5. (a) Use algebraic integration to show that the centre of mass of a uniform solid hemisphere of radius r is at a distance $\frac{3}{8}r$ from the centre of its plane face.

[*You may assume that the volume of a sphere of radius r is* $\frac{4}{3}\pi r^3$]

(5)

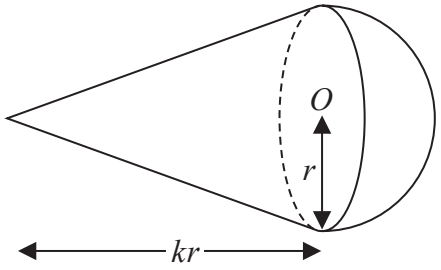


Figure 3

A uniform solid hemisphere of radius r is joined to a uniform solid right circular cone made of the **same material** to form a toy. The cone has base radius r and height kr. The centre of the base of the cone is O. The plane face of the cone coincides with the plane face of the hemisphere, as shown in Figure 3.

The toy can rest in equilibrium on a horizontal plane with any point of the curved surface of the hemisphere in contact with the plane.

(b) Find the exact value of k

(5)

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(Total for Question 5 is 10 marks)

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