

11.6

Geometric Probability

- Goals**
- Find a geometric probability.
 - Use geometric probability to solve real-life problems.

VOCABULARY

Probability A probability is a number from 0 to 1 that represents the chance that an event will occur.

Geometric probability A geometric probability is a probability that involves a geometric measure such as length or area.

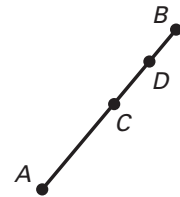
GEOMETRIC PROBABILITY

Probability and Length

Let \overline{AB} be a segment that contains the segment \overline{CD} .

If a point K on \overline{AB} is chosen at random, then the probability that K is on \overline{CD} is

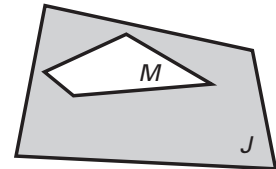
$$P(\text{Point } K \text{ is on } \overline{CD}) = \frac{\text{Length of } \overline{CD}}{\text{Length of } \overline{AB}}.$$



Probability and Area

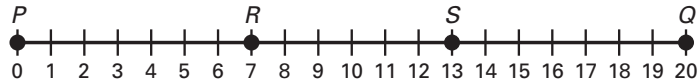
Let J be a region that contains region M . If a point K in J is chosen at random, then the probability that K is in region M is

$$P(\text{Point } K \text{ is in region } M) = \frac{\text{Area of } M}{\text{Area of } J}.$$



Example 1 Finding a Geometric Probability

Find the probability that a point chosen at random on \overline{PQ} is on \overline{RS} .

**Solution**

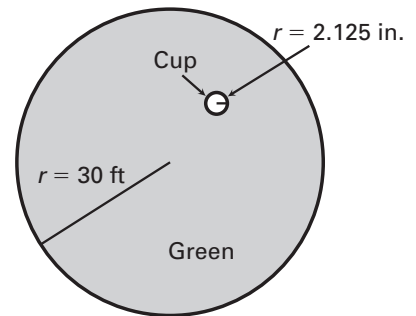
$$P(\text{Point is on } \overline{RS}) = \frac{\text{Length of } \overline{RS}}{\text{Length of } \overline{PQ}} = \frac{6}{20} = \frac{3}{10}$$

Answer The probability can be written as $\frac{3}{10}$, 0.3, or 30%.

You can write a probability as a fraction, as a decimal, or as a percent.

Example 2 Using Areas to Find a Geometric Probability

Golf A golf ball is hit and lands on the circular green shown. The ball is equally likely to land on any point on the green. Find the probability that the ball lands in the cup.

**Solution**

Convert the radius of the green to inches. Then find the ratio of the area of the hole to the area of the golf green.

$$30 \text{ ft} = \underline{360} \text{ in.} \quad \text{Convert feet to inches.}$$

$$P(\text{Ball lands in cup}) = \frac{\text{Area of cup}}{\text{Area of green}} \quad \text{Write ratio.}$$

$$= \frac{\pi(2.125^2)}{\pi(360^2)} \quad \text{Formula for area of circle}$$

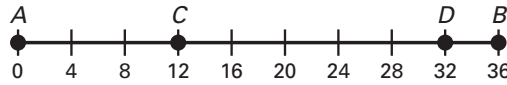
$$= \frac{2.125^2}{360^2} \quad \text{Divide out common factor.}$$

$$\approx \underline{0.000035} \quad \text{Use a calculator.}$$

Answer The probability that the ball lands in the cup is about 0.000035.

Checkpoint Complete the following exercises.

1. Find the probability that a point chosen at random on \overline{AB} is on \overline{CD} .



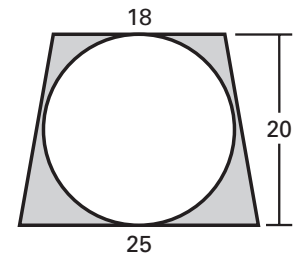
$$\frac{5}{9} \approx 55.6\%$$

The area of a trapezoid is

$$A = \frac{1}{2}h(b_1 + b_2)$$

where h is the height of the trapezoid and b_1 and b_2 are the lengths of the bases.

2. Find the probability that a randomly chosen point in the figure lies in the shaded region.



$$\frac{43 - 10\pi}{43} \approx 26.9\%$$

3. You are expecting a visit from a friend anytime between 3:00 P.M. and 5:00 P.M. During this time, you know that you will need to spend 20 minutes cleaning your room. What is the probability that your friend will arrive while you are cleaning your room?

$$\frac{1}{6} \approx 16.67\%$$