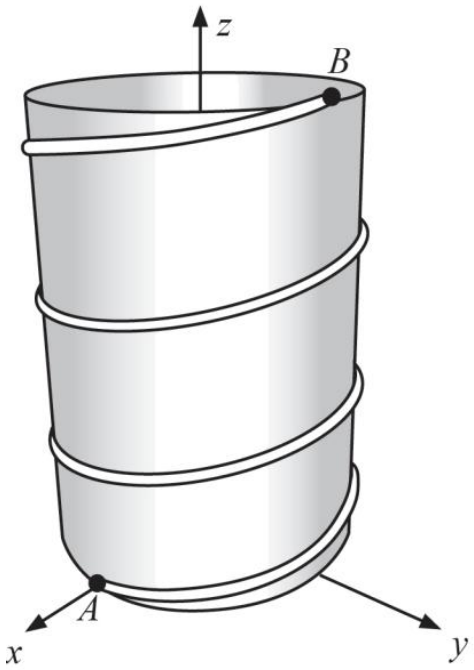
Question 12 **(6 marks)**

A cylindrical shaped tower has a path that spirals upwards from the ground to an observation deck at point B as shown in the diagram below. The path begins at point A on the ground and finishes at point B at the top.



Let t = time in seconds that a tourist has been walking along the spiral path. The tourist takes 65π seconds to reach point B.

The tourist's position on this path at any time t is given by:

$$\underset{\sim}{r}(t) = \begin{pmatrix} 10\cos(0.1t) \\ 10\sin(0.1t) \\ 0.2t \end{pmatrix} \text{ metres.}$$

(a) Determine the height of the observation deck above the ground, correct to the nearest 0.01 metres. (1 mark)

(b) Determine the tourist's velocity $v(t)$. (2 marks)

(c) Show that the tourist walks at a constant speed and determine this speed, correct to 0.01 metres per second. (3 marks)