

13-1

Practice

Form G

Experimental and Theoretical Probability

You roll a standard number cube 10 times. The results are shown below.

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

Find the experimental probability of each outcome.

1. $P(\text{rolling a 5}) = \frac{1}{10}$

2. $P(\text{rolling a 6}) = \frac{2}{10} = \frac{1}{5}$

3. $P(\text{rolling an even number}) = \frac{7}{10}$

4. $P(\text{rolling a 1}) = \frac{1}{10}$

5. What is the experimental probability of rolling an odd number on a standard number cube? For 50 rolls of the number cube, predict the number of rolls that will result in an odd number.

$\frac{3}{10}$

15 rolls

Find the theoretical probability of each outcome.

6. $P(\text{rolling a 5}) = \frac{1}{6}$

7. $P(\text{rolling a 6}) = \frac{1}{6}$

8. $P(\text{rolling an even number}) = \frac{3}{6} = \frac{1}{2}$

9. $P(\text{rolling a 1}) = \frac{1}{6}$

10. $P(\text{rolling an odd number}) = \frac{3}{6} = \frac{1}{2}$

11. $P(\text{rolling a multiple of 3}) = \frac{2}{6} = \frac{1}{3}$

A bag contains 2 red ping-pong balls, 3 green ping-pong balls, 3 blue ping-pong balls, and 1 yellow ping-pong ball. Find the probability of randomly selecting each outcome.

12. $P(\text{not red}) = \frac{7}{9}$

13. $P(\text{not green}) = \frac{6}{9} = \frac{2}{3}$

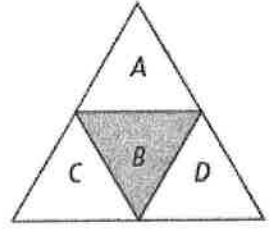
14. $P(\text{not blue}) = \frac{6}{9} = \frac{2}{3}$

15. $P(\text{not yellow}) = \frac{8}{9}$

13-1 Practice (continued) Form G

Experimental and Theoretical Probability

16. A game is played where students throw beanbags at the target shown to the right. Each region of the target is the same size and every beanbag hits the target. For one game, section A was hit 6 times, section B 3 times, section C 8 times, and section D 5 times.



- a. What is the experimental probability of hitting section D? $\frac{5}{22}$
- b. What is the theoretical probability of hitting section D? $\frac{1}{4}$

17. **Reasoning** How are the probability of an event and the probability of its complement related mathematically? *They add up to 1*

Two standard number cubes are rolled. Find each probability.

- 18. $P(\text{a sum equal to 2}) = \frac{1}{36}$
- 19. $P(\text{sum not equal to 2}) = \frac{35}{36}$
- 20. $P(\text{a product equal to 15}) = \frac{2}{36} = \frac{1}{18}$
3,5; 5,3
- 21. $P(\text{a sum greater than 6}) = \frac{9}{36} \rightarrow \frac{15}{36} \rightarrow \frac{21}{36} = \frac{7}{12}$
1,1; 1,2; 1,3; 1,4; 1,5; 2,2; 2,3; 2,4; 3,3; 3,4; 4,4
- 22. $P(\text{a product less than or equal to 2}) = \frac{3}{36} = \frac{1}{12}$
1,1; 1,2; 2,1
- 23. $P(\text{a sum equal to 12}) = \frac{1}{36}$

24. **Open-Ended** Is it possible for an event to have a probability of 1? Explain your answer. *Yes, that means the event will happen everytime.*

25. **Error Analysis** Out of 20 coin flips, your classmate gets heads 14 times. She determines that the experimental probability of getting heads is $\frac{1}{2}$.

What error did your classmate make? What is the correct value for experimental probability? Explain.

She simplified wrong. $\frac{14}{20} = \frac{7}{10}$

13-2 Practice

Form K

Probability Distributions and Frequency Tables

A student records the type of weather each day for 21 consecutive days. The results are shown in the table below.

Weather Type	Number of days
Sunny	12
Rainy	4
Cloudy with no rain	5

Find the relative frequency of each type of weather.

1. Sunny $\frac{12}{21} = \frac{4}{7}$

2. Rainy $\frac{4}{21}$

3. Cloudy with no rain $\frac{5}{21}$

A student randomly chooses marbles from a bag containing 3 blue marbles and 3 red marbles. He chooses two at a time, and repeats this 10 times. The results are shown in the frequency table below.

Colors	BB	BR	RR	RB
Frequency	2	3	1	4

4. If 2 marbles are randomly chosen, what is the probability of choosing *exactly*

a. one red marble? $\frac{7}{10}$

b. two blue marbles? $\frac{2}{10} = \frac{1}{5}$

At a recreation center, 15 friends throw 3 darts each to try and get a bull's eye. The results are shown in the probability distribution below. Complete the table.

Number of Bull's Eyes	0	1	2	3
Frequency	8	4	2	1
Probability	5. $\frac{8}{15}$	$\frac{4}{15}$	6. $\frac{2}{15}$	7. $\frac{1}{15}$

13-2 Practice (continued)

Probability Distributions and Frequency Tables

Form K

8. A student records the favorite sport for 17 students. The results are shown in the table at the right.

a. What is the relative frequency of soccer as a favorite sport?

$$\frac{8}{17}$$

b. What is the relative frequency of basketball as a favorite sport?

$$\frac{4}{17}$$

Favorite Sport

Sport	Number of Responses
Soccer	8
Baseball	5
Basketball	4

9. A student chooses socks randomly, one at a time, from his drawer. Out of 20 different times, he chooses 6 black socks, 3 blue socks, and 11 white socks. What is the probability of choosing a blue sock?

$$\frac{3}{20}$$

10. **Error Analysis** A gymnastics coach records the number of medals won by 17 of his gymnasts at a recent meet. The results are shown in the probability distribution below.

Number of Medals	0	1	2
Frequency	3	6	9
Probability	$\frac{3}{17}$	$\frac{6}{17}$	$\frac{9}{17}$

Explain the error the coach made when making the table.

The relative frequencies don't add up to 17.

11. **Vocabulary** What is the difference between the total frequency and the relative frequencies of a probability experiment?

The total frequency is the amount of times the total events happened. The relative frequency is the amount of times a specific event happened.

13-3 Practice

Permutations and Combinations

Form G

1. A band sells t-shirts in 3 sizes and 2 different colors. How many different t-shirts are there to choose from?

$$3 \cdot 2 = 6 \text{ t-shirts}$$

2. Each player on the baseball team can order a baseball bat using the table to the right. How many choices does each player have?

Finish	Length	Wood Type
Natural	32"	Ash
Black	33"	Maple
	34"	

$$2 \cdot 3 \cdot 2 = 12 \text{ choices}$$

3. In how many different orders can 5 runners finish a race?

$$5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120 \text{ ways}$$

4. Evaluate $7!$.

$$7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 5040$$

5. What is the value of $\frac{25!}{24!}$?

$$\frac{25 \cdot 24 \cdot 23 \cdot \dots \cdot 1}{24 \cdot 23 \cdot \dots \cdot 1} = 25$$

6. How many possible combinations of 3 items from a group of 5 are possible?

$${}^5C_3 = \frac{5!}{3!(2)!} = \frac{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{(3 \cdot 2 \cdot 1)(2 \cdot 1)} = \frac{20}{2} = 10$$

7. Evaluate 6P_3 .

$$\frac{6!}{3!} = 120$$

8. A basketball coach will choose 5 players from a group of 8 players to start the next game. How many different groups of starting players are possible?

$${}^8C_5 = \frac{8!}{5!(3)!} = 56 \text{ combinations}$$

9. What is the value of nC_r when $n = 7$ and $r = 4$?

$${}^7C_4 = \frac{7!}{4!(3)!} = 35$$

10. What is the probability of randomly choosing a penny and a nickel from a cup of coins that contains a penny, a nickel, a dime, and a quarter?

11. Three playing cards are randomly chosen from a set numbered from 1 to 7. What is the probability that the chosen cards are numbered 1, 2 and 3?

13-3 Practice (continued)

Permutations and Combinations

Form G

12. **Recreation** When renting a bike from a local bike shop, you can choose from the types, sizes, and colors in the table shown below?

Type	Size	Color
Mountain	Small	Green
Cruising	Medium	Red
Road	Large	Blue

How many different choices do you have?

$$3 \cdot 3 \cdot 3 = 27 \text{ choices}$$

13. **Reasoning** A hiker has 2 pairs of hiking shoes, 3 different shirts, and 2 different pairs of shorts to choose from. How does the number of combinations of shoes, shirts, and shorts change as the hiker adds shirts to his collection? Explain.

The number of combinations will go up.

14. **Business** For each weekly meeting of a group of business leaders, members take turns being the note-taker, the facilitator, and the speaker. In how many different ways can these positions be chosen from the 9 members?

$${}^9P_3 = \frac{9!}{6!} = 504 \text{ ways}$$

- ~~15.~~ A game at the fair involves ping-pong balls numbered 1 to 18. You can win a prize if you correctly choose the 5 numbers that are randomly drawn. What are your chances of winning?