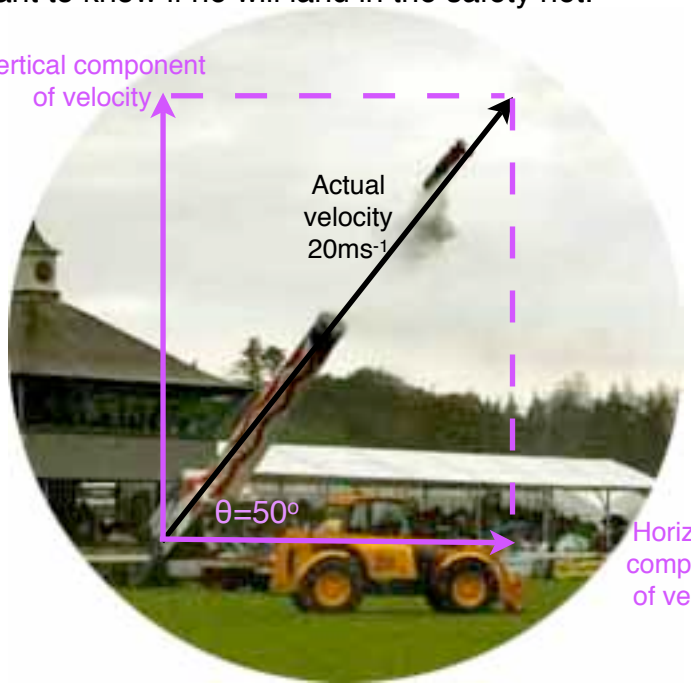
It is often useful to split up some vector quantities such as force and velocity. Here are two examples.

The human cannon ball is fired at an angle of about 50 degrees, as shown, but we may want to work out how high he will go and he will certainly want to know if he will land in the safety net.



To split up the velocity into vertical and horizontal components we draw a rectangle which has the actual velocity as its diagonal. We need to know or measure the angle θ.

We work out the horizontal velocity from
$\cos\theta = \frac{adj}{hyp}$

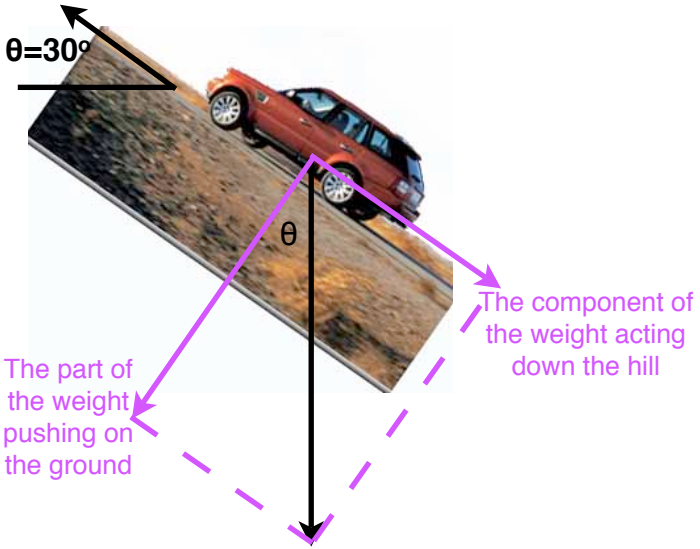
so horizontal velocity = 20 x cos50 =12.9ms^{-1}

and in a similar way
the vertical velocity = 20 x sin50 = 15.3ms^{-1}

Now we have a value for vertical velocity we can use one of the equations of motion to work out the height it would reach:
$v^2 = u^2 + 2as$ (v=0; u=15.3; a=-10)
the time it would take:
v = u + at so t = 15.3/10 = 1.53 seconds
remember that the total flight time is twice that because it comes down as well as going up.

The horizontal velocity remains constant throughout, so the distance covered = horizontal velocity x total flight time
that is 12.9 x 3.06 = 39.5 metres

The Range Rover engine has to overcome friction as the car drives forward but what is the extra force required to lift the weight uphill?



To split the forces up we simply make the weight the diagonal of a rectangle with one side parallel to the slope. The angle θ is the angle of the slope.

The force down the hill is therefore found from:
$\sin\theta = \frac{opps}{hyp}$
so force down hill (opps) = 30,000 x sin 30
= 15,000N

Resolving vectors

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