# Math-Circle: Session 2

## TIFR-CAM and ICTS

### November 7, 2022

Problem 2   (Carom/Billiard Problem)  . Theme: Observe the world around yourself and ask questions!!

All of us have played carom at some point in our life.  Some people are extremely gifted in playing rebound shots. Let's play a mathematically idealised carom game.  Suppose you are given a carom board which is a square ABCD. Assume that carom pockets are point sized and placed at corners A, B, C, and D. Also assume that your striker is point sized.  You are sitting on the side AB, and you pick a point P on the line segment AB where you place your striker.  You hit the striker in the direction making an angle  $\theta$ with the line segment AB. Suppose that the striker moves indefinitely, i.e. there is no friction, and it reflects from sides like light.  Can you try to understand this system by asking any question that comes to your mind. Some question that come to my mind are:

(a)  How can I play so that I eventually hit one of the corners ?

(b)  How can I play so that my striker eventually repeats its original move, i.e. it comes back to the original position $P$  and leaves with the same angle $\theta$?

(c)  How can I play so that my striker never repeats its original move?

(d)  Now assume that the striker is not point sized and it has some positive radius. Then, can we hit the striker so that it touches every point within the carom board?