11 A cylinder has radius r cm and height h cm.
The total surface area, including the two ends, is $A\,\text{cm}^2$.
The volume of the cylinder is $330\,\text{cm}^3$.

(a) Show that $A = 2\pi r^2 + \frac{660}{r}$. [3]

(b) Given that r can vary, find the value of r that gives a stationary value for A and show that this value is a minimum. [5]

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12 In this question, the x- and y-directions are east and north respectively. The units are metres and seconds. Boat A starts from the origin O and moves with constant speed $5\sqrt{3}\,\text{ms}^{-1}$ on a bearing of 030°.

After 100 seconds boat B starts from point P, which has position vector $\begin{pmatrix} 0 \\ 1000 \end{pmatrix}$.

Boat B moves with constant speed $10\,\text{ms}^{-1}$ on a bearing of 060°.

(a) Find the velocity of each boat in vector form. [2]

(b) Show that the two boats will collide. [5]

Question 13 is printed on the next page.

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