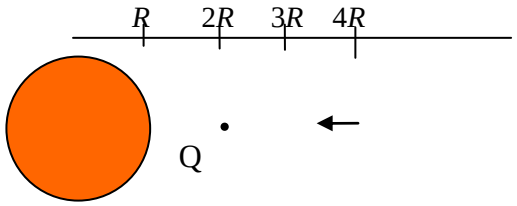
Extension Worksheet – Topic 5, Worksheet 4

1 State what is meant by a **field of force**. [1]

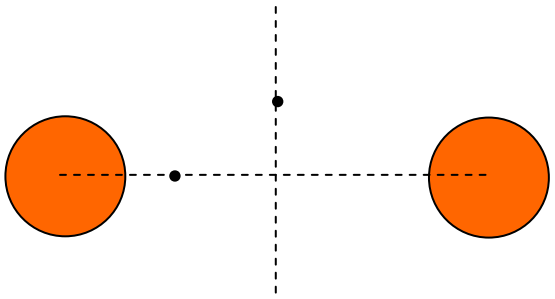
2 The arrow in the diagram represents the gravitational field strength created by the uniform spherical body at a distance 4*R* from the centre (where *R* is the radius of the body).



a Define **gravitational field strength**. [1]

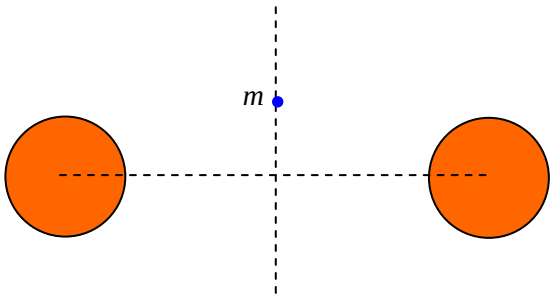
b Draw an arrow to represent the gravitational field strength at point Q. [1]

3 Draw an arrow to indicate the direction of the gravitational field strength created by two equal mass stars at the two indicated points.



[2]

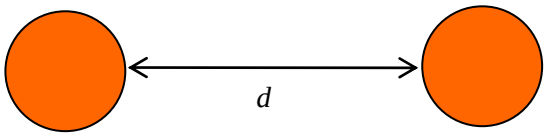
4 A small point mass *m* is placed on the perpendicular bisector of the line joining the centres of two equal mass stars. The mass is then released.



Describe, qualitatively, the motion of the mass *m*. [3]

5 The two stars of the previous problem are replaced by two positively charged spheres and the point mass is replaced by a point positive charge. Describe the changes, if any, in the motion of the small positive charge. [2]

6 Two equal mass spherical bodies are separated by a distance *d*, from surface to surface.



Draw a sketch graph to show the variation with distance *r* from the surface of the left body of the **magnitude** of the gravitational field strength along the line joining the bodies.

[2]

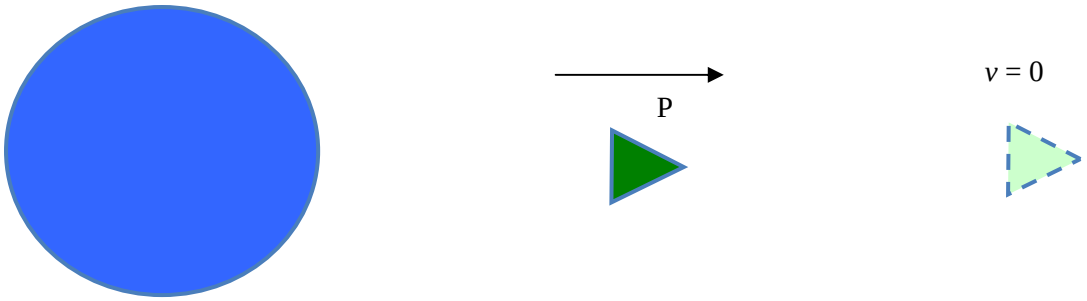
7 A star has mass *M* and radius *R*. The gravitational field at its surface has magnitude *g*. Point P is at a distance of 10*R* from the centre. The star explodes and half its mass is ejected into space. The radius is reduced to half its initial value.

a Calculate, in terms of *g*, the new gravitational field strength at the surface of the star. [2]

b State how the values of the gravitational field strength at point P before and after the explosion compare. [1]

8 The weight of a satellite on the surface of the Earth is 8500 N. Calculate the weight of this satellite when in orbit around the Earth at a height that is $\frac{1}{10}$ of the radius of the Earth. [2]

9 A spacecraft is moving away from Earth. When at position P the engines are turned off. Some distance later the speed of the spacecraft becomes zero and it begins to fall back to Earth. Make a sketch graph to show the variation with distance of the velocity of the spacecraft from the time when it was at position P to until it returns to the same position.



[3]