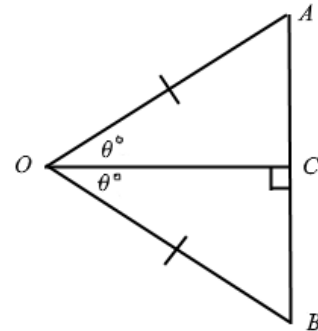# Edexcel A level Maths Projectiles

Section 1: Introduction

Exercise level 3 (Extension)

1. By writing down the area of the triangle OAB in two different ways, show that
$$\sin 2\theta° = 2\sin\theta° \cos\theta°$$

Find an expression for the range of a particle (in terms of the usual u, α and g), and deduce from it that the maximum range for a given speed and angle of projection is $45°$ above the horizontal.

2. In this question use $g = 10$.
   (i) A particle is projected with speed 40 ms^{-1} at an angle $30°$ above the horizontal. Find its range.
   (ii) A second particle is projected with speed 40 ms^{-1} but at a different angle $\alpha°$ to the horizontal, yet it has the same range as the first. What was its projection angle $\alpha°$?
   (iii) A particle is projected with speed u ms^{-1} at an angle $\theta°$ to the horizontal. Find a second angle ϕ (in terms of θ) to obtain the same range.
   (iv) If the time of flight using ϕ is twice that using θ, what were the two projection angles θ and ϕ? What is the ratio of their maximum heights?

3. In this question use $g = 9.8$.
   (i) A pellet is fired from ground level with speed 4 ms^{-1} at an angle to the horizontal of $75°$. Find an expression for its distance from its starting point at a time t seconds after it is projected and while it is still in flight.
   (ii) An enclosure in the form of a hemisphere with radius 88 cm stands with its circular base on a horizontal surface. The enclosure is made from a plastic material which is impenetrable but slightly extensible. A pellet is fired with speed 4 ms^{-1} at an angle of $75°$ to the horizontal from the centre of the circular base. Show using a spreadsheet that the pellet grazes the plastic envelope before it lands.