



## ***Unit 12: Probability, Ratios, and Rates***

A **ratio** is a comparison of two quantities with the same unit. For example, if one house has a floor area of 2,000 square feet, and a second house has a floor area of 3,000 square feet, the ratio of the areas is 2,000 to 3,000 or (simplified) 2 to 3.

To prepare students for working with ratios in algebra, the class will review the meanings and forms of ratios, and will solve number stories involving ratios of part of a set to the whole set. Your child will find, write, and solve many number models (equations) for ratio problems.

Your child will continue to use the American Tour as part of the discussion of ratios. We will also be doing projects based on information in the American Tour.

A **rate** is a comparison of two quantities with different units. For example, speed is expressed in miles per hour. In our study of rates, students will determine their own heart rates (heartbeats per minute). Then they will observe the effect of exercise on heart rate, and represent the class results graphically.

We will continue our study of probability by looking at situations in which a sequence of choices is made. For example, if a menu offers you 2 choices of appetizer, 4 choices of entrée, and 3 choices of dessert, and you choose one of each kind, there are  $2 * 3 * 4$  or 24 different possible combinations for your meal. If all the choices were equally appealing (which is unlikely), and you chose at random, the probability of any one combination would be  $\frac{1}{24}$ .

Your child will play *Frac-Tac-Toe*, which was introduced in Unit 4, as well as a new game, *Spoon Scramble*, to practice operations and equivalencies with fractions, decimals, and percents.

You can help your child by asking questions about homework problems; by pointing out fractions, percents, and ratios that you encounter in everyday life; and by playing *Frac-Tac-Toe* or *Spoon Scramble* to sharpen skills.

**Please keep this Family Letter for reference as your child works through Unit 12.**

## Vocabulary

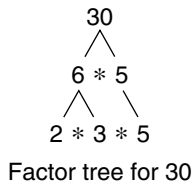
Important terms in Unit 12:

**common factor** Any number that is a factor of two or more numbers. The common factors of 18 and 24 are 1, 2, 3, and 6.

**equal chance or equally likely** When each of the possible outcomes for some situation has the same chance of occurring, the outcomes are said to have an equal chance or to be equally likely. For example, in tossing a coin there is an equal chance of getting heads or tails. Heads and tails are equally likely outcomes.

**factor tree** A method used to obtain the prime factorization of a number. The original number is written as a product of factors.

Then each of these factors is written as a product of factors, and so on, until the factors are all prime numbers. A factor tree looks like an upside down tree with the root (the original number) at the top, and the leaves (the factors) beneath it.



**greatest common factor** The largest factor that two or more numbers have in common. For example, the common factors of 24 and 36 are 1, 2, 3, 4, 6, and 12. Thus, the greatest common factor of 24 and 36 is 12.

**least common multiple** The smallest number that is a multiple of two or more numbers. For example, while some common multiples of 6 and 8 are 24, 48, and 72, the least common multiple of 6 and 8 is 24.

**multiplication counting principle** A way of determining the total number of possible outcomes for two or more separate choices. Suppose, for example, you roll a die and then flip a coin. There are 6 choices for which face of the die shows and 2 choices for which side of the coin shows. Then there are  $6 * 2$ , or 12 possible outcomes all together: (1,H), (1,T), (2,H), (2,T), (3,H), (3,T), (4,H), (4,T), (5,H), (5,T), (6,H), (6,T).

**prime factorization** A whole number expressed as a product of prime factors. For example, the prime factorization of 24 is  $2 * 2 * 2 * 3$ .

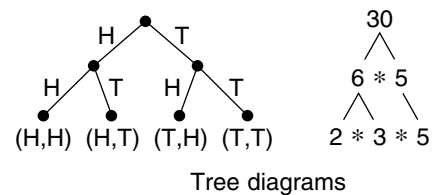
**probability** A number from 0 to 1 that tells the chance that an event will happen. For example, the probability that a fair coin will show heads is  $\frac{1}{2}$ . The closer a probability is to 1, the more likely it is that the event will happen. The closer a probability is to 0, the less likely it is that the event will happen.

**rate** A comparison by division of two quantities with unlike units. For example, traveling 100 miles in 2 hours can be expressed as 100 mi/2 hr, or 50 miles per hour. In this case, the rate compares distance (miles) to time (hours).

**ratio** A comparison by division of two quantities with the same units. Ratios can be expressed as fractions, decimals, or percents, as well as in words. Ratios can also be written with a colon between the two numbers being compared. For example, if a team wins 3 out of 5 games played, the ratio of wins to total games can be written as  $\frac{3}{5}$ , 3/5, 0.6, 60%, 3 to 5, or 3:5 (read "three to five").

**tree diagram** A diagram such as a factor tree or a probability tree. A tree diagram is a network of points connected by line segments. One special point is the root of the tree and closed loops are not allowed. Tree diagrams can be used to factor numbers and to represent probability situations in which there is a series of events.

The first tree diagram below represents flipping one coin two times. The second tree diagram below shows the prime factorization of 30.



## Do Anytime Activities

To work with your child on the concepts taught in this unit and in previous units, try these interesting and rewarding activities:

- 1 Identify different ratios and ask your child to write each ratio using words, a fraction, a decimal, a percent, and a colon. For example, the ratio of 1 adult for every 5 students could be written as 1 to 5,  $\frac{1}{5}$ , 0.2, 20%, or 1:5.
- 2 Play one of the games in this unit with your child: *Frac-Tac-Toe*, *Name That Number*, or *Spoon Scramble*.
- 3 Read the book *Jumanji* with your child and review the possible outcomes when rolling two dice. Ask your child to verify the probabilities of rolling certain number combinations by recording the outcomes for 100 rolls of a pair of dice.
- 4 Identify rate situations in everyday life and ask your child to solve problems involving rates. For example, find the number of miles your car travels for each gallon of gas, or find the number of calories that are burned each hour or minute for different types of sports activities.

### Building Skills through Games

In Unit 12, your child will practice skills with probability, ratios, and rates by playing the following games. For detailed instructions, see the *Math Masters* and the *Student Reference Book*.

**Frac-Tac-Toe** See *Student Reference Book*, pp. 274–276

This is a game for two players. Game materials include 4 each of the number cards 0–10, pennies or counters of two colors, a calculator, and a gameboard. The gameboard is a 5-by-5 number grid that resembles a bingo card. Several versions of the gameboard are shown in the *Student Reference Book*. *Frac-Tac-Toe* provides students with practice in converting fractions to decimals and percents.

**Name That Number** See *Student Reference Book*, p. 286

This is a game for two or three players. Game materials include the Everything Math Deck or a complete deck of number cards. Playing *Name That Number* provides students with practice in working with operations and in using the order of operations.

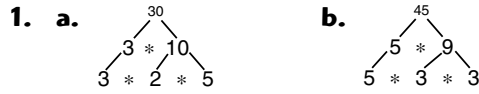
**Spoon Scramble** See *Math Masters*, p. 174

This game provides students with practice identifying equivalent expressions for finding a fraction, decimal, or percent of a number. Four players use 3 spoons and a deck of 16 *Spoon Scramble Cards* to play this game.

## As You Help Your Child with Homework

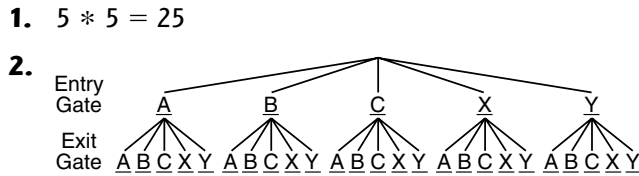
As your child brings assignments home, you may want to go over the instructions together, clarifying them as necessary. The answers listed below will guide you through this unit's Study Links.

### Study Link 12.1 Sample answers:

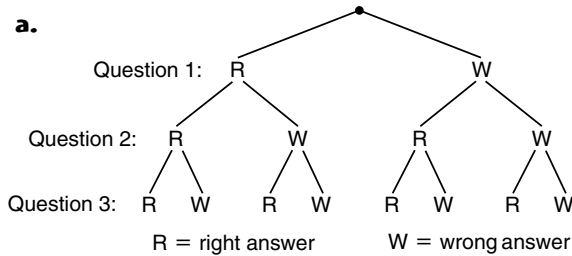


2. a.  $\frac{2}{3}$       b.  $\frac{4}{9}$       c.  $\frac{2}{3}$   
 3.  $2 * 5 * 5 * 5$   
 4. a. 32      b. 49      5.  $\frac{2}{3}$

### Study Link 12.2



3. no; Sample answer: Some gates will probably be used more than other gates.  
 4. 20  
 5. a.



- b.  $\frac{1}{8}$

### Study Link 12.3

1. Sixteen out of twenty-five  
 2.  $\frac{16}{25}$       3. 64%      4. 16:25  
 5. 23:50; 0.46 of the cars were blue  
 6.  $\frac{2}{3}$ ; 6:9;  $66\frac{2}{3}\%$  of the people were swimmers  
 7. 7 out of 8; 35:40 of the caps sold were baseball caps

### Study Link 12.4

1. a. 4      b. 16  
 2. 15  
 3. 16      4. 8      5. 32

### Study Link 12.5

1. 8      2. 24      3. 45  
 4. 60      5. 20      6. 26  
 7.  $\frac{2}{5} = \frac{\square}{115}$ ; 46 students  
 8.  $\frac{3}{4} = \frac{\square}{156}$ ; 117 students  
 9.  $\frac{1.50}{3} = \frac{\square}{90}$ ; \$45  
 10. 210 tickets

### Study Link 12.6

1. a.

Number of spiders	27,000	54,000	81,000	108,000	135,000
Pounds of spider web	1	2	3	4	5

- b. 270,000

2. a.

Miles	13	26	39	52	65
Minutes	1	2	3	4	5

- b. 780

3. 1,000      4. 930      5.  $7\frac{1}{2}$ , or 7.5

### Study Link 12.8

3. 15 clarinetists  
 4. a. 12      b. 6      c. 4      d. 2