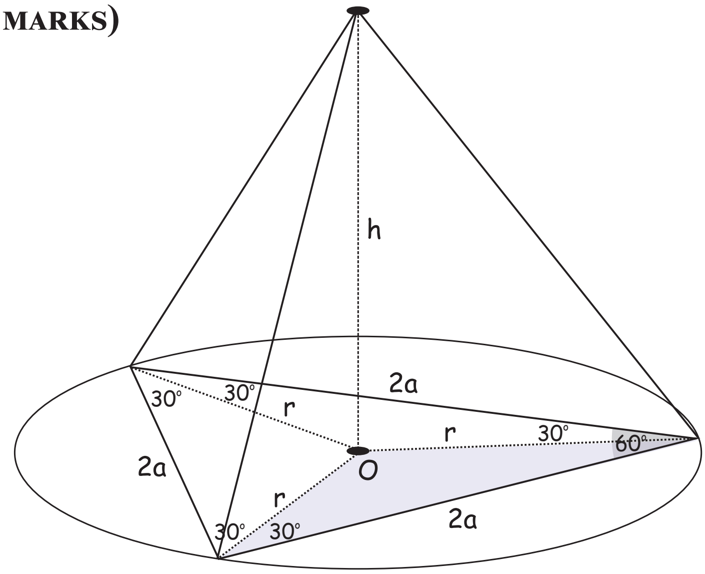
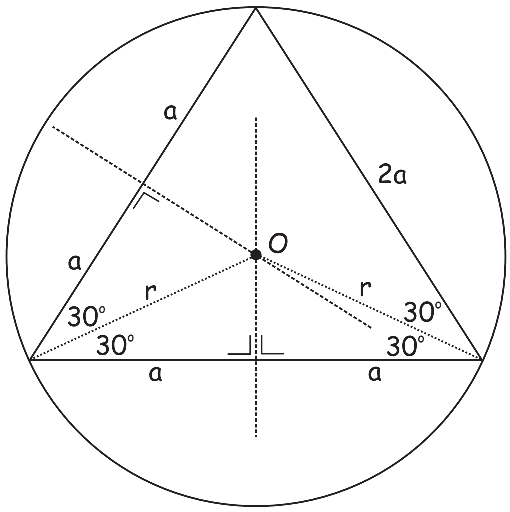
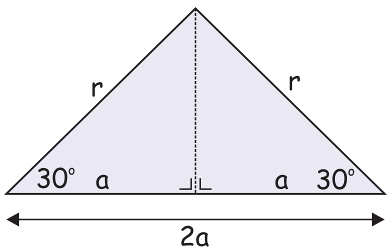
Sample Paper 2014: Paper 2

Question 9 (25 marks)



An equilateral triangle fits into the base of the cylinder exactly. The circle at the base of the cylinder is a circumcircle with centre O. The centre of a circumcircle O is found by intersecting the perpendicular bisectors of the sides of the triangle. Lift out the highlighted triangle to find an expression for r.



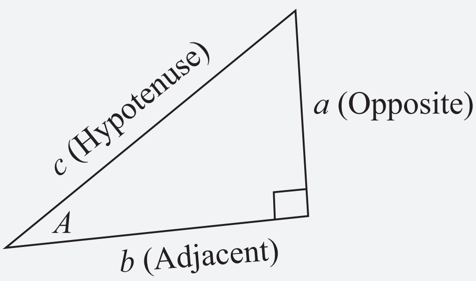


$$\cos 30^\circ = \frac{a}{r}$$

$$\frac{\sqrt{3}}{2} = \frac{a}{r}$$

$$\therefore r = \frac{2a}{\sqrt{3}}$$

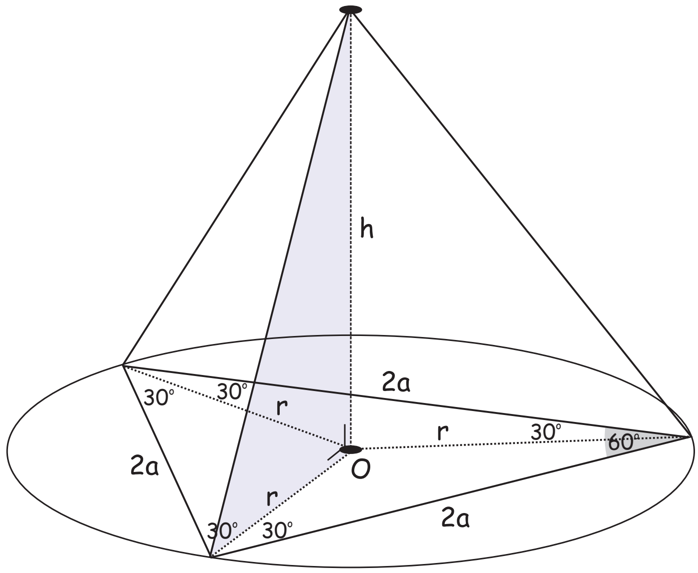
Formulae and Tables Book
Trigonometry: Right-angled triangle [page 16]



$$\sin A = \frac{a}{c},\ \cos A = \frac{b}{c},\ \tan A = \frac{a}{b}$$

$$c^2 = a^2 + b^2$$

Lift out the highlighted triangle to find an expression for h. It is a right-angled triangle.

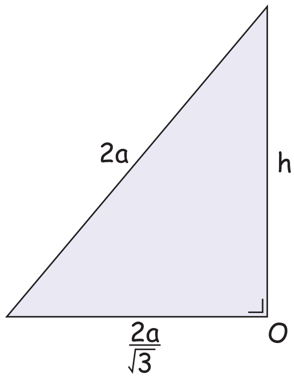


$$h^2 + \left(\frac{2a}{\sqrt{3}}\right)^2 = (2a)^2$$

$$h^2 + \frac{4a^2}{3} = 4a^2$$

$$h^2 = 4a^2 - \frac{4a^2}{3} = \frac{8a^2}{3}$$

$$h = \sqrt{\frac{8a^2}{3}} = \frac{2\sqrt{2}a}{\sqrt{3}}$$



$$V = \pi r^2 h$$

$$= \pi\left(\frac{2a}{\sqrt{3}}\right)^2\left(\frac{2\sqrt{2}a}{\sqrt{3}}\right)$$

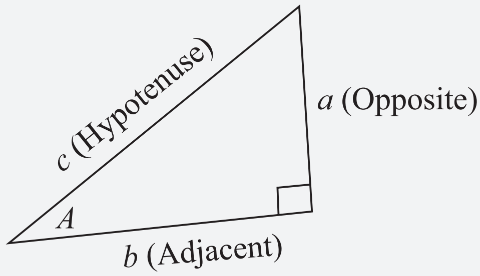
$$= \pi\left(\frac{4a^2}{3}\right)\left(\frac{2\sqrt{2}a}{\sqrt{3}}\right)$$

$$= \frac{8\pi\sqrt{2}a^3}{3\sqrt{3}}$$

$$= \frac{8\pi\sqrt{2}a^3}{3\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$= \left(\frac{8\sqrt{6}}{9}\right)\pi a^3$$

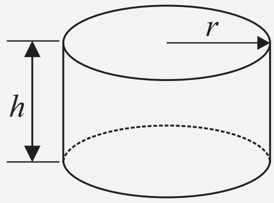
Formulae and Tables Book
Trigonometry: Right-angled triangle [page 16]



$$\sin A = \frac{a}{c},\ \cos A = \frac{b}{c},\ \tan A = \frac{a}{b}$$

$$c^2 = a^2 + b^2$$

Formulae and Tables Book
Surface area and volume: Cylinder [page 10]



$$A = 2\pi rh$$

$$V = \pi r^2 h$$