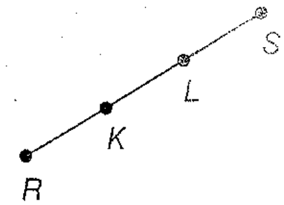
NAME ______________________ DATE May 12, 2014 PERIOD ________

13-3 *Geometric Probability*

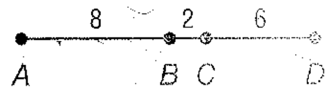
Target: Use geometric distances and areas to find probability of an event.

Probability with Length Probability that involves a geometric measure is called **geometric probability**. One type of measure is length.



Look at line segment $\overline{KL}$.
If a point, M, is chosen at random on the line segment, then
$P(M \text{ is on } \overline{KL}) = \frac{KL}{RS}$.

Example: Point X is chosen at random on $\overline{AD}$. Find the probability that X is on $\overline{AB}$.



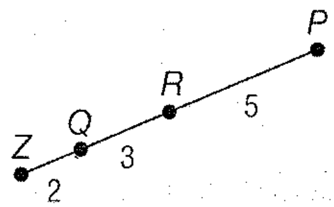
$P(X \text{ is on } \overline{AB}) = \frac{AB}{AD}$ — Length probability ratio

$= \frac{8}{16}$ — $AB = 8$ and $AD = 8 + 2 + 6 = 16$

$= \frac{1}{2}$, 0.5, or 50% — Simplify.

Exercises

Point M is chosen at random on $\overline{ZP}$. Find the probability of each event.



1. $P(M \text{ is on } \overline{ZQ})$

   $\frac{2}{10} = \frac{1}{5}$ or 20%

2. $P(M \text{ is on } \overline{QR})$

   $\frac{3}{10}$ or 30%

3. $P(M \text{ is on } \overline{RP})$

   $\frac{5}{10} = \frac{1}{2}$ or 50%

4. $P(M \text{ is on } \overline{QP})$

   $\frac{8}{10} = \frac{4}{5}$ or 80%

5. **TRAFFIC LIGHT** In a 5-minute traffic cycle, a traffic light is green for 2 minutes 27 seconds, yellow for 6 seconds, and red for 2 minutes 27 seconds. What is the probability that when you get to the light it is green?

   $\frac{2 \text{ min } 27 \text{ sec}}{5 \text{ min}}$ $P = \frac{147}{300} = \frac{49}{100} = 49\%$

6. **GASOLINE** Your mom's mini van has a 24 gallon tank. What is the probability that, when the engine is turned on, the needle on the gas gauge is pointing between $\frac{1}{4}$ and $\frac{1}{2}$ full? $\frac{6}{24} = \frac{1}{4}$ or 25%

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Probability with Area Geometric probabilities can also involve area. When determining geometric probability with targets, assume that the object lands within the target area and that it is equally likely that the object will land anywhere in the region.

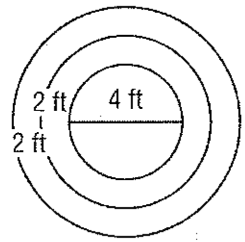
P = area want / total area

Example: Suppose a coin is flipped into a reflection pond designed with colored tiles that form 3 concentric circles on the bottom. The diameter of the center circle is 4 feet and the circles are spaced 2 feet apart. What is the probability the coin lands in the center?

$P(\text{coin lands in center}) = \frac{\text{area of center circle}}{\text{area of base of pond}}$

$= \frac{4\pi}{36\pi}$

$= \frac{1}{9}$, about 0.11, or 11%



Exercises

1. **LANDING** A parachutist needs to land in the center of a target on a rectangular field that is 120 yards by 30 yards. The target is a circular design with a 10 yard radius. What is the probability the parachutist lands somewhere in the target?

120, 30, 10 yd

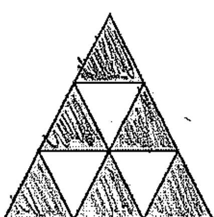
$P = \frac{\pi 10^2}{120 \cdot 30} = \frac{100\pi}{3600} = \frac{314.15}{3600}$ 8.7%

2. **CLOCKS** Jonus watches the second hand on an analog clock as it moves past the numbers. What is the probability that at any given time the second hand on a clock is between the 2- and the 3-hour numbers?

$\frac{360}{12} = 30$ $P = \frac{30}{360} = \frac{1}{12}$ or 8.3%

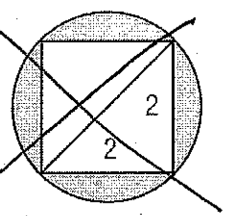
Find the probability that a point chosen at random lies in the shaded region.

3.

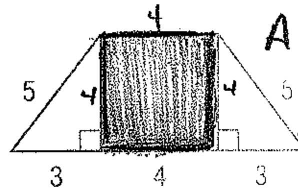


$\frac{6}{9} = \frac{2}{3}$ or 66.6%

4.



5.



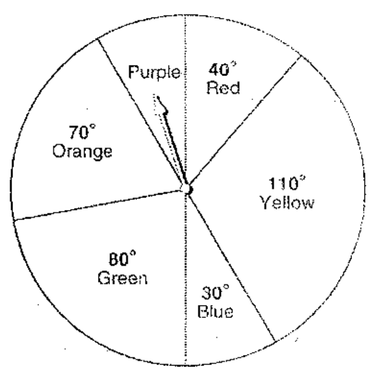
A = 4 · 4 = 16

$A = \frac{bh}{2} = \frac{4 \cdot 3}{2} = 6$

2 triangles = 12

$\frac{16}{16+12} = \frac{16}{28} = \frac{4}{7}$ or 57%

Use the spinner to find each probability. If the spinner lands on a line it is spun again.



6. *P*(pointer landing on red)

$\frac{40}{360} = \frac{1}{9} = 11.1\%$

7. *P*(pointer landing on blue)

$\frac{30}{360} = \frac{1}{12}$ or 8.3%

8. *P*(pointer landing on green)

$\frac{80}{360} = \frac{2}{9}$ or 22.2%