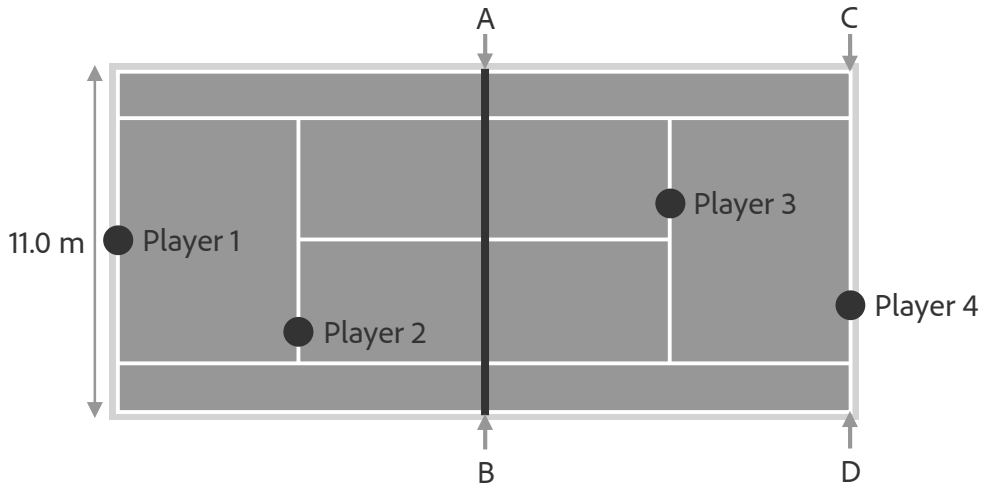


In a tennis rally, Player 1 is standing at the centre of their baseline, 12.0 m from the net, and strikes the ball from a height of 1.20 m above the ground. The court is 11.0 m wide, and the net spans the same width.

On the opposite side of the court:

- Player 3 starts 1.00 m right of the middle of their service line, which is exactly halfway between the net and their baseline. They have an average reaction delay of 0.30 s, after which they accelerate from rest at an average 2.80 ms^{-2} until reaching a maximum speed of 5.50 ms^{-1}, and then continue at that speed.
- Player 4 starts 2.20 m left of the middle of their baseline. They have an average reaction delay of 0.40 s, after which they accelerate from rest at an average 3.50 ms^{-2} until reaching a maximum speed of 7.50 ms^{-1}, and then continue at that speed.

Player 1 may aim the ball toward any of the four corners of the defenders' court. If they choose a front corner, the ball would pass just over the net and instantly lose all horizontal velocity due to contact with the net, causing it to drop vertically under the influence of gravity. The initial speed and launch angle for each corner are given below. The launch angle is measured from the horizontal along the court.

	Initial speed (ms^{-1})	Launch angle (°)
A	15.941	74.751
B	15.504	73.782
C	15.357	50.108
D	16.212	58.418

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Use exact values throughout your calculations and give your final answers to 3 significant figures.

For each corner Player 1 can hit to, find out:

	Corner A	Corner B	Corner C	Corner D
Initial horizontal velocity of the ball after being hit				
Initial vertical velocity of the ball after being hit				
Time for the ball to reach the top of the net				
Horizontal velocity of the ball on impact with the top of the net				
Vertical velocity of the ball on impact with the top of the net				
Speed of the ball on impact with the top of the net				
Angle of impact of the ball at the top of the net				
Height of the net				
Speed of the ball on impact with the ground after falling from the top of the net				
Time for the ball to reach the ground after falling from the top of the net				
Time the ball is above the ground from when it is hit				
Speed of Player 3 the instant they reach the corner				
Speed of player 4 the instant they reach the corner				
Time for Player 3 to reach the corner				
Time for Player 4 to reach the corner				
Most likely corner Player 1 will hit to win the point				

(Maximum mark: 42)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA