Maths Circle Explorations: Session 8

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Problem 2

1. Suppose we have a photograph of a straight running track, called AB, whose length we want to compute. To do this, we identify some known objects $\{X_i\}$, which we think of as points on the track; and we ask people on the ground to measure some of the distances X_iX_j. How many of X_iX_j should we know apiori to compute the length of the track? Note: We do have a scale and can measure distances on the photograph itself.

2. Suppose instead that the points X_i were not on the running track but on the playground (which we assume to be a plane) containing the track, then how many of the distances X_iX_j do we need? What if the playground is not a plane and we instead have golf-course with significant highs and falls (we still assume the track is a straight line)?

3. The playground is used for a race, and you have a video of two runners practicising on two parallel straight tracks. You have no one on the ground to measure any distance. Can you tell which of the runner is faster? (We visualize runners as points on the straight track, and they run with a uniform speed, but they are not assumed to start together).