Name_____ Date _____

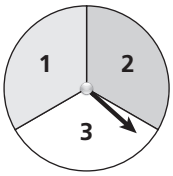
10.5 Permutations and Combinations

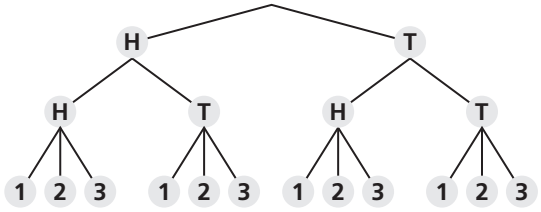
For use with Exploration 10.5

Essential Question How can a tree diagram help you visualize the number of ways in which two or more events can occur?

1 EXPLORATION: Reading a Tree Diagram

Work with a partner. Two coins are flipped and the spinner is spun. The tree diagram shows the possible outcomes.





Coin is flipped.

Coin is flipped.

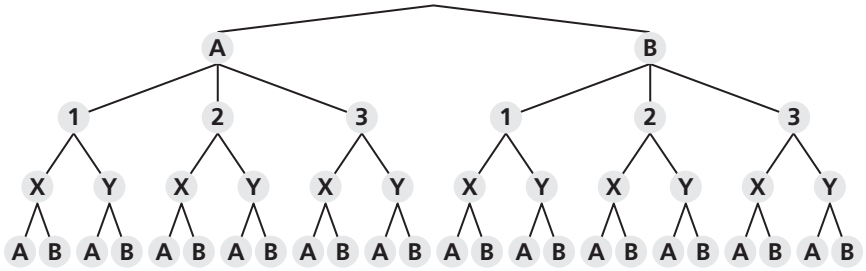
Spinner is spun.

a. How many outcomes are possible?

b. List the possible outcomes.

2 EXPLORATION: Reading a Tree Diagram

Work with a partner. Consider the tree diagram below.



a. How many events are shown?

b. What outcomes are possible for each event?

c. How many outcomes are possible?

d. List the possible outcomes.

3 EXPLORATION: Writing a Conjecture

Work with a partner.

a. Consider the following general problem: Event 1 can occur in m ways and event 2 can occur in n ways. Write a conjecture about the number of ways the two events can occur. Explain your reasoning.

b. Use the conjecture you wrote in part (a) to write a conjecture about the number of ways *more than* two events can occur. Explain your reasoning.

c. Use the results of Explorations 1(a) and 2(c) to verify your conjectures.

Communicate Your Answer

4. How can a tree diagram help you visualize the number of ways in which two or more events can occur?

5. In Exploration 1, the spinner is spun a second time. How many outcomes are possible?

Name_____ Date _____

10.5 Notetaking with Vocabulary

For use after Lesson 10.5

In your own words, write the meaning of each vocabulary term.

permutation

n factorial

combination

Binomial Theorem

Core Concepts

Permutations

Formulas	**Examples**
The number of permutations of n objects is given by $_nP_n = n!$.	The number of permutations of 4 objects is $_4P_4 = 4! = 4 \bullet 3 \bullet 2 \bullet 1 = 24$.
The number of permutations of n objects taken r at a time, where $r \leq n$, is given by $_nP_r = \frac{n!}{(n-r)!}$.	The number of permutations of 4 objects taken 2 at a time is $_4P_2 = \frac{4!}{(4-2)!} = \frac{4 \bullet 3 \bullet \cancel{2!}}{\cancel{2!}} = 12$.

Notes:

Name _____ Date _____

10.5 Notetaking with Vocabulary (continued)

Combinations

Formula The number of combinations of n objects taken r at a time, where $r \leq n$, is given by

$$_nC_r = \frac{n!}{(n-r)! \bullet r!}.$$

Example The number of combinations of 4 objects taken 2 at a time is

$$_4C_2 = \frac{4!}{(4-2)! \bullet 2!} = \frac{4 \bullet 3 \bullet \cancel{2!}}{\cancel{2!} \bullet (2 \bullet 1)} = 6.$$

Notes:

The Binomial Theorem

For any positive integer n, the binomial expansion of $(a+b)^n$ is

$$(a+b)^n = {}_nC_0a^nb^0 + {}_nC_1a^{n-1}b^1 + {}_nC_2a^{n-2}b^2 + \cdots + {}_nC_na^0b^n.$$

Notice that each term in the expansion of $(a+b)^n$ has the form $_nC_ra^{n-r}b^r$, where r is an integer from 0 to n.

Notes:

Name_____ Date _____

10.5 Notetaking with Vocabulary (continued)

Extra Practice

In Exercises 1 and 2, find the number of ways you can arrange (a) all of the numbers and (b) 3 of the numbers in the given amount.

1. $2,564,783

2. $4,128,675,309

3. Your rock band has nine songs recorded but you only want to put five of them on your demo CD to hand out to local radio stations. How many possible ways could the five songs be ordered on your demo CD?

4. A witness at the scene of a hit-and-run accident saw that the car that caused the accident had a license plate with only the letters I, R, L, T, O, and A. Find the probability that the license plate starts with a T and ends with an R.

5. How many possible combinations of three colors can be chosen from the seven colors of the rainbow?

6. Use the Binomial Theorem to write the binomial expansion of $\left(2x^4 + y^3\right)^3$.