Force, Energy and Momentum

1 Scalars and Vectors

Scalar - Magnitude
Vector - Magnitude and Direction

2 Moments

2.1 Moment

Force × Perpendicular distance from the point to the line of action of the force

2.2 Couple

A pair of equal and opposite coplanar forces

2.3 Moment of a couple

Force × Perpendicular distance between the lines of action of the forces

2.4 Principle of moments

For an object in equilibrium, **Clockwise Moments=Anticlockwise Moments**

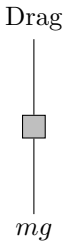
3 Graphs with respect to time

Type of Graph	**Gradient**	**Area Under Graph**
Distance Time	Velocity	-
Velocity time	Acceleration	Displacement
Acceleration time	-	Change in velocity

4 Projectile motion

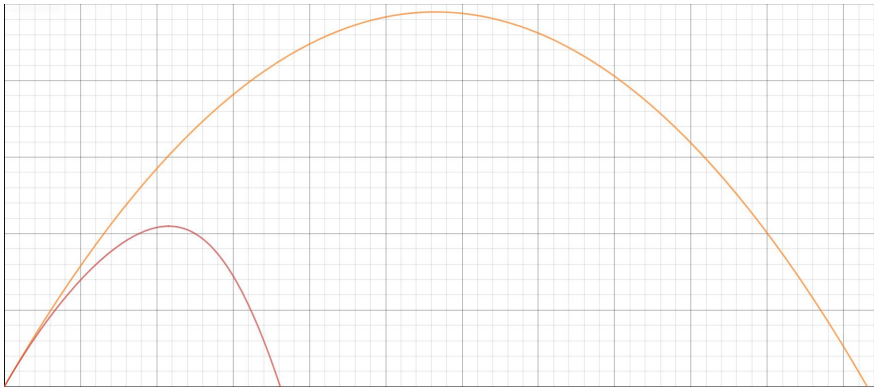
For a falling object with no air resistance there is no horizontal acceleration or deceleration

4.1 Terminal Velocity



As an object accelerates speed increases so drag increases, when **Drag=mg** the object has reached **terminal velocity** meaning that it now travels at a **constant velocity**

4.2 The effect of air resistance



No Air Resistance
Air resistance

- Steeper descent
- Peak Further Left
- Smaller Range

4.2.1 Factors that affect air resistance

- Surface area
- Air Pressure/Density
- Speed
- Roughness of shape

5 Newton's laws of motion

First Law - Objects either stay at rest or move with a constant velocity unless acted on by a resultant force
Second law - For an object with constant mass its acceleration will be directly proportional to the resultant force $F = ma$
Third law - Every action has an equal and opposite reaction

6 Momentum

Momentum=Mass $\times$ Velocity
In a collision **Momentum is conserved**
Impulse=Change in momentum
The area under a force time graph is the impulse
Elastic collision - A collision with no loss of kinetic energy
Inelastic collision - A collision with a loss of kinetic energy

7 Work, energy and power

Rate of doing work=Rate of energy transfer
The area under a force displacement graph is the **work done**

8 Conservation of energy

Principle of conservation of energy - In an isolated system the total energy remains constant