10-3 Probability Distributions

Identify the random variable in each distribution, and classify it as *discrete* or *continuous*. Explain your reasoning.

1. the number of pages linked to a Web page

2. the number of stations in a cable package

3. the amount of precipitation in a city per month

4. the number of cars passing through an intersection in a given time interval

5. *X* represents the sum of the values of two spins of the wheel.

    a. Construct a relative-frequency table showing the theoretical probabilities.
    b. Graph the theoretical probability distribution.
    c. Construct a relative-frequency table for 100 trials.
    d. Graph the experimental probability distribution.
    e. Find the expected value for the sum of two spins of the wheel.
    f. Find the standard deviation for the sum of two spins of the wheel.

Identify the random variable in each distribution, and classify it as *discrete* or *continuous*. Explain your reasoning.

6. the number of texts received per week

7. the number of diggs (or "likes") for a Web page

8. the height of a plant after a specific amount of time

9. the number of files infected by a computer virus

10-3 Probability Distributions

10. **CCSS PERSEVERANCE** A contestant has won a prize on a game show. The frequency table at the right shows the number of winners for 3200 hypothetical players.

Prize, X	Winners
$100	1120
$250	800
$500	480
$1000	320
$2500	256
$5000	128
$7500	64
$10,000	32

a. Construct a relative-frequency table showing the theoretical probability.
b. Graph the theoretical probability distribution.
c. Construct a relative-frequency table for 50 trials.
d. Graph the experimental probability distribution.
e. Find the expected value.
f. Find the standard deviation.

11. **SNOW DAYS** The following probability distribution lists the probable number of snow days per school year at North High School. Use this information to determine the expected number of snow days per year.

| Number of Snow Days Per Year									
Days	0	1	2	3	4	5	6	7	8
Probability	0.1	0.1	0.15	0.15	0.25	0.1	0.08	0.05	0.02

12. **CARDS** In a standard deck of 52 cards, there are 4 different suits.
a. If jacks = 11, queens = 12, kings = 13, and aces = 1, what is the expected value of a card that is drawn from a standard deck?
b. If you are dealt 7 cards with replacement, what is the expected number of spades?

13. **RAFFLES** The table shows the probability distribution for a raffle if 100 tickets are sold for $1 each. There is 1 prize for $20, 5 prizes for $10, and 10 prizes for $5.

Distribution of Prizes			
Prize	no prize	$20	$10	$5
Probability	0.84	0.01	0.05	0.10

a. Graph the theoretical probability distribution.
b. Find the expected value.
c. Interpret the results you found in part b. What can you conclude about the raffle?

10-3 Probability Distributions

14. **CCSS TOOLS** Based on previous data, the probability distribution of the number of students running for class president is shown.

Number of Students Running
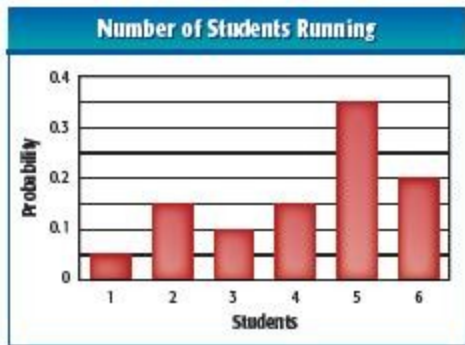
a. Determine the expected number of students who will run. Interpret your results.
b. Construct a relative-frequency table for 50 trials.
c. Graph the experimental probability distribution.

15. **BASKETBALL** The distribution below lists the probability of the number of major upsets in the first round of a basketball tournament each year.

Number of Upsets Per Year									
Upsets	0	1	2	3	4	5	6	7	8
Probability	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{5}{16}$	$\frac{1}{8}$	$\frac{3}{32}$	$\frac{1}{32}$

a. Determine the expected number of upsets. Interpret your results.
b. Find the standard deviation.
c. Construct a relative-frequency table for 50 trials.
d. Graph the experimental probability distribution.

16. **RAFFLES** The French Club sold 500 raffle tickets for $1 each. The first prize ticket will win $100, 2 second prize tickets will each win $10, and 5 third prize tickets each win $5.
a. What is the expected value of a single ticket?
b. Calculate the standard deviation of the probability distribution.
c. **DECISION MAKING** The Glee Club is offering a raffle with a similar expected value and a standard deviation of 2.2. In which raffle should you participate? Explain your reasoning.

17. **DECISION MAKING** Carmen is thinking about investing $10,000 in two different investment funds. The expected rates of return and the corresponding probabilities for each fund are listed below. Compare the two investments using the expected value and standard deviation. Which investment would you advise Carmen to choose, and why?

Fund A
30% chance of a $1900 profit
30% chance of a $600 profit
15% chance of a $200 loss
25% chance of a $500 loss

Fund B
40% chance of a $1600 profit
10% chance of a $900 profit
10% chance of a $300 loss
40% chance of a $400 loss

18. **MULTIPLE REPRESENTATIONS** In this problem, you will investigate geometric probability.
    a. Tabular The spinner shown has a radius of 2.5 inches. Copy and complete the table below.

Color	Probability	Sector Area	Total Area	Sector Area / Total Area
red				
orange				
yellow				
green				
blue				

b. Verbal Make a conjecture about the relationship between the ratio of the area of the sector to the total area and the probability of the spinner landing on each color.

c. Analytical Consider the dartboard shown.
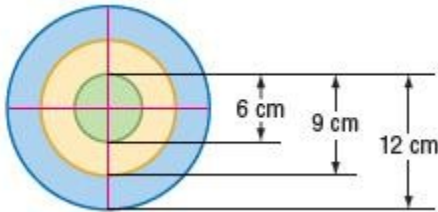
Predict the probability of a dart landing in each area of the board. Assume that any dart thrown will land on the board and is equally likely to land at any point on the board.

d. Tabular Construct a relative-frequency table for throwing 100 darts.

e. Graphical Graph the experimental probability distribution.

19. **CCSS CRITIQUE** Liana and Shannon each created a probability distribution for the sum of two spins on the spinner. Is either of them correct? Explain your reasoning.
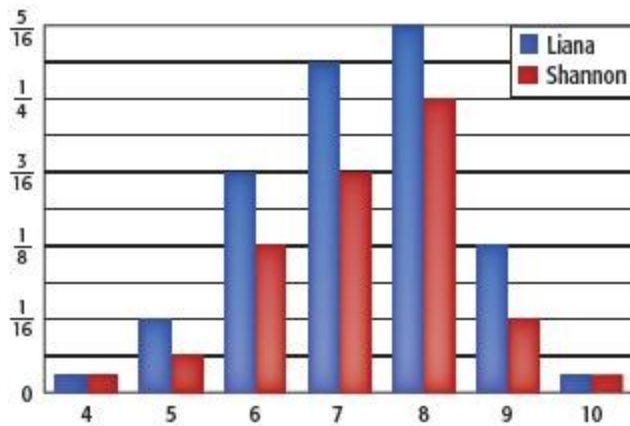

20. **REASONING** Determine whether the following statement is true or false. Explain.
    If you roll a die 10 times, you will roll the expected value at least twice.

21. **OPEN ENDED** Create a discrete probability distribution that shows five different outcomes and their associated probabilities.

22. **REASONING** Determine whether the following statement is true or false. Explain.
    Random variables that can take on an infinite number of values are continuous.

23. **OPEN ENDED** Provide examples of a discrete probability distribution and a continuous probability distribution. Describe the differences between them.

24. **WRITING IN MATH** Compare and contrast two investments that have identical expected values and significantly different standard deviations.

25. **GRIDDED RESPONSE** The height $f(x)$ of a bouncing ball after x bounces is represented by $f(x) = 140(0.8)^x$. How many times higher is the first bounce than the fifth bounce?

26. **PROBABILITY** Andres has a bag that contains 4 red, 6 yellow, 2 blue, and 4 green marbles. If he reaches into the bag and removes a marble without looking, what is the probability that it will not be yellow?

    A $\dfrac{1}{8}$

    B $\dfrac{1}{4}$

    C $\dfrac{3}{8}$

    D $\dfrac{5}{8}$

27. **GEOMETRY** Find the area of the shaded portion of the figure to the nearest square inch.
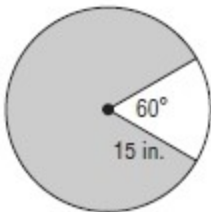
    F 79
    G 94
    H 589
    J 707

28. **SAT/ACT** If x and y are positive integers, which of the following expressions is equivalent to $\dfrac{\left(5^x\right)^y}{5^x} = \,?$

    A 1^y
    B ± 1
    C 5^y
    D 5^{xy-1}
    E 5^{xy-x}

29. **ARTICLES** Peter and Paul each write articles for an online magazine. Their employer keeps track of the number of likes received by each article.
    a. Use a graphing calculator to create a histogram for each data set. Then describe the shape of each distribution.
    b. Compare the distributions using either the means and standard deviations or the five-number summaries. Justify your choice.

Peter's Articles
16, 22, 19, 31, 24, 8, 40, 19, 33, 18,
36, 21, 55, 3, 16, 44, 22, 39, 12, 18,
13, 20, 67, 31, 13, 38, 31, 22, 26, 28

Paul's Articles
41, 38, 29, 33, 36, 55, 51, 19, 49, 56,
28, 52, 49, 19, 38, 33, 42, 61, 72, 55,
48, 39, 37, 43, 48, 45, 52, 43, 34, 29

Determine whether the situation calls for a *survey*, an *observational study*, or an *experiment*. Explain your reasoning.

30. You want to test a drug that reverses male pattern baldness.

31. You want to find voters' opinions on recent legislation.

Find the first five terms of each geometric sequence described.

32. $a_1 = 0.125$, $r = 1.5$

33. $a_1 = 0.5$, $r = 2.5$

34. $a_1 = 4$, $r = 0.5$

35. $a_1 = 12$, $r = \dfrac{1}{3}$

36. $a_1 = 21$, $r = \dfrac{2}{3}$

37. $a_1 = 80$, $r = \dfrac{5}{4}$

38. **COMMUNICATION** A microphone is placed at the focus of a parabolic reflector to collect sound for the television broadcast of a football game. Write an equation for the cross section, assuming that the focus is at the origin, the focus is 6 inches from the vertex, and the parabola opens to the right.

Solve each equation. Check your solutions.

39. $\log_9 x = \dfrac{3}{2}$

40. $\log_{\frac{1}{10}} x = -3$

41. $\log_b 9 = 2$

Expand each power.

42. $(a - b)^3$

43. $(m + n)^4$

44. $(r + n)^8$