

Objective Using Tree Diagrams

Warm-Up



Nora's treat bag has 5 chocolate bars, 7 peanut butter cups, and 8 sour gummies. If she selects 1 piece of candy at random, determine each probability.

1. $P(\text{chocolate bar})$
2. $P(\text{peanut butter cups})$
3. $P(\text{sour gummy})$
4. $P(\text{not sour gummy})$

GETTING STARTED

Three Children, Three Girls

What is the probability that if a family has 3 children, those 3 children are girls? Let's say that the theoretical probability of a girl being born is equal to the theoretical probability of a boy being born, $\frac{1}{2}$.

Let's simulate the event of a family with 3 children having 3 girls.

1. Choose an appropriate model to simulate the probability of a family having three girls. Explain how you will represent girls and boys in your model.

2. Conduct 25 trials of the simulation. Record the results in the table shown.

Trial	Results
1	
2	
3	
4	
5	
6	
7	
8	
9	

Trial	Results
10	
11	
12	
13	
14	
15	
16	
17	
18	

Trial	Results
19	
20	
21	
22	
23	
24	
25	

3. List all possible outcomes for the number of girls among 3 children.

4. Use the results from your simulation to construct a probability model.

Outcome	0 girls	1 girl	2 girls	3 girls
Probability				

5. What is the experimental probability that a family with 3 children has 3 girls according to your probability model?



In the previous simulation, your probability model is based on experimental probabilities. In some cases, this is the only method of constructing a probability model. For example, in an earlier lesson you determined the experimental probabilities of a cup landing on its top, bottom, or side when it was tossed. It would be difficult or impossible to determine the theoretical probabilities for the cup toss. However, it is possible to determine the theoretical probability for a family with 3 children having 3 girls.

One method to calculate the theoretical probability for a family having 3 girls is to list all of the possible outcomes for a family having 3 children, and then determine how many of those outcomes include 3 girls.

1. Karl says, "I think that the probability of a family having 3 girls is 1 out of 3 because there is only one outcome that has all three children being girls. There are only two other outcomes."

Germaine says, "I don't think that's correct. I think the probability is much lower since there are many combinations of boys and girls in a family of three."

Who's correct? Explain your reasoning.

2. List all of the possible outcomes for having 3 children, using G to represent girls and B to represent boys.

3. What does the outcome BGG represent?

4. Copy and complete the probability model using all possible outcomes.

Outcome	0 girls	1 girl	2 girls	3 girls
Probability				

5. What is the theoretical probability that a family having 3 children has 3 girls?

Another method of determining the theoretical probability of an event is to construct a tree diagram. A tree diagram illustrates the possible outcomes of a given situation. Tree diagrams can be constructed vertically or horizontally.

You can construct a tree diagram to show all the possible outcomes for a family having 3 children.

WORKED EXAMPLE

What are the possible outcomes for a family having 3 children?

List the possible outcomes of the 1st child.

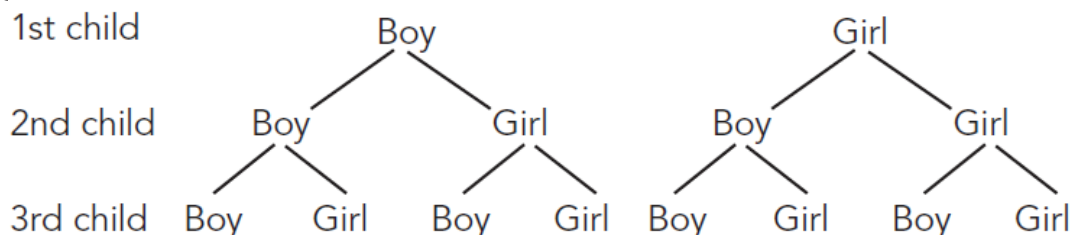
List the possible outcomes of the 2nd child.

List the possible outcomes of the 3rd child.

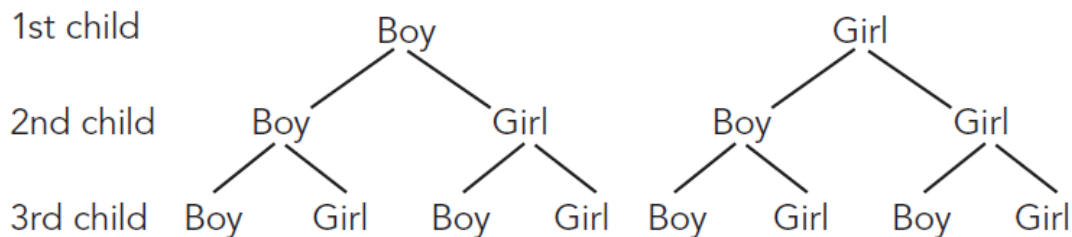
6. How would this tree diagram change if you were trying to determine the possible outcomes for a family having 4 children?

7. How does the tree diagram in the worked example compare to the list you made in Question 2?

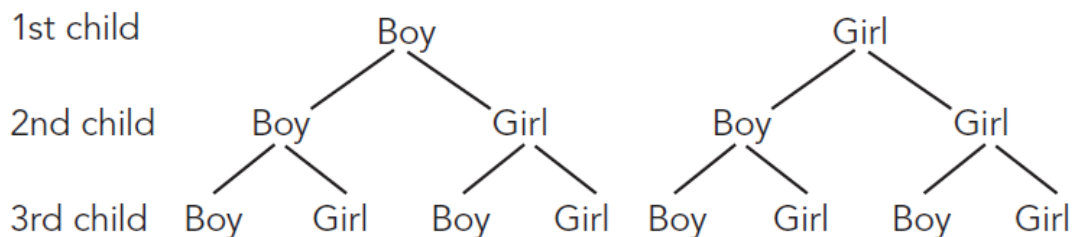
8. Copy the diagram and circle the outcome(s) of a family having three children that are all girls on the tree diagrams shown.



9. Copy the diagram and circle the outcome(s) of a family having three children in which two of the children are girls in the tree diagrams shown.



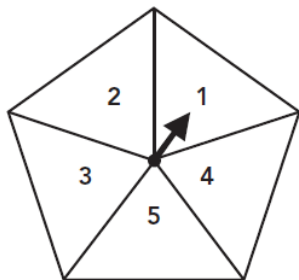
10. Copy the diagram and circle the outcome BBG in the tree diagrams shown.



11. Complete the probability model shown with the information from the tree diagrams.

Outcome	0 girls	1 girl	2 girls	3 girls
Probability				

12. Is there a difference in the theoretical probability of each outcome between the list of outcomes you wrote and the tree diagrams you analyzed?



The 5-sided spinner is spun twice and a product is calculated.

1. Construct a tree diagram to determine all the possible outcomes. Then, list the product at the end of each branch of the tree.

2. Construct a probability model for spinning the spinner twice and recording the product.

3. Use the probability models you created to calculate the probability for each event shown.

Product	Probability
1	
2	
3	
4	
5	
6	
8	
9	
10	
12	
15	
16	
20	
25	

a. $P(10)$

b. $P(\text{less than } 10)$

c. $P(\text{multiple of } 5)$

d. $P(\text{not a multiple of } 5)$

4. Which events from Question 3 represent complementary events? Explain your reasoning.

5. Betina says that the product being less than 10 and the product being more than 10 are complementary events. Davika disagrees. Who is correct? Explain your reasoning.

6. What event would be complementary to the event that the product is an even number? Determine the probability of both events.

7. What is the sum of the probabilities of two complementary events? Explain why your answer makes sense.



LESSON 11.2 Three Girls and No Boys?



Objective

Using Tree Diagrams

Practice

1. Dinah's family has 4 children. The birth order of the children is G, G, B, G. Create a tree diagram to list all the possible birth orders of a family of 4 children. Then determine the probability of Dinah's family birth order.

2. Kimberly is learning probability in middle school while her little brother, Rodney, is learning arithmetic in first grade. Kimberly uses a six-sided number cube to help Rodney learn how to add one-digit numbers. She rolls two cubes, numbered 1 through 6, and Rodney adds up the two numbers on the faces.
 - a. Construct a tree diagram to determine all the possible outcomes. List the sum at the end of each branch of the tree.

 - b. Construct a probability model for rolling 2 six-sided number cubes and determining the sum of the faces.

 - c. What is the probability that the sum is 7?

 - d. What is the probability that the sum is 11?

 - e. Calculate the probability that the sum is an even number.

 - f. Calculate the probability that the sum is greater than 5.

 - g. What event would be complementary to the event that the sum is greater than 5? Explain your reasoning.