

Quantum Club

Entrance test 2023 (pre-selection)

1. The base of a pyramid is a rectangle. Each of the side edges has length l and makes angles α and β with the base edges. Find the volume of the pyramid.
2. Find all solutions to the equation $\sqrt{1+\sin x} - \sqrt{1-\sin x} = 1 + \cos x$.
3. Three trains are moving with a constant speed. After some time has elapsed, the sum of distances that trains A and C travelled is twice as much as the distance travelled by train B, and that of trains B and C – three times as much as A. Which train is the fastest?
4. Which term is the largest in the decomposition $(\sqrt{5} + \sqrt{2})^{20}$?
5. Eight chess players A, B, C, D, E, F, G and H are playing in a tournament. Before the tournament, it is randomly decided who play against each other in the first game. What is the probability that the pairs are AB, CD, EF and GH? The order of players in a pair does not matter, e.g. AB and BA are considered the same pair.

Please email your solutions to Alex.Lvovsky@physics.ox.ac.uk with the subject “Quantum Club Entrance Test” no later than **15 October 2023**.