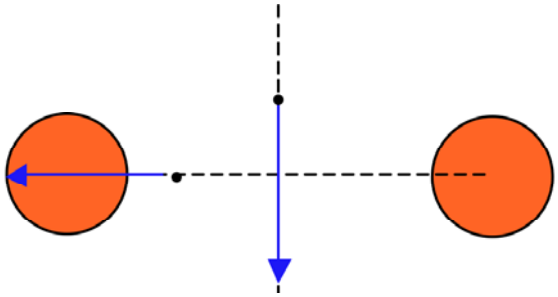
Mark scheme for Extension Worksheet – Topic 5, Worksheet 4

1 A region of space where a force acts on a particle. [1]

2 **a** The force per unit mass exerted on a small, point test mass. [1]

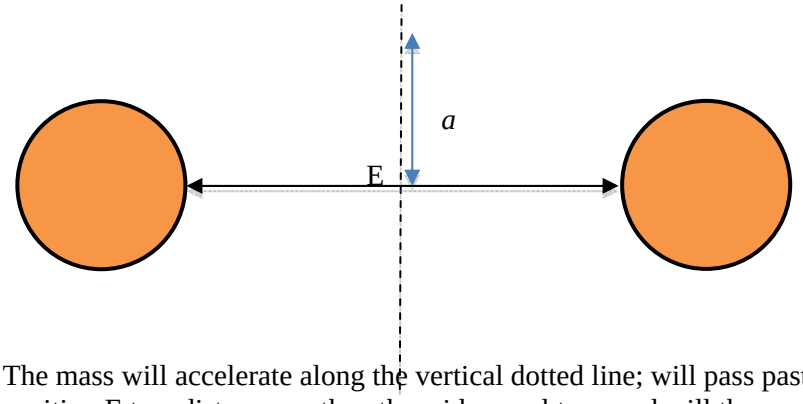
b Distance is half as great so arrow should be four times longer directed towards the centre of the planet. [1]

3 See diagram.



[2]

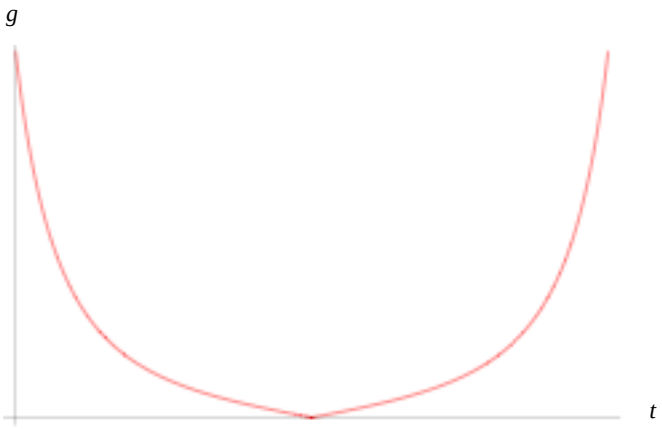
4 See diagram.



The mass will accelerate along the vertical dotted line; will pass past the equilibrium position E to a distance on the other side equal to a; and will then continue oscillating about the equilibrium position E. [3]

5 The electric force on the positive charge is vertically upwards; and so the charge will accelerate away (with a decreasing acceleration) never to return. [2]

6 See graph.



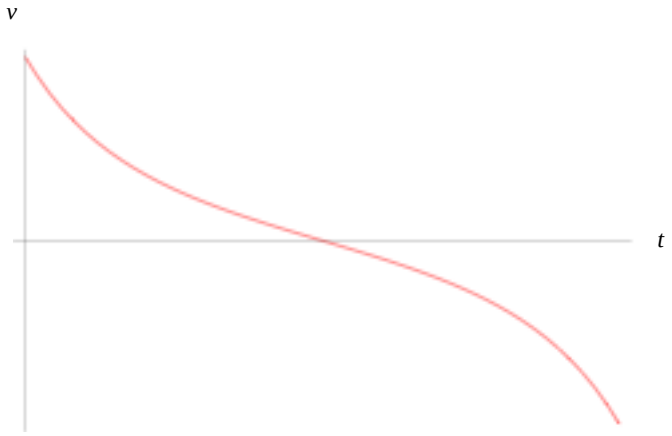
[2]

7 **a** The new gravitational field strength is $g' = \dfrac{G\frac{M}{2}}{\left(\frac{R}{2}\right)^2} = \dfrac{4}{2}\dfrac{GM}{R^2} = 2\dfrac{GM}{R^2}$; $g' = 2g$ [2]

b It will be half as great since the mass has been reduced to half. [1]

8 $8500 = \dfrac{GMm}{R^2}$ so $W = \dfrac{GMm}{\left(R + \frac{R}{10}\right)^2} = \dfrac{100}{121}\dfrac{GMm}{R^2}$; and so $W = \dfrac{100}{121} \times 8500 \approx 7000\,\text{N}$ [2]

9 See graph. The important points are to show equal initial and final speed and a non-zero gradient when the line intersects the time axis. The gradient cannot be zero because even when the speed is zero there is a force acting on the spacecraft (gravity) and we have acceleration, i.e. a non-zero gradient.



[3]