## **Question** (\*\*\*\*+)

A person standing at a fixed origin O observes an insect taking off from a point A on horizontal ground.

The position vector of the insect, t seconds after taking off, is given by

$$\mathbf{r} = (t+1)\mathbf{i} + (2t + \frac{1}{2})\mathbf{j} + 2t\mathbf{k} .$$

All distances are in metres and the coordinates axes Ox, Oy, Oz are oriented due east, due north and vertically upwards, respectively.

- **a)** Find ...
  - i. ... the coordinates of A.
  - ii. ... the bearing of the insect's flight path.
  - iii. ... the angle between the flight path and the horizontal ground.

The roof top of a garden shed is located at  $B(5, \frac{9}{2}, 3)$ .

**b)** Calculate the shortest distance between the insect's path and the point B.

When the insect reaches a height of 20 metres, at the point C, the insect gets eaten by a bird.

**c**) Determine the coordinates of *C*.

$$A(1,\frac{1}{2},0)$$
, bearing  $\approx 027^{\circ}$ ,  $\theta \approx 42^{\circ}$ ,  $\sqrt{5}$ ,  $C(11,\frac{41}{2},20)$ 

