EXERCISE SET 11.4

• Practice and Application Exercises

Exercises 1–54 involve theoretical probability. Use the theoretical probability formula to solve each exercise. Express each probability as a fraction reduced to lowest terms.

In Exercises 1–10, a die is rolled. The set of equally likely outcomes is $\{1, 2, 3, 4, 5, 6\}$. Find the probability of rolling

1. a 4.

2. a 5.

3. an odd number.

4. a number greater than 3.

5. a number less than 3.

6. a number greater than 4.

7. a number less than 7.

8. a number less than 8.

9. a number greater than 7.

10. a number greater than 8.

In Exercises 11–20, you are dealt one card from a standard 52-card deck. Find the probability of being dealt

11. a queen.

12. a jack.

13. a club.

14. a diamond.

15. a picture card.

16. a card greater than 3 and less than 7.

17. the queen of spades.

18. the ace of clubs.

19. a diamond and a spade.

20. a card with a green heart.

In Exercises 21–26, a fair coin is tossed two times in succession. The set of equally likely outcomes is $\{HH, HT, TH, TT\}$. Find the probability of getting

21. two heads.

22. two tails.

23. the same outcome on each toss.

24. different outcomes on each toss.

25. a head on the second toss.

26. at least one head.

In Exercises 27–34, you select a family with three children. If M represents a male child and F a female child, the set of equally likely outcomes for the children's genders is $\{MMM, MMF, MFM, MFF, FMM, FMF, FFM, FFF\}$. Find the probability of selecting a family with

27. exactly one female child.

28. exactly one male child.

29. exactly two male children.

30. exactly two female children.

31. at least one male child.

32. at least two female children.

33. four male children.

34. fewer than four female children.

In Exercises 35–40, a single die is rolled twice. The 36 equally likely outcomes are shown as follows:

First Roll	Second Roll ⚀	⚁	⚂	⚃	⚄	⚅
⚀	(1, 1)	(1, 2)	(1, 3)	(1, 4)	(1, 5)	(1, 6)
⚁	(2, 1)	(2, 2)	(2, 3)	(2, 4)	(2, 5)	(2, 6)
⚂	(3, 1)	(3, 2)	(3, 3)	(3, 4)	(3, 5)	(3, 6)
⚃	(4, 1)	(4, 2)	(4, 3)	(4, 4)	(4, 5)	(4, 6)
⚄	(5, 1)	(5, 2)	(5, 3)	(5, 4)	(5, 5)	(5, 6)
⚅	(6, 1)	(6, 2)	(6, 3)	(6, 4)	(6, 5)	(6, 6)

Find the probability of getting

35. two even numbers.

36. two odd numbers.

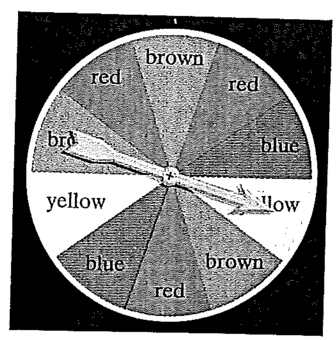
37. two numbers whose sum is 5.

38. two numbers whose sum is 6.

39. two numbers whose sum exceeds 12.

40. two numbers whose sum is less than 13.

Use the spinner shown to answer Exercises 41–48. Assume that it is equally probable that the pointer will land on any one of the ten colored regions. If the pointer lands on a borderline, spin again.



Find the probability that the spinner lands in

41. a red region.

42. a yellow region.

43. a blue region.

44. a brown region.

45. a region that is red or blue.

46. a region that is yellow or brown.

47. a region that is red and blue.

48. a region that is yellow and brown.

Exercises 49–54 deal with sickle cell anemia, an inherited disease in which red blood cells become distorted and deprived of oxygen. Approximately 1 in every 500 African-American infants is born with the disease; only 1 in 160,000 white infants has the disease. A person with two sickle cell genes will have the disease, but a person with only one sickle cell gene will have a mild, nonfatal anemia called sickle cell trait. (Approximately 8%–10% of the African-American population has this trait.)

		Second Parent	
		S	*s*
First	*S*	*SS*	*Ss*
Parent	*s*	*sS*	*ss*

If we use s to represent a sickle cell gene and S a healthy gene, the table shows the four possibilities for the children of two Ss parents. Each parent has only one sickle cell gene, so each has the relatively mild sickle cell trait. Find the probability that these parents give birth to a child who

49. has sickle cell anemia. **50.** has sickle cell trait.

51. is healthy.

In Exercises 52–54, use the following table that shows the four possibilities for the children of one healthy, SS, parent, and one parent with sickle cell trait, Ss.

		Second Parent (with Sickle Cell Trait)	
		S	*s*
Healthy	*S*	*SS*	*Ss*
First Parent	*S*	*SS*	*Ss*

Find the probability that these parents give birth to a child who

52. has sickle cell anemia. **53.** has sickle cell trait.

54. is healthy.

The table shows the distribution, by age and gender, of the 29.3 million Americans who live alone. Use the data in the table to solve Exercises 55–60.

NUMBER OF PEOPLE IN THE UNITED STATES LIVING ALONE, IN MILLIONS

	Ages 15–24	Ages 25–34	Ages 35–44	Ages 45–64	Ages 65–74	Ages ≥75	Total
Male	0.7	2.2	2.6	4.3	1.3	1.4	12.5
Female	0.8	1.6	1.6	5.0	2.9	4.9	16.8
Total	1.5	3.8	4.2	9.3	4.2	6.3	29.3

Source: U.S. Census Bureau

Find the probability, expressed as a decimal rounded to the nearest hundredth, that a randomly selected American living alone is

55. male. **56.** female.

57. in the 25–34 age range.

58. in the 35–44 age range.

59. a woman in the 15–24 age range.

60. a man in the 45–64 age range.

The table shows the number of Americans who moved i categorized by where they moved and whether they v owner or a renter. Use the data in the table, expressed in n to solve Exercises 61–66.

NUMBER OF PEOPLE IN THE UNITED STATE WHO MOVED IN 2004, IN MILLIONS

	Moved to Same State	Moved to Different State	Move Diffe Cour
Owner	11.7	2.8	0.
Renter	18.7	4.5	1.

Source: U.S. Census Bureau

Find the probability, expressed as a decimal roundec nearest hundredth, that a randomly selected Americ moved in 2004 was

61. an owner.

62. a renter.

63. a person who moved within the same state.

64. a person who moved to a different country.

65. a renter who moved to a different state.

66. an owner who moved to a different state.

• Writing in Mathematics

67. What is the sample space of an experiment? Wh event?

68. How is the theoretical probability of an event con

69. Describe the difference between theoretical prc and empirical probability.

70. Give an example of an event whose probability determined empirically rather than theoretically.

71. Use the definition of theoretical probability to expl the probability of an event that cannot occur is 0.

72. Use the definition of theoretical probability to expl the probability of an event that is certain to occur

73. Write a probability word problem whose answer i the following fractions: $\frac{1}{6}$ or $\frac{1}{4}$ or $\frac{1}{3}$.

74. The president of a large company with 10,000 em is considering mandatory cocaine testing fo employee. The test that would be used is 90% a meaning that it will detect 90% of the cocaine us are tested, and that 90% of the nonusers will test n This also means that the test gives 10% false Suppose that 1% of the employees actually use Find the probability that someone who tests pos cocaine use is, indeed, a user.

Hint: Find the following probability fraction:

$$\frac{\text{the number of employees who test positiv and are cocaine users}}{\text{the number of employes who test positive}}$$