10-8 Geometric Probability

Vocabulary

Review

Write T for *true* or F for *false*.

_____ **1.** A *point* indicates a location and has no size.

_____ **2.** A line contains a finite number of *points*.

3. Use the diagram at the right. Circle the segment that includes *point S*.

$\overline{PR}$ $\overline{PT}$ $\overline{QR}$

Vocabulary Builder

probability (noun) **prah buh BIL uh tee**

Related Term: geometric probability

Definition: The **probability** of an event is the likelihood that the event will occur.

Main Idea: In geometric **probability,** favorable outcomes and possible outcomes are geometric measures such as lengths of segments or areas of regions.

theoretical **probability**

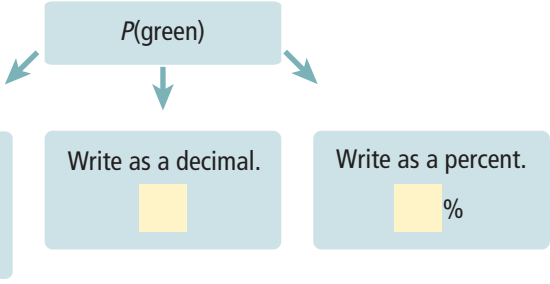
$$P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

Use Your Vocabulary

4. Underline the correct words to complete the sentence.

The *probability* of an event is the ratio of the number of favorable / possible outcomes to the number of favorable / possible outcomes.

5. There are 7 red marbles and 3 green marbles in a bag. One marble is chosen at random. Write the *probability* that a green marble is chosen.



Take note

Key Concept Probability and Length or Area

Probability and Length

Point S on $\overline{AD}$ is chosen at random. The probability that S is on $\overline{BC}$ is the ratio of the length of $\overline{BC}$ to the length of $\overline{AD}$.

$$P(S \text{ on } \overline{BC}) = \frac{BC}{AD}$$

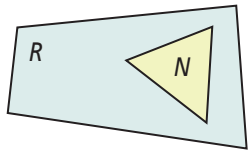
Complete.

6. $P(S \text{ on } \overline{AC}) = \frac{\square}{AD}$

7. $P(S \text{ on } \overline{AB}) = \frac{\square}{\square}$

Probability and Area

Point S in region R is chosen at random. The probability that S is in region N is the ratio of the area of region N to the area of region R.



$$P(S \text{ in region } N) = \frac{\text{area of region } N}{\text{area of region } R}$$

8. Find the probability for the given areas.

area of region $R = 11 \text{ cm}^2$ area of region $N = 3 \text{ cm}^2$

$P(S \text{ in } N) = \frac{\square}{\square}$

Problem 1 Using Segments to Find Probability

Got It? **Point H on $\overline{ST}$ is selected at random. What is the probability that H lies on $\overline{SR}$?**

9. Find the length of each segment.

length of $\overline{SR} = |2 - \square| = \square$ length of $\overline{ST} = |\square - \square| = \square$

10. Find the probability.

$$P(H \text{ on } \overline{SR}) = \frac{\text{length of } \overline{SR}}{\text{length of } \square} = \frac{\square}{\square} = \frac{\square}{\square}$$

11. The probability that H is on $\overline{SR}$ is $\square$, or $\square$ %.

Problem 2 Using Segments to Find Probability

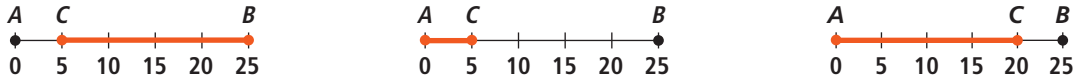
Got It? **Transportation** **A commuter train runs every 25 min. If a commuter arrives at the station at a random time, what is the probability that the commuter will have to wait no more than 5 min for the train?**

12. Circle the time t (in minutes) before the train arrives that the commuter will need to arrive in order to wait *no more than* 5 minutes.

$0 \le t \le 5$ $5 < t \le 10$ $10 < t \le 15$

$15 < t \le 20$ $20 < t \le 25$

13. Circle the diagram that models the situation.



14. Complete.

length of favorable segment = ____ length of entire segment = ____

15. Find the probability.

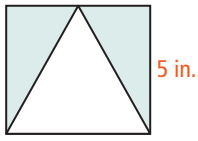
$P(\text{waiting no more than 5 min}) = \dfrac{\text{length of favorable segment}}{\text{length of entire segment}}$

$= \dfrac{\quad}{\quad}$, or $\dfrac{\quad}{\quad}$

16. The probability of waiting no more than 5 min for the train is ____, or ____%.

Problem 3 Using Area to Find Probability

Got It? **A triangle is inscribed in a square. Point *T* in the square is selected at random. What is the probability that *T* lies in the shaded region?**



17. Complete the model below to write an equation.

Define Let s = the area of the shaded region.

Relate area of the shaded region is area of the square minus area of the triangle

Write $s = (\quad)^2 - \frac{1}{2} \cdot \quad \cdot \quad$

18. Now solve the equation to find the area of the shaded region.

19. Find the probability.

$P(\text{point } T \text{ is in shaded region}) = \dfrac{\text{area of shaded region}}{\text{area of square}}$

$= \dfrac{\quad}{\quad}$, or $\dfrac{\quad}{2}$

20. The probability that *T* lies in the shaded region is ____, or ____%.

Problem 4 Using Area to Find Probability

Got It? Archery An archery target has 5 colored scoring zones formed by concentric circles. The target's diameter is 122 cm. The radius of the yellow zone is 12.2 cm. The width of each of the other zones is also 12.2 cm. If an arrow hits the target at a random point, what is the probability that it hits the yellow zone?

21. The radius of the target is $\frac{\quad}{2}$, or $\quad$ cm.

22. Find the probability. Write the probability as a decimal.

$$P(\text{arrow hits yellow zone}) = \frac{\text{area of yellow zone}}{\text{area of entire target}}$$

$$= \frac{\pi(12.2)^2}{\pi(\quad)^2} = \frac{\quad}{\quad} = \quad$$

23. Explain why the calculation with π is not an estimate.

_____

24. The probability that the arrow hits the yellow zone is $\quad$, or $\quad$%.

Lesson Check • Do you UNDERSTAND?

Reasoning In the figure at the right, $\frac{SQ}{QT} = \frac{1}{2}$. What is the probability that a point on $\overline{ST}$ chosen at random will lie on $\overline{QT}$? Explain.

25. If $SQ = x$, then $QT =$ $\quad$ and $ST =$ $\quad$.

26. What is $P(\text{point on } \overline{QT})$? Explain.

_____

Math Success

Check off the vocabulary words that you understand.

☐ length ☐ area ☐ geometric probability

Rate how well you can *use geometric probability*.

Need to review 0 2 4 6 8 10 Now I get it!