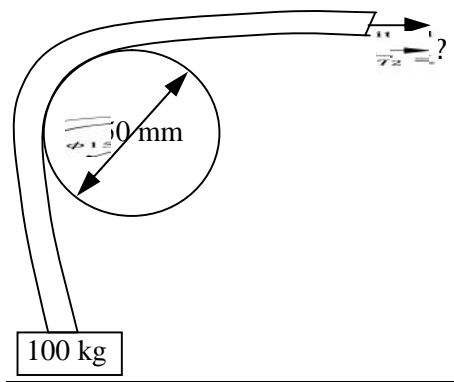




Problem 13:

A mass of 100kg is lifted by a rope on a cylinder of 150mm diameter as shown in Figure. The coefficient of friction is 0.20 and velocity 30 m/s calculate,

- (i) The necessary force to be applied to lift the load
- (ii) The Torque at the cylinder surface
- (iii) Power transmitted



Solution :

$$\text{Given } T_1 = 100 \times 9.81 = 981 \text{ N}$$

$$\text{Angle of contact } \theta = 90^\circ$$

$$= 90^\circ \times \frac{\pi}{180} \text{ rad}$$

$$= \frac{\pi}{2} \text{ rad}$$

Using the equation,

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

$$= e^{(0.2 \times \frac{\pi}{2})} = \frac{981}{T_2}$$



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$$T_2 = 716.58 \text{ N}$$

$$\text{Torque} = (T_1 - T_2) \times \text{radius}$$

$$\begin{aligned} \text{Torque} &= (981 - 716.58) \times \left(\frac{0.15}{2}\right) \\ &= 19.83 \text{ Nm} \end{aligned}$$

$$\text{Power transmitted} = (T_1 - T_2) \times V$$

$$= (981 - 716.58) \times 30$$

$$= 7932.6 \text{ Nm/s}$$