Force and motion

R2 Understand and use Newton's second law for motion in a straight line; extended to situations where forces need to be resolved..

R4 Understand and use Newton's third law; equilibrium of forces on a particle and motion in a straight line; application to problems involving smooth pulleys and connected particles; resolving forces in 2 dimensions; equilibrium of a particle under coplanar forces.

R5 Understand and use addition of forces; resultant forces; dynamics for motion in a plane .

For a brief commentary on this content go to the MEI outline SoW.

Pre-requisites

- Basic trigonometry to resolve forces.
- Linear and simultaneous equations from GCSE.

Common student errors

- Thinking that there must always be a force in the direction of motion (i.e. the misconception that forces always seek to *cause* motion rather than change it).
- Getting sine and cosine mixed up when resolving forces.
- Applying $F = ma$ to a single force, rather than to the resultant force.
- Not accounting for the components of forces acting at angles when resolving horizontally or vertically.

Teaching it!

- A series of videos designed to support students on this topic. (Coming soon)
- Teacher guidance for force experiments.
- A GeoGebra file exploring two particles connected by a string over a pulley - there are plenty of adjustable features, making it great for demonstration/question setting.
- A GeoGebra file showing the tension forces for an object suspended by two strings.
- A Desmos card sort activity for connected particles and pulleys.

Getting them thinking

- An object is at rest on a horizontal surface. In what situations will its weight be equal in magnitude to the reaction force, and in what situations might they be different?
- When finding a resultant force, when is it more efficient to resolve into perpendicular components and when is it more efficient to draw a triangle/polygon of forces?
- For a particle of mass m on a plane inclined at $\theta°$ to the horizontal, draw a clear diagram to show that the component of the weight force down the plane is $mg\sin\theta$.