5.3 Section Exercises

Determining the Value of λ for a Poisson Distribution

Determine the mean, which is the value of λ, for each scenario.

1. A fifth-grader averages three grammatical errors per paragraph. What is his average for four paragraphs?
2. A surveillance officer reports two incidents of shoplifting per month, on average. How many incidents of shoplifting on average are reported per year?
3. Baggage handlers at a certain airport move an average of 1500 bags on an eight-hour shift. On average, how many bags are moved per hour?
4. An assembly line, on average, produces 1 defective part for every 100 parts that roll off the line. What is the average number of defects for a group of 20 parts?
5. You average 70 heartbeats per minute. What is the average number of heartbeats you have in 10 seconds?
6. Someone with mild sleep apnea, a condition where the person stops breathing for 10 seconds or longer during sleep, has 10 such episodes where their breathing stops per hour. If on a typical night they sleep for 7 hours, what is the average number of episodes that they have per night?

Probability for Poisson Distributions

Find each specified probability. Assume that the random variable X has a Poisson distribution with the given value of λ.

7. $P(X = 2), \quad \lambda = 1.80$
8. $P(X = 0), \quad \lambda = 2.60$
9. $P(X = 13), \quad \lambda = 6.50$
10. $P(X = 8), \quad \lambda = 9.30$
11. $P(X \leq 2), \quad \lambda = 3.80$
12. $P(X \leq 5), \quad \lambda = 7.10$
13. $P(X < 4), \quad \lambda = 8.30$
14. $P(X < 8), \quad \lambda = 2.90$
15. $P(X \geq 3), \quad \lambda = 4.90$
16. $P(X \geq 12), \quad \lambda = 9.60$

Find each specified probability for the given scenario. Assume that each scenario can be modeled by a Poisson distribution.

17. The Oxford Gift Shop averages four sales each hour. Betty is scheduled to work the cash register from 1:00–3:00 on Saturday afternoon.
    a. What is the probability that Betty rings up exactly ten customers?
    b. What is the probability that Betty rings up more than ten customers?
18. The Pancake House is so popular that it boasts of selling a stack of pancakes every two minutes.
    a. What is the probability that there is a ten-minute interval in which no pancakes are sold?
    b. What is the probability that there is a five-minute interval in which fewer than three stacks of pancakes are sold?
19. The pizza place next to the local college receives an average of 20 pizza orders per hour during lunch.
    a. In any given hour during lunch, what is the probability that the pizza place receives at least 22 pizza orders?
    b. In any given hour during lunch, what is the probability that the pizza place receives more than 22 pizza orders?

20. Rob is a busy physician in the emergency room. He sees an average of four major trauma patients each night.

a. What is the probability that fewer than three major trauma patients will be admitted on any given night?

b. What is the probability that no more than five major trauma patients will be admitted on any given night?

21. Suppose that a bank drive-through serves customers at a rate of twelve cars every hour.

a. What is the probability that the bank drive-through will serve fewer than five customers in 30 minutes?

b. What is the probability that the bank drive-through will serve three customers in 15 minutes?

22. On average, Patrick sees a spider in his home once a month.

a. What is the probability that Patrick sees two spiders in a month and a half?

b. What is the probability that Patrick sees no more than one spider in a month and a half?

23. Jane cannot sell a finished piece of pottery if she discovers that the clay has a defect in it. Suppose that she has to discard 2 pieces for every 56 pieces she makes.

a. What is the probability that in 14 pieces of pottery, just 1 piece is defective?

b. What is the probability that in 28 pieces of pottery, at least 1 piece is defective?

24. An experienced transcriber misspells only 2 out of every 100 words on average. The transcriber is currently transcribing a 1000 word essay.

a. What is the probability that the transcriber will misspell 15 words?

b. What is the probability that the transcriber will misspell no more than 10 words?

25. Suppose that, on average, 45 books are checked out of the local public library per day.

a. What is the probability that 100 books are checked out in two days?

b. What is the probability that at most 200 books are checked out in four weeks?

26. A landscape architect knows that in the cable that he lays for landscape lighting he can expect one defect in 300 yards of cable.

a. What is the probability that in 100 yards of cable, he would find two defects?

b. What is the probability that in 200 yards of cable, he would find fewer than three defects?