$v_{cone} = \frac{1}{3}\pi r^2 h$

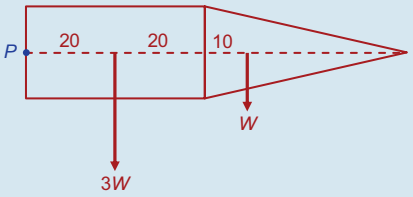
$= \frac{1}{3}\pi(12^2)(40)$

$= \frac{1}{3}(5{,}760\pi)\ cm^3$

$\Rightarrow v_{cylinder} = 3(v_{cone})$

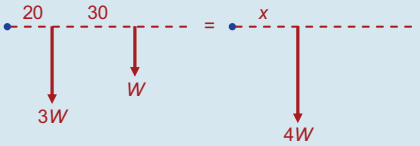
$\Rightarrow$ weight of cylinder = 3(weight of cone)

(ii)



Let W be the weight of the cone. Therefore $3W$ is the weight of the cylinder. W acts through a point $\frac{1}{4}h = \frac{1}{4}(40) = 10$ cm from the base of the cylinder. $3W$ acts through a point $\frac{1}{2}h = \frac{1}{2}(40) = 20$ cm from the base of the cone.

Here, then, is the diagram of the forces. The total weight of the compound body is $4W$, which acts through a point which is x cm from P.



By the Principle of Moments:

$3W(20) + W(50) = 4W(x)$

... divide by W

$\Rightarrow 110 = 4x$

$\Rightarrow x = 27.5$ cm

Q. 12. (i) $v_{cylinder} = \pi r^2 h = \pi(18^2)(24)$

$= 7{,}776\pi\ cm^3$

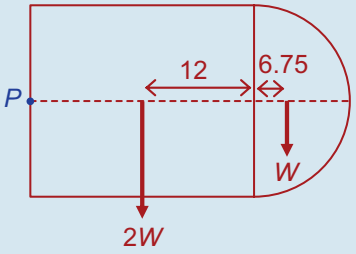
$v_{hemisphere} = \frac{2}{3}\pi r^3 = \frac{2}{3}\pi(18^3)$

$= 3{,}888\pi\ cm^3$

$\Rightarrow v_{cylinder} = 2(v_{hemisphere})$

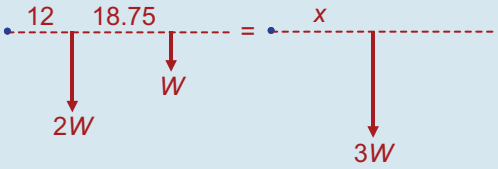
$\Rightarrow$ weight of cylinder : weight of cone = 2 : 1

(ii)



Let W be the weight of the hemisphere. Therefore $2W$ is the weight of the cylinder. W acts through a point $\frac{3}{8}r = \frac{3}{8}(18) = 6{\cdot}75$ cm from the top of the cylinder. $2W$ acts through a point $\frac{1}{2}h = \frac{1}{2}(24) = 12$ cm from the base of the hemisphere.

Here, then, is the diagram of the forces. The total weight of the compound body is $3W$, which acts through a point which is x cm from P.



By the Principle of Moments:

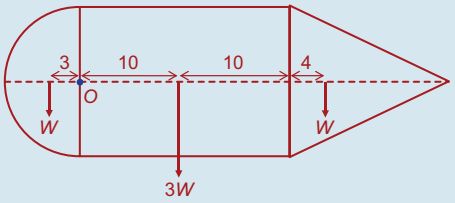
$2W(12) + W(30.75) = 3W(x)$

... divide by W

$\Rightarrow 3x = 54.75$

$\Rightarrow x = 18.25$ cm

Q. 13.



Let W be the weight of the hemisphere and of the cone. Therefore $3W$ is the weight of the cylinder. The weight of the hemisphere, W, acts through a point $\frac{3}{8}r = \frac{3}{8}(8) = 3$ cm from the base of the cylinder. The weight of the cylinder, $3W$, acts through a point $\frac{1}{2}h = \frac{1}{2}(20) = 10$ cm from the base of the cylinder. The weight of the cone, W, acts through a point $\frac{1}{4}h = \frac{1}{4}(16) = 4$ cm from the top of the cylinder.