Kinematics

1 Horizontal Projections

For a **constant speed** use $Speed = \frac{Distance}{Time}$
For a **constant acceleration** use **SUVAT**
For all projections:

- Assume air resistance to be zero
- Resolve horizontal and vertical motion
- Horizontal - Constant speed
- Vertical - Constant acceleration

2 Angular projections

The same as horizontal projections but the initial vertical velocity isn't zero.
Example:
A particle is projected at a speed of $49ms^{-1}$ at an angle of $45°$ above the horizontal.
What is the time taken for the particle to reach its maximum height?

- u=$49\sin 45$
- v=0
- a=-g
- t=?

$0 = 49\sin 45 - gt$
$t = \frac{49\sin 45}{g} = \frac{5\sqrt{2}}{2} \approx 3.54$
What is the maximum height reached?

- u=$49\sin 45$
- v=0
- a=-g
- s=?

$v^2 = u^2 + 2as$
$0=(49\sin 45)^2 - 2gs$
$S = \frac{(49\sin 45)^2}{2g} = 61.3$
What is the time of the flight?

- u=$49\sin 45$
- a=-g
- S=0
- t=?

$S = ut + \frac{1}{2}at^2$

$0 = (49\sin 45)t - \frac{1}{2}gt^2$
$0=t(49\sin 45 - \frac{gt}{2}$
$t = 0$

$49 \sin 45 = \frac{gt}{2}$

$t = \frac{2 \times 49 \sin 45}{g} = 7.07$

What is the horizontal range of the particle?

- t=7.07
- Speed=$49 \cos 45$

$S = 45 \cos 45 \times 7.07 = 245$

3 Displacement, velocity and acceleration

$v = \frac{dx}{dt}$

$a = \frac{dv}{dt}$