AQA – Dimensional analysis – AS Further Mathematics Mechanics

1. June/2020/Paper_2/No.6

The magnitude of the gravitational force F between two planets of masses m_1 and m_2 with centres at a distance d apart is given by

$$F = \frac{Gm_1m_2}{d^2}$$

where G is a constant.

(a) Show that G must have dimensions $L^3M^{-1}T^{-2}$, where L represents length, M represents mass and T represents time.

[2 marks]

(b) The lifetime t of a planet is thought to depend on its mass m, its radius r, the constant G and a dimensionless constant k such that

$$t = km^a r^b G^c$$

where a, b and c are constants.

Determine the values of a, b and c.

[3 marks]

2. June/2019/Paper_2/No.3

A formula for the elastic potential energy, E, stored in a stretched spring is given by

$$E = \frac{kx^2}{2}$$

where x is the extension of the spring and k is a constant.

Use dimensional analysis to find the dimensions of k.

[3 marks]