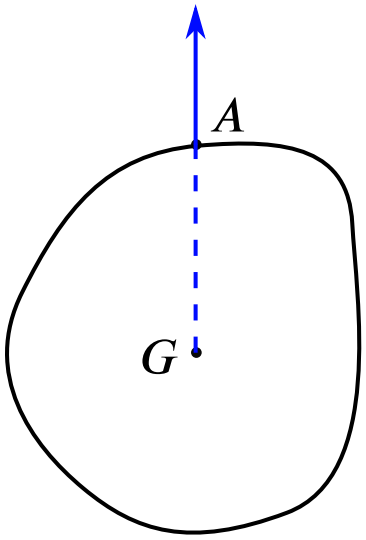
Centre of mass

The *centre of mass* is also known as the centre of gravity.

The centre of mass of a body has the property that the total moment of the object's weight about any line through the centre of mass is zero.

If a body is freely suspended from a point on the body and hangs in stable equilibrium, it will hang so that the centre of mass is directly below the point of attachment.

In this sketch, a body is suspended from the point A, and its centre of mass G lies directly below A.



For a planar shape (a lamina), the centre of mass is also the point on which it could be balanced horizontally.

If masses are given with a coordinate system, say there is a mass of m_1 at (x_1, y_1), a mass of m_2 at (x_2, y_2), ..., and a mass of m_n at (x_n, y_n), then the moments property above can be used to calculate the centre of mass of the whole collection. It turns out that this centre of mass, $(\bar{x}, \bar{y})$, has the property that $\bar{x}$ is the weighted mean of the x_i (weighted by the masses m_i), and similarly for $\bar{y}$. So

$$\bar{x} = \frac{\sum_{i=1}^{n} m_i x_i}{\sum_{i=1}^{n} m_i} \qquad \text{and} \qquad \bar{y} = \frac{\sum_{i=1}^{n} m_i y_i}{\sum_{i=1}^{n} m_i}.$$