10

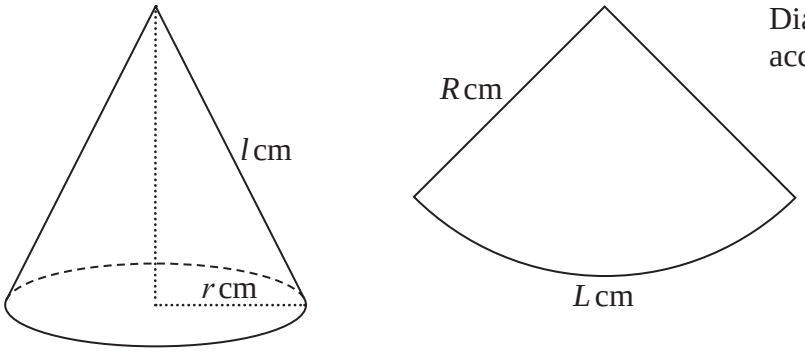

Diagram **NOT** accurately drawn

Figure 4

Figure 4 shows a right circular cone with base radius r cm and slant height l cm.
Figure 4 also shows a sector of a circle with radius R cm and arc length L cm.

The area of the curved surface of the cone is A cm^2

By considering how the sector of the circle can be folded to exactly form the curved surface of the cone with R and L suitably chosen,

(a) prove that $A = \pi rl$

(4)

Sand is poured onto a horizontal surface at a constant rate of 1.5 cm^3/s.
The sand forms a pile in the shape of a right circular cone with its base on the surface.
The curved surface area of the cone, A cm^2, increases in such a way that the height of the cone is always three times the radius of the base of the cone.

Given that $\frac{\mathrm{d}A}{\mathrm{d}r} = k\pi r$, where k is a constant,

(b) find the exact value of k.

(3)

(c) Calculate the rate, in cm^2/s, to 3 significant figures, at which the curved surface area of the pile is increasing when the height of the pile is 24 cm.

(5)

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 12 marks)

11

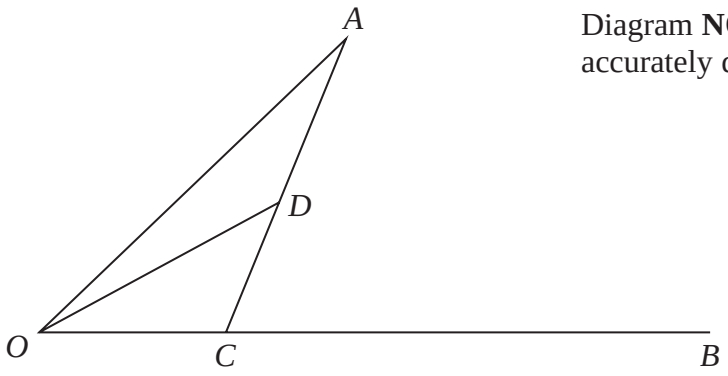

Diagram **NOT** accurately drawn

Figure 5

In Figure 5, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$

The point C divides OB in the ratio $1:3$
The point D is the midpoint of AC

(a) Find, as a simplified expression in terms of **a** and **b**

(i) $\overrightarrow{AC}$ (ii) $\overrightarrow{OD}$ (iii) $\overrightarrow{BD}$

(5)

The point E is such that $\overrightarrow{OE} = \lambda\overrightarrow{OA}$

Given that E, D and B are collinear

(b) find the value of λ

(4)

Given that $\dfrac{\text{area } \Delta OAC}{\text{area } \Delta OEB} = \mu$

(c) find the value of μ

(4)

Question 11 continued

Question 11 continued

(Total for Question 11 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS