Geometric Probability Notes

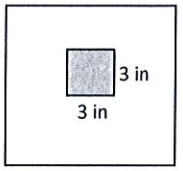
1. Instead of using algebraic formulas to solve probability problems, sometimes you can use geometric figures. The geometric figures allow you to picture the possibilities of a situation before solving the problem. You can then use geometric relationships to find the solution.

To Find Geometric Probability:

Find the area of success then divide it by the total area.

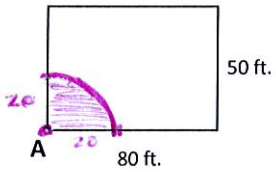
$$Probability = \frac{Area\ of\ Success}{Total\ Area}$$

Ex: Sue is throwing darts at a square game board as shown in the figure. What is the chance that she will throw a dart in the shaded area in the center of the board? (Assume that every dart thrown lands somewhere on the board.)



$= \frac{9}{100}$

Ex: Moe Mentum owns a goat that will eat anything especially the tennis balls that are hit into Moe's yard from a neighboring tennis court. To keep his goat from eating a lot of tennis balls, Moe decides to tether it in a corner of a yard at Point A as shown. The tether is 20 feet long. What is the probability that a tennis ball hit into Moe's yard will be within reach of the tethered goat?



$A = \pi r^2$

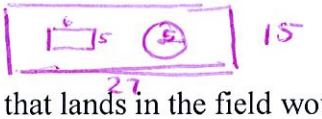
$A = \frac{1}{4} \cdot 20^2 \cdot \pi = 100\pi$

$= \frac{100\pi}{4000}$

Ex: Washington, D.C. was originally laid out as a square with sides ten miles in length. On a visit to Washington, Myles Away plans to visit all the important sites such as the White House, the Smithsonian Museum, the Capitol, and the National Zoo. What is the probability that any one of these sites in within a mile of the center of Washington?

$\frac{\pi}{100}$

Ex: A rectangular field measures 27 feet by 15 feet. A small shed is on the field. Its dimensions are 6 feet by 5 feet. There is also an oak tree in the field whose branches form a circular canopy with a diameter of 10 feet. (Assume the shed is not under the tree.)



a. What is the probability that a single drop of rain that lands in the field would hit the shed?

$\frac{30}{405} = \frac{2}{27}$

b. What is the probability that a single drop of rain that lands in the field would *not* hit the shed?

$\frac{375}{405} = \frac{25}{27}$

c. What is the probability that a single drop of rain that lands in the field would miss both the shed and the tree

$1 - \left(\frac{30 + 25\pi}{405}\right) = \frac{175 + 5\pi}{81}$

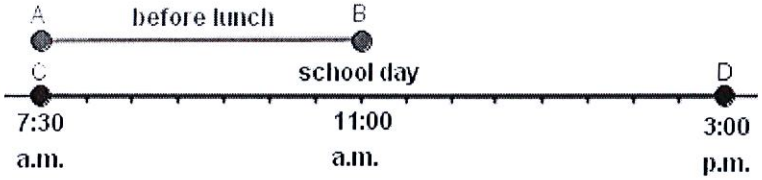
$1 - (\text{Shed or tree})$

2. Some problems involve linear information. The best way to approach these types of problems is to draw the picuture with the given information then use

$$Probability = \frac{Length\ of\ line\ that\ represents\ success}{Total\ Length}$$

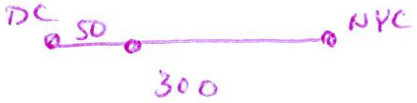
Ex: Suppose that your school day begins at 7:30 a.m. and ends at 3:00 p.m. You eat lunch at 11:00 A.M. If there is a fire drill at a random time during the day, what is the probability that it begins before lunch?

You can use line segments to model the probability.



$\frac{3.5}{7.5} = \frac{7}{15}$

Ex: Holly Mackerel and Patty Cake are driving from New York City to Washington, D.C., a distance of about 300 miles. Their car has a broken gas gauge, but Holly knows her car's gas tank holds exactly enough gas to make the trip without having to stop for gas. Unfortunately, they hit bad weather, which causes traffic delays, and they run out of gas. What is the probability that they will be within 50 miles of Washington when they run out of gas?

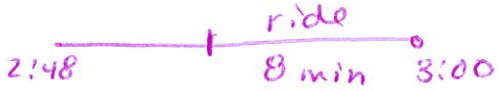


$\frac{50}{300} = \frac{1}{6}$

Ex: Buses arrive at a resort hotel every 15 minutes. They wait for three minutes while passengers get on and get off, and then the buses depart. What is the probability that there is a bus waiting when a hotel guest walks out of the door at a randomly chosen time?

$\frac{3}{15}$

Ex: You are visiting San Francisco and are taking a trolley ride to a store on Market Street. You are supposed to meet a friend at the store at 3:00 p.m. The trolleys run every 10 minutes and the trip to the store is 8 minutes. You arrive at the trolley stop at 2:48 p.m. What is the probability that you will arrive at the store by 3:00 p.m.?



$\frac{4}{12}$

Ex: Dwayne Pipe is driving one car in a line of cars, with about 150 feet between successive cars. Each car is 13 feet long. At the next overpass, there is a large icicle. The icicle is about to crash down onto the highway. If the icicle lands on or within 30 feet of the front of a car, it will cause an accident. What is the chance that the icicle will cause an accident?

$\frac{86}{206}$