

DTP-Math-Circle: Session 2—Probability

Sept 16 2022

10 Three-way paint-ball duel

Amar, Akbar and Antony agree to enter into a three-way paint-ball duel, or a paint-ball “truel”. They stand at the vertices of an equilateral triangle, so each person is the same distance from the other two. In paint-ball, you shoot balls of paint out of a gun, and if you are hit by a paint-ball shot at you by someone else, you are out. If you are the last to not be hit, you win. So each person tries to maximize the chance that they win by not getting hit by a paint ball before the others.

In the case of the paint-ball truel, the way they play is that they take turns taking one shot at a time with their paint=ball gun. Amar is the worst shot, and when he aims at a target he only hits it $1/3$ of the time, so he gets to shoot first. Akbar is second-worst, hitting $2/3$ of the time, so he gets to shoot second. Antony is a sharpshooter who always hits his target, so he will have to wait and shoot third. The three men will take turns shooting their paint-ball guns in this order until only one man is left without paint on him, and he will of course be the winner.

Amar is up first. What should he do to secure his best odds of winning?