

Projectiles Challenge

Challenge 1

- 4 A golfer hits a ball, from ground level on a horizontal surface. The initial velocity of the ball is 21 ms^{-1} at an angle of 60° above the horizontal. Assume that the ball is a particle and that no resistance forces act on the ball.
- (a) Find the maximum height of the ball. *(4 marks)*
- (b) Find the range of the ball. *(4 marks)*
- (c) Find the speed of the ball at its maximum height. *(2 marks)*



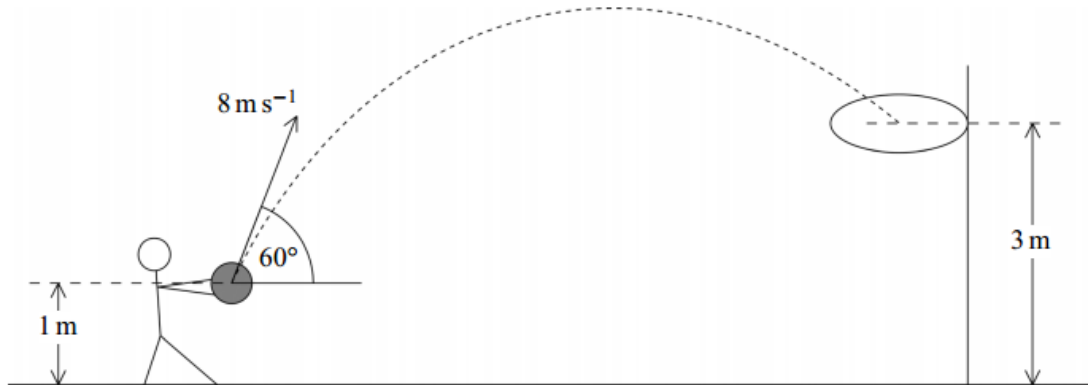
Challenge 2

- 5 A javelin is modelled as a particle. Assume that only gravity acts on the javelin after it has left the thrower's hand. The initial velocity of the javelin is 20 ms^{-1} at an angle of 40° above the horizontal.
- (a) Find the range of the javelin on horizontal ground if the height of release is ignored. *(6 marks)*
- (b) The javelin is actually released at a height of 2 metres. Find the range of the javelin in this case. *(6 marks)*



Challenge 3

- 6 A ball is thrown so that it passes through the centre of a basket ball hoop, as shown in the diagram.



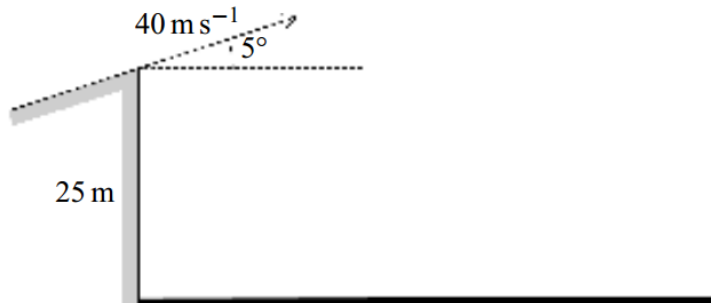
The ball is thrown from a height of 1 metre and the hoop is at a height of 3 metres above the ground. The initial velocity of the ball is 8 m s^{-1} at an angle of 60° above the horizontal.

- (a) Find the maximum height of the ball above the ground. (4 marks)
- (b) Find the time that it takes for the ball to reach the centre of the hoop. (6 marks)
- (c) Find the horizontal distance from the initial position of the ball to the centre of the hoop. (2 marks)



Final Challenge

- 6 In a film a stunt-man drives a car off the top of a vertical cliff. The top of the cliff is 25 metres above the level of the sea. When it leaves the cliff the car is travelling at 40 m s^{-1} at an angle of 5° above the horizontal. The diagram shows the cliff and the initial velocity of the car.



Model the car as a particle and assume that, while it is in the air, it moves under the influence of gravity alone.

- (a) Show that the car hits the sea approximately 2.64 seconds after it leaves the top of the cliff. *(6 marks)*
- (b) Find the horizontal distance of the car from the cliff when the car hits the sea. *(2 marks)*
- (c) Find the speed of the car when it hits the sea. *(5 marks)*

