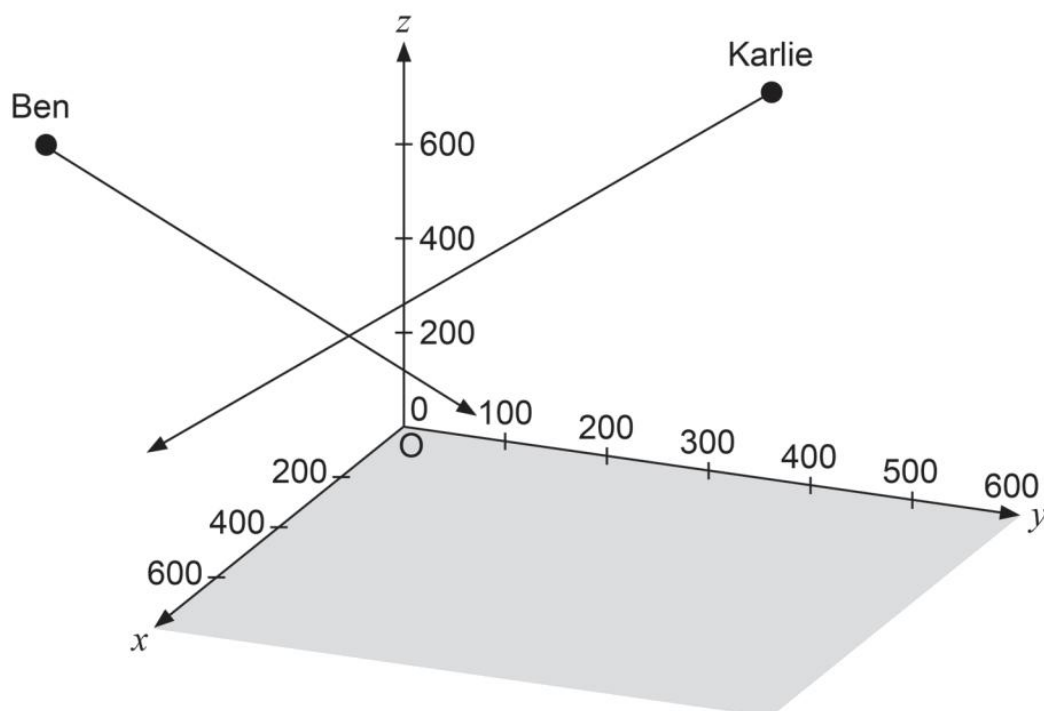


Question 16

(9 marks)

Two thrill-seekers, Karlie and Ben, are each attached to straight wires that allow them to slide down within a wide canyon.

A co-ordinate system is defined showing the positive co-ordinate axes with O being the origin. At exactly 10.30 am, Karlie is at a position of $-200\mathbf{i} + 300\mathbf{j} + 700\mathbf{k}$ metres and is sliding down her wire with velocity $2\mathbf{i} - \mathbf{j} - \mathbf{k}$ metres per second. Meanwhile, Ben is at position $500\mathbf{i} - 200\mathbf{j} + 800\mathbf{k}$ and is sliding down his wire at a velocity of $-0.5\mathbf{i} + \mathbf{j} - 1.5\mathbf{k}$ metres per second.



- (a) Determine Ben's speed, correct to the nearest 0.01 metres per second. (2 marks)

- (b) Calculate the angle of Ben's descent to the horizontal, correct to the nearest degree.
(3 marks)

It was found that the closest that Karlie and Ben approached one another was approximately 57.74 metres after 266.67 seconds of motion (from 10.30 am).

Suppose that Ben is able to adjust the speed of his descent and the time at which he commences sliding down his wire.

- (c) Calculate the minimum distance (correct to the nearest 0.01 metres) that Ben could be separated from Karlie, if he was able to adjust the speed and timing of his motion.
Show all evidence of your working. (4 marks)