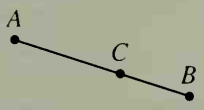
11-8 *Geometric Probability*

The geometric probability problems in this section can be solved by using one of the following two principles.

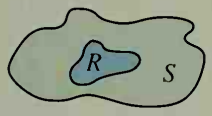
1. Suppose a point P of $\overline{AB}$ is picked at random. Then:

$$\text{probability that } P \text{ is on } \overline{AC} = \frac{\text{length of } \overline{AC}}{\text{length of } \overline{AB}}$$



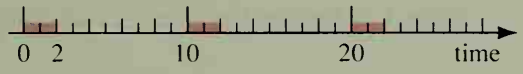
2. Suppose a point P of region S is picked at random. Then:

$$\text{probability that } P \text{ is in region } R = \frac{\text{area of } R}{\text{area of } S}$$



Example 1 Every ten minutes a bus pulls up to a hotel and waits for two minutes while passengers get on and off. Then the bus leaves. If a person walks out of the hotel front door at a random time, what is the probability that a bus is there?

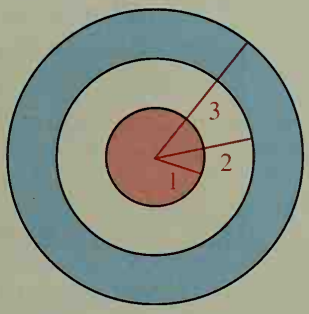
Solution Think of a time line in which the colored segments represent times when the bus is at the hotel. For *any* ten-minute period, a two-minute subinterval is colored. Thus:



$$\text{probability that a bus will be there} = \frac{\text{length of colored segment}}{\text{length of whole segment}}$$

$$= \frac{2}{10} = \frac{1}{5}$$

Example 2 A person who is just beginning archery lessons misses the target frequently. And when a beginner hits the target, each spot is as likely to be hit as another. If a beginner shoots an arrow and it hits the target, what is the probability that the arrow hits the red bull's eye?



Solution probability arrow hits bull's eye if it hits target =

$$\frac{\text{area of bull's eye}}{\text{area of target}} = \frac{\pi \cdot 1^2}{\pi \cdot 3^2} = \frac{1}{9}$$