

'Wiring Up A Net-Zero Home'

$$\text{a) } \overrightarrow{AB} = B - A = -5\mathbf{i} - 2\mathbf{j} - 7\mathbf{k}$$

$$\text{Length of wire} = \sqrt{(-5)^2 + (-2)^2 + (-7)^2} = \sqrt{78} = 8.83 \text{ m (2 d. p.)}$$

[2 marks]

$$\text{b) } \overrightarrow{AM} = \frac{2}{3} \times \overrightarrow{AB} = -\frac{10}{3}\mathbf{i} - \frac{4}{3}\mathbf{j} - \frac{14}{3}\mathbf{k}$$

$$\overrightarrow{AM} = \overrightarrow{OM} - \overrightarrow{OA}$$

$$\overrightarrow{OM} = \left(-\frac{10}{3}\mathbf{i} - \frac{4}{3}\mathbf{j} - \frac{14}{3}\mathbf{k}\right) + (2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}) = -\frac{4}{3}\mathbf{i} + \frac{5}{3}\mathbf{j} - \frac{2}{3}\mathbf{k}$$

$$\text{the distance of } M = \sqrt{\left(-\frac{4}{3}\right)^2 + \left(\frac{5}{3}\right)^2 + \left(-\frac{2}{3}\right)^2} = \sqrt{5}m$$

[4 marks]