

### 5.4.1: Field of a Point Mass

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Equation 5.3.1, together with the definition of field strength as the force experienced by unit mass, means that the field at a distance  $r$  from a point mass  $M$  is

$$g = \frac{GM}{r^2} \quad \text{N kg}^{-1} \text{ or m s}^{-2} \quad (5.4.1)$$

In vector form, this can be written as

$$\mathbf{g} = -\frac{GM}{r^2} \hat{\mathbf{r}} \quad \text{N kg}^{-1} \text{ or m s}^{-2} \quad (5.4.2)$$

Here  $\hat{\mathbf{r}}$  is a dimensionless *unit* vector in the radial direction.

It can also be written as

$$\mathbf{g} = -\frac{GM}{r^3} \mathbf{r} \quad \text{N kg}^{-1} \text{ or m s}^{-2} \quad (5.4.3)$$

Here  $\mathbf{r}$  is a vector of magnitude  $r$  – hence the  $r^3$  in the denominator.

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