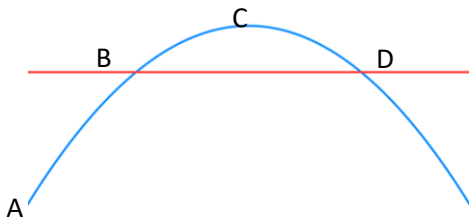
A particle is projected vertically upwards with a speed of 30 ms^{-1} from a point A. The point B is *h* metres above A. The particle moves freely under gravity and is above B for 2.4 seconds. Calculate the value of *h.*

The particle reaches a highest point. Let's call it C. At this point v = 0. The journey from B to D takes 2.4 seconds so the journey from B to C takes 1.2 seconds



There are two ways of doing this

Method 1

Consider the journey from A to C

s = u = 30 v = 0 a = -9.8 t = ?

Let's find t

$v = u + at$ leads to t = $\frac{150}{49}$

The journey from B to C takes 1.2 seconds (ask me if you don't understand)

So the journey from A to C takes $\frac{150}{49} - 1.2 = \frac{456}{245}$

Now consider the journey from A to C

s = h u = 30 v = a = -9.8 t = $\frac{456}{245}$

$s = ut + \frac{1}{2}at^2$ leads to h = 38.86 = 39 m (2 s.f.)

Method 2

Consider the journey from B to C

s = u = ? v = 0 a = -9.8 t = 1.2 (ask me if you don't understand)

$v = u + at$ leads to $u = \frac{294}{25}$

Consider the journey from A to B

s = h u = 30 v = $\frac{294}{25}$ a = -9.8 t =

$v^2 = u^2 + 2as$ leads to h = 38.86 = 39 m (2 s.f.)