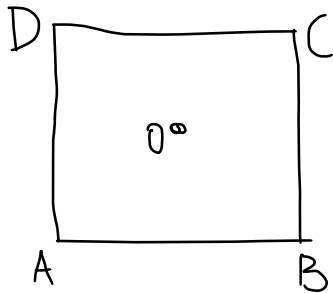


## Quantum Club

### Entrance test 2022

1. You drop a metal ball from an aerostat and hear a bang  $t$  seconds later. Find the height  $d$  of the aerostat in terms of time  $t$ , speed of sound  $c$  and free-fall acceleration  $g$ . Neglect air resistance.
2. A criminal is in the centre  $O$  of a square swimming pool, and a police officer, initially at the pool's corner  $A$ , is trying to catch the criminal. The officer cannot swim but can run three times faster than the criminal can swim. Can the criminal get out of the pool and run away from the officer? Once out of the pool, the criminal can run faster than the officer.



3. Calculate  $\sin^3 x - \cos^3 x$  if  $\sin x - \cos x = u$ .
4. Paper cards numbered 1 to 10 are placed on a table in a row, in a random order. What is the probability that cards 1 and 2 are situated next to each other?
5. Solve the equation  $4\sin x + \sqrt{3}\sin 2x = 2\cos 2x\sin x$ .
6. What is the probability that a random 6-digit phone number (a sequence of digits between 0 and 9) has at least two identical digits next to each other?
7. Find the complete set of all positive integer numbers such that each of them is 13 times greater than the sum of its digits.