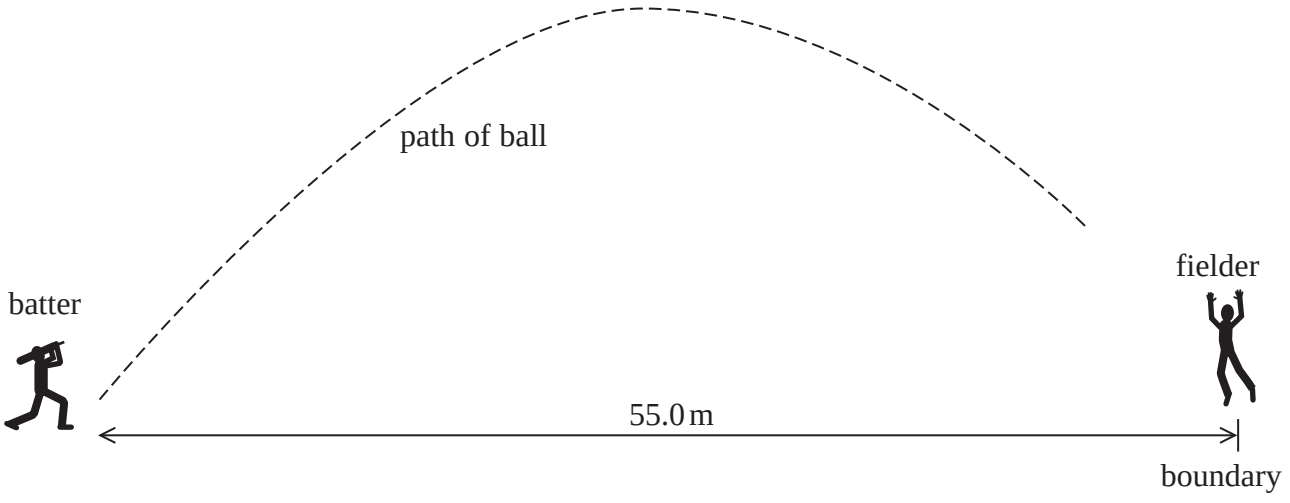
17 In cricket a fielder is often placed at the boundary edge as shown. If the fielder catches the ball, the batter is out.



The fielder is 55.0 m away from the batter. The fielder can catch the ball providing the ball is less than three metres above the height at which it was hit.

The ball is hit with a velocity of 23.8 m s^{-1} and at an angle of 50.0° to the horizontal.

(a) Deduce whether the fielder can catch the ball in this case.

(5)

(b) The ball was bowled. Just after the bat hit the ball, the ball had a velocity of 23.8 m s^{-1} at an angle of 50° to the horizontal.

(i) Show that the magnitude of the momentum of the ball, after it was hit, was about 3.3 N s.

mass of cricket ball = 0.140 kg

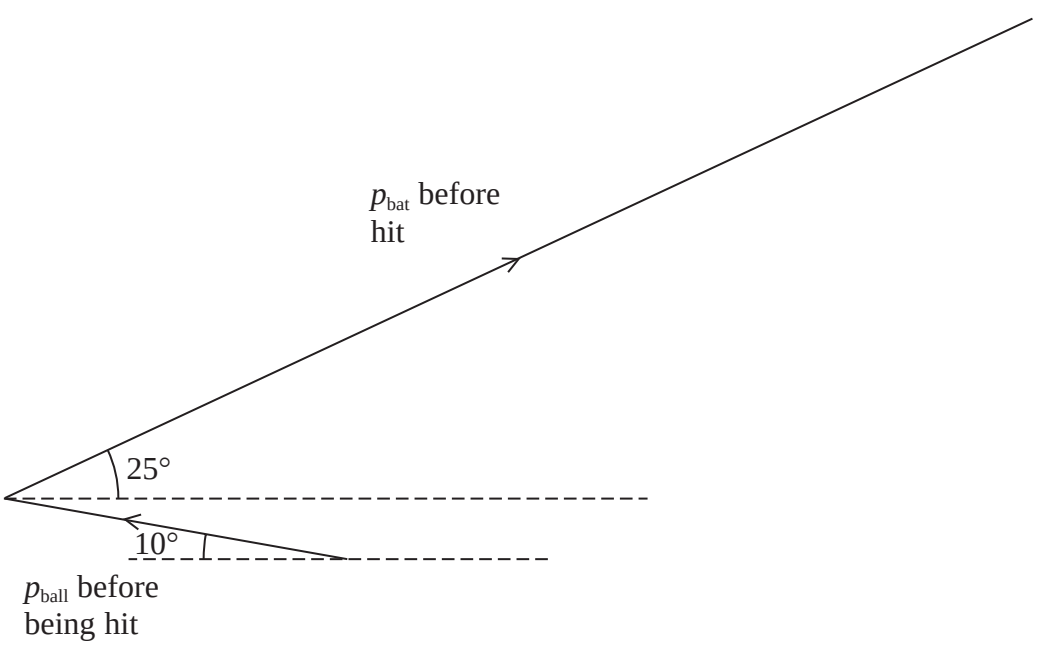
(1)

(ii) The vector diagram below shows, accurately to scale, the momentum of the ball and the momentum of the bat before the hit.

Determine, by completing the vector diagram, the momentum of the bat after it hit the ball.

momentum of bat before hitting ball = 15.0 N s at 25° to the horizontal
momentum of ball before hitting bat = 4.6 N s at 10° to the horizontal

(5)



Momentum of bat after hitting ball = ...

at an angle of ..... to the horizontal

(Total for Question 17 = 11 marks)