**2.** A spacecraft $S$ of mass $m$ moves in a straight line towards the centre of the Earth.

The Earth is modelled as a sphere of radius $R$ and $S$ is modelled as a particle.

When $S$ is at a distance $x$, $x \geqslant R$, from the centre of the Earth, the force exerted by the Earth on $S$ is directed towards the centre of the Earth.

The force has magnitude $\frac{K}{x^2}$, where $K$ is a constant.

(a) Show that $K = mgR^2$

**(2)**

When $S$ is at a distance $3R$ from the centre of the Earth, the speed of $S$ is $V$.

Assuming that air resistance can be ignored,

(b) find, in terms of $g$, $R$ and $V$, the speed of $S$ as it hits the surface of the Earth.

**(7)**

**(Total for Question 2 is 9 marks)**