## 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

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

All distances are in metres and the coordinates axes $O x, O y, O z$ 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 $B\left(5, \frac{9}{2}, 3\right)$.
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 $C$.

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



