails.

2. Which situation involves an experimental probability?

   A. Fiona drew a tree diagram to determine the probability of rolling a 2 twice in a row using a six-sided die.

   B. Matthew tossed a coin ten times and recorded his results. He used his results to calculate the probability of tossing heads.

   C. Max used an organized list to determine the probability of choosing a white marble and then a green marble from a bag of five different marbles.

   D. Liam created a chart to determine the probability of getting a total of 8 or more when rolling two dice and adding the total.

3. Nolan, Max, and Fiona are playing a game. They each roll two dice. If Nolan gets a 1 on either die, he wins. If Max gets an even number on either die, he wins. If Fiona gets two 6s, she wins. Who is most likely to win the game?

   A. Nolan **B.** Max **C.** Fiona **D.** They all have an equal chance.

4. An eight-sided die has sides numbered 1 to 8. What fraction represents the probability of rolling an 8?

   A. $\frac{1}{8}$ **B.** $\frac{1}{4}$ **C.** $\frac{1}{6}$ **D.** $\frac{1}{2}$

5. Which set of events is <u>not</u> independent?

   A. Sarah has three different coins in her pocket. She takes one coin out, and puts it back in without looking at it. Then, she takes another coin out of her pocket.

   B. Ken rolls a die to see if he gets an even number. He rolls the die a second time to see if he gets an even number.

   C. A bag has three identical coins in it. Max takes two coins out of the bag and looks at them. Then, he takes another coin out of the same bag.

   D. Liam tosses a coin to see if he gets heads. The next day, he repeats the experiment.

6. Julie has two bills in her pocket. She knows that they can only be \$5.00, \$10.00, and/or \$20.00 bills. Julie made an organized list of the possibilities.

5–5	10–5	20–5
5–10	10–10	20–10
5–20	10–20	20–20

   What is the theoretical probability that Julie has a \$10.00 and a \$5.00 bill in her pocket?

   A. $\frac{2}{3}$ **B.** $\frac{1}{2}$ **C.** $\frac{2}{9}$ **D.** $\frac{1}{9}$

7. Matthew has two paper bags. Each bag has a red, a green, and a blue marble in it. Matthew made a tree diagram to calculate the probability of taking a blue marble out of the first bag, and then a blue marble out of the second bag.

   What is the probability of taking a blue marble out of both bags?

   A. $\frac{1}{9}$ **B.** $\frac{2}{9}$ **C.** $\frac{5}{9}$ **D.** $\frac{1}{3}$