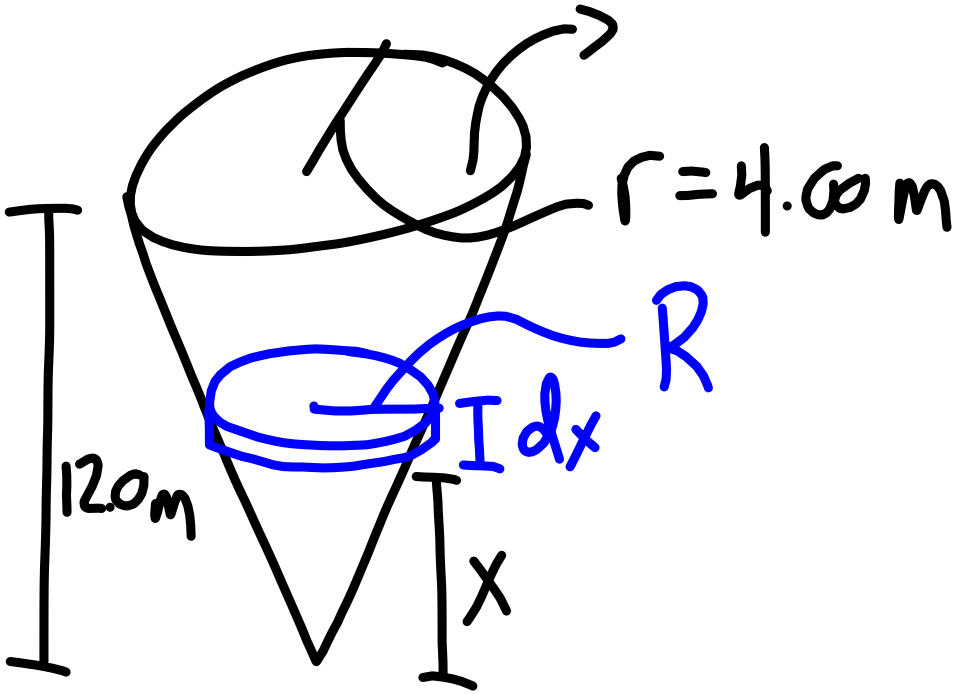
$$E_i = E_f$$

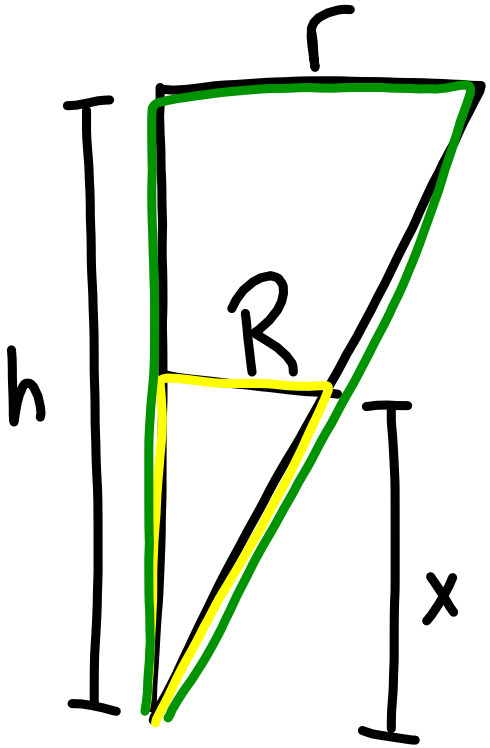
$$PE_s = K_f + W_{nc}$$

$$\frac{1}{2}kx^2 = \frac{1}{2}mv^2 + \mu mgd$$

$$v_f = v_i + at \quad (v_f = 0)$$

$$\frac{-v_i}{t} = a$$





$$\frac{h}{r} = \frac{x}{R}$$

$$hR = rx$$

$$R = \frac{rx}{h}$$

$$R = \frac{4x}{12}$$

$R = \frac{1}{3}x$

$R = \frac{1}{3}x$

$W = \int F(x)\,dx$

$W = \int mg$

$\rho V g$

$\rho \pi R^2 dx\, g$

$\rho \pi \left(\frac{1}{3}x\right)^2 dx\, g(12-x)$

m

d

$\rho = \frac{m}{V}$

$\rho V = m$

$$\rho\pi\left(\frac{1}{3}x\right)^2 dx\, g(12-x)$$

$$W=\int_0^{12} \rho\pi\frac{1}{9}x^2 g(12-x)\,dx$$

$$W=\rho\pi\frac{1}{9}g\int_0^{12} x^2(12-x)\,dx$$

$$W=(1000)(3.14)\left(\frac{1}{9}\right)(9.81)\int_0^{12} 12x^2-x^3\,dx$$

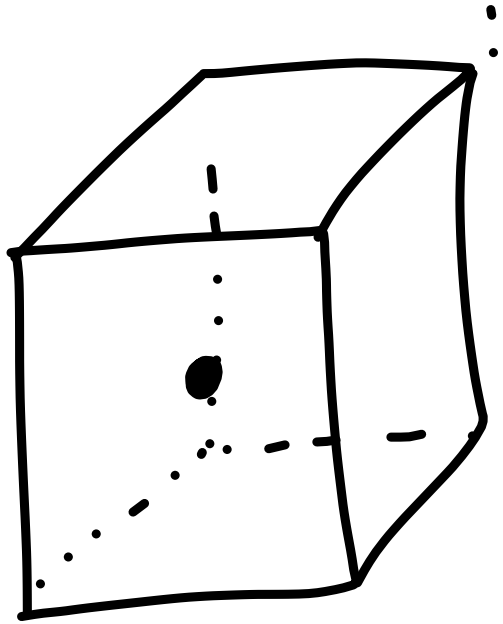
3422.6

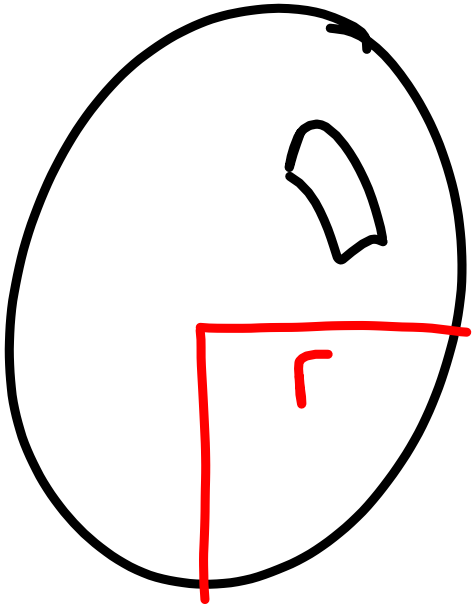
$$W = 3422.6\left(\frac{12x^3}{3} - \frac{x^4}{4}\right)\Bigg|_0^{12}$$

$$W = 3422.6\left(\frac{12(12)^3}{3} - \frac{(12)^4}{4}\right)$$

$$W = 5.914 \times 10^6 \text{ J}$$

$$P = \frac{\omega}{t} = \frac{5.914 \times 10^6}{120} = \frac{49{,}285.44 \text{ W}}{745} = 66.2 \text{ hp}$$

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