9. A small comet C is passing near to a planet. The planet can be modelled as a sphere with centre O taken as a fixed point in space, so that the motion of the comet is relative to the origin O.

The diameter of the planet is $13\,000$ km.

The comet is monitored by satellites orbiting the planet.

When the monitoring begins the comet is at position $146\mathbf{i} + 234\mathbf{j} - 85\mathbf{k}$ and is moving with vector $-21\mathbf{i} - 33\mathbf{j} + 13\mathbf{k}$ every hour, where the units are in thousands of kilometres.

Assuming the comet maintains a straight line course throughout its motion,

(a) determine whether or not the comet will collide with the planet.

(6)

Two of the satellites, A and B, have position vectors $\overrightarrow{OA} = 5\mathbf{i} + 12\mathbf{k}$ and $\overrightarrow{OB} = 4\mathbf{i} + 12\mathbf{j} - 3\mathbf{k}$ at the beginning of monitoring. They return to these positions every 4 hours.

(b) Find the expected angle ACB between the comet and the satellites A and B when they first return to their initial positions. Give your answer to the nearest $0.1°$

(4)

(c) Give a reason why the answer to (b) may differ from the true value.

(1)