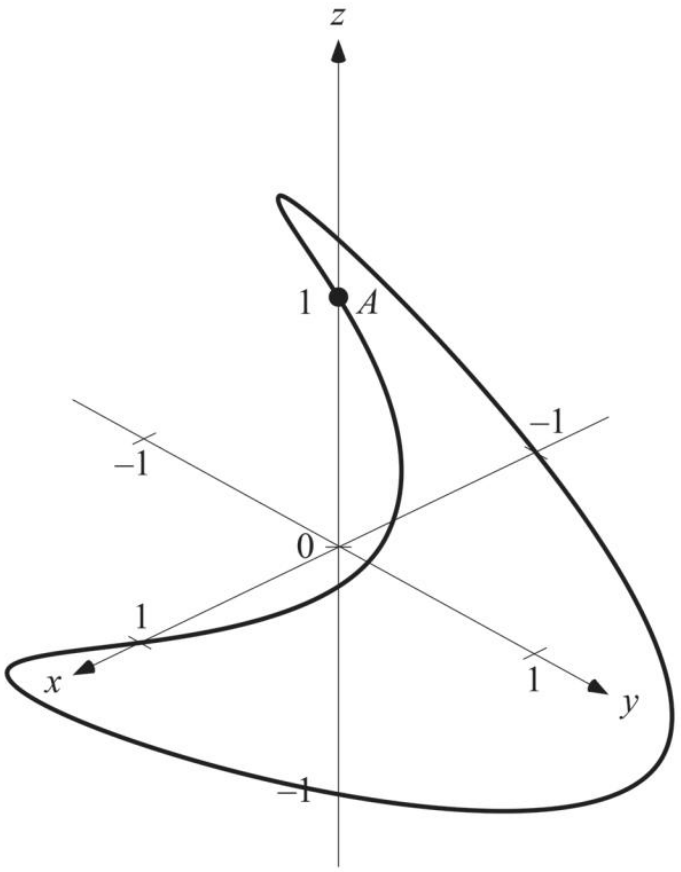
**Question 16** **(5 marks)**

A fly moves around a path given by a three dimensional curve. The fly's path begins at point $A$ and is shown below. Its position vector is specified by $\underset{\sim}{r}(t) = \begin{pmatrix} \sin t \\ \sin 2t \\ \cos t \end{pmatrix}$ metres where $0 \leq t \leq 2\pi$ seconds.




(a) Determine the initial acceleration vector and indicate this clearly on the diagram above.

(3 marks)

(b) Calculate the length of the path taken by the fly, correct to 0.001 metres. (2 marks)