MIND MAP FOR JEE ASPIRANTS

Physics

Work Power Energy

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Today's Targets

1. Work Power Energy
2. [redacted]
3. [redacted]
4. [redacted]

$$(WD)_{\text{by force } F} = \int \vec{F} \cdot d\vec{s}$$

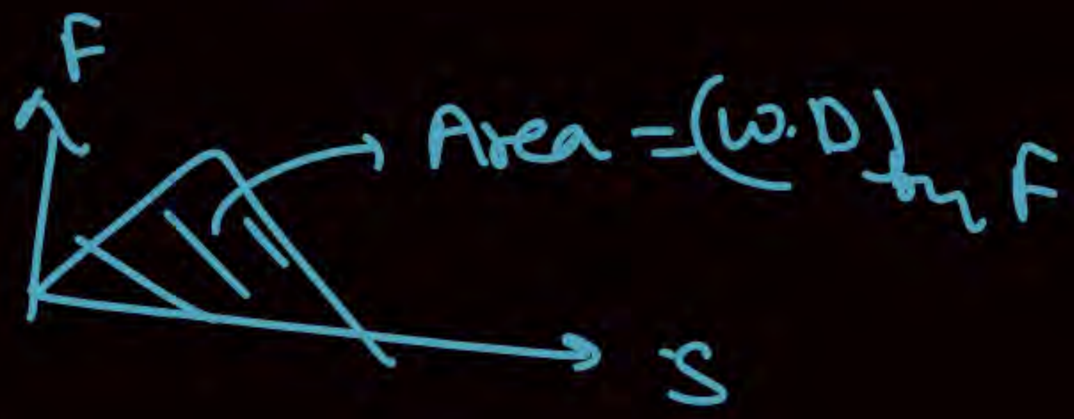
$d\vec{s} \longrightarrow$ Displacement of point of application of force.

$$\begin{cases} \vec{F_3} = 3x^2y\,\hat{i} + 4\underline{y^2}z\,\hat{j} \\ \vec{F_1} = 2\hat{i} + 3\hat{j} \\ \vec{F_2} = 4\hat{i} + 5\hat{j} \end{cases}$$

$$WD = \int \vec{F} \cdot d\vec{s}$$

$\vec{F}$ Const $\boxed{WD = \vec{F} \cdot \vec{d}}$

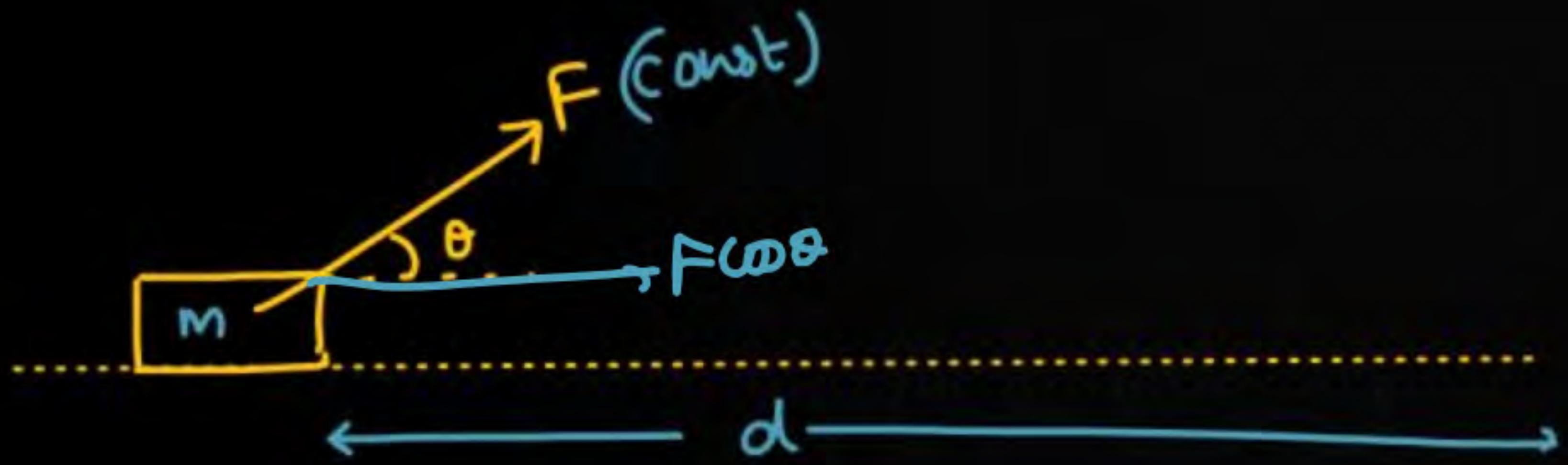
$$(1,2,3) \xrightarrow{\vec{d} = 3\hat{i} + 3\hat{j} + 3\hat{k}} (4,5,6)$$



$$(WD)_{F_2} = \vec{F_2} \cdot \vec{d} = 12 + 15 = \checkmark$$

by const force

$$(WD) = \vec{F} \cdot \vec{d} = Fd\cos\theta$$



$(WD)_{\substack{\text{force } F \\ (\text{const})}} = \vec{F} \cdot \vec{d} = F d \cos\theta$

$= (F\cos\theta)\, d$

Component of force along displac × displ.

(magnitude)

$WD = F d \cos\theta$

$= (\text{Force}) \times \left(\begin{array}{l}\text{component of} \\ \text{displacement} \\ \text{along force}\end{array}\right)$

$(WD)_g =$

$$w_g = mgh$$

mg

$$l\sin\theta = h$$

w

$m = 2kg$

$v = 2t^2$

$t=0 \longrightarrow t=4$

$t=0$

$v=0$

$\boxed{v=32}$

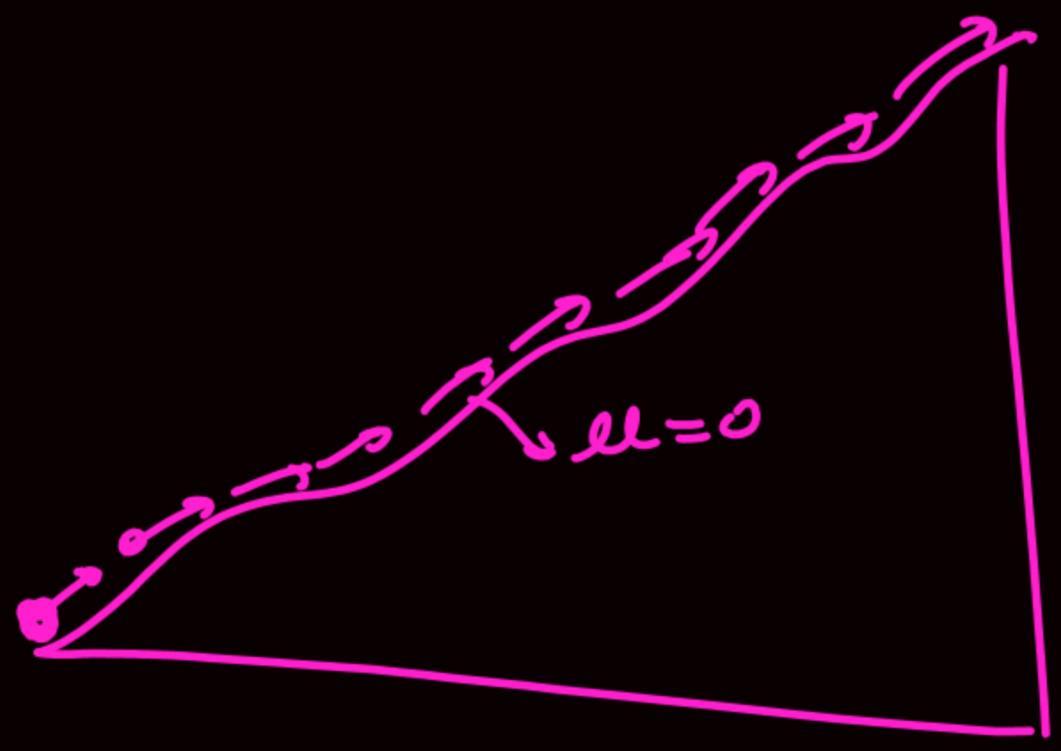
$$WD = \int \vec{F}\cdot d\vec{s} = \int \vec{F}\cdot\vec{v}\,dt$$

$$= \int_0^4 m.4t\,2t^2\,dt$$

$v = 5x^{3/2}$ $m = 2\,kg$

$x = 0$ Rest $x = 16$ $v = 5 \times 64$

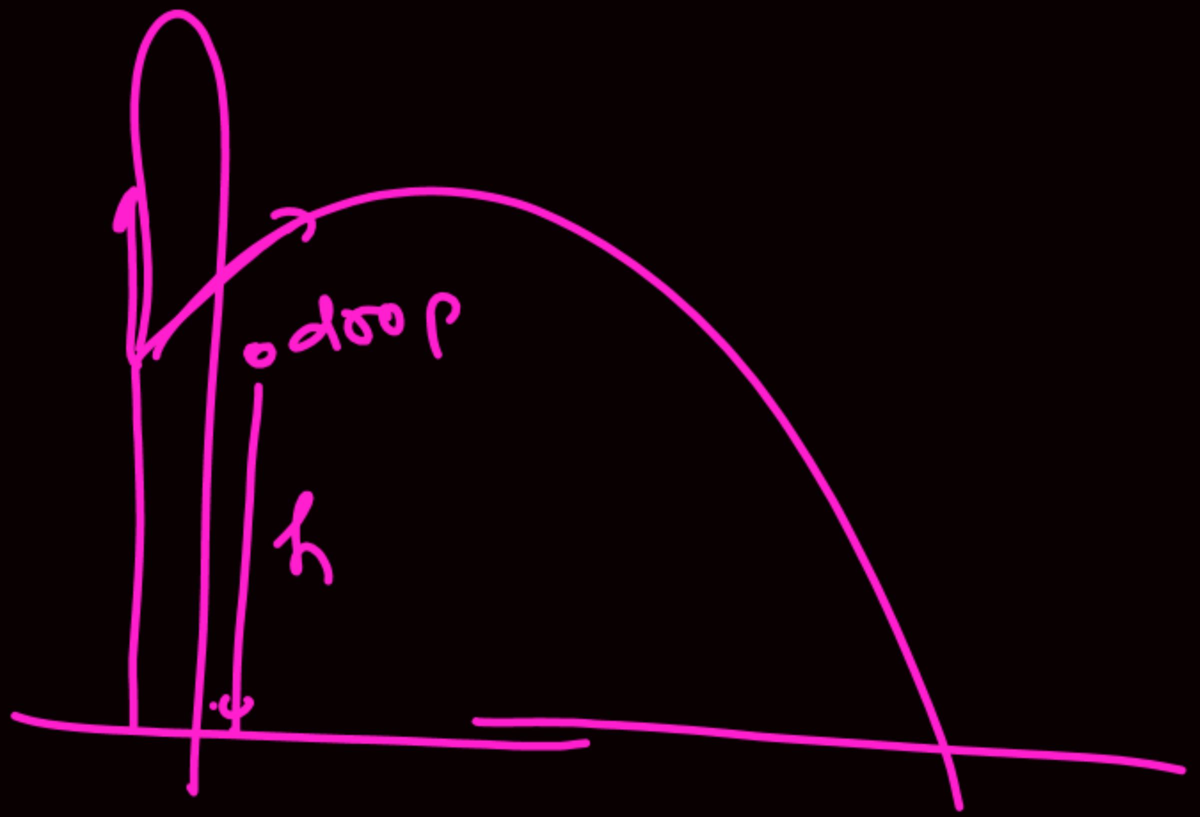
$(WD)_{\text{all the force}} = K_f - K_i$



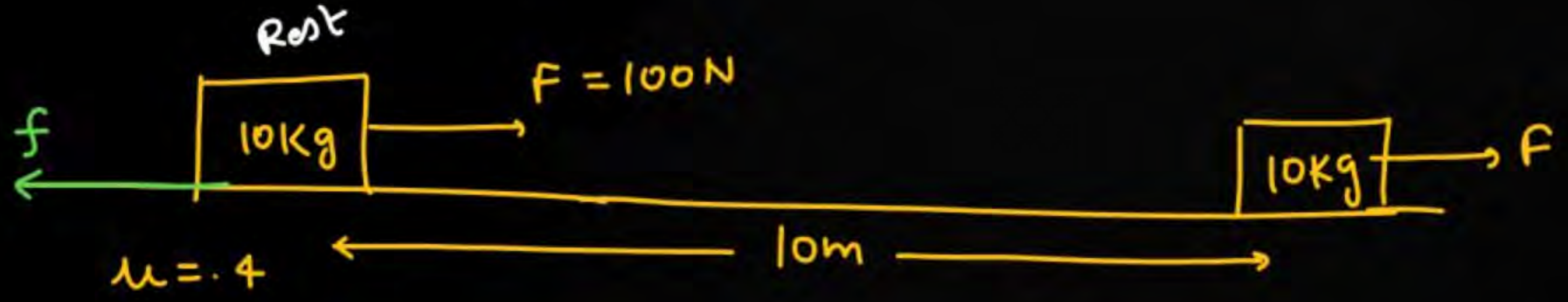
$$W_g + W_{ext} = \Delta K.E.$$

$$-mgh + W_{ext} = 0$$

$$W_{ext} = mgh$$



$$\boxed{(WD)_{\text{by all the forces}} = \Delta K.E.}$$



$$(WD)_F = 100 \times 10 = +1000$$

$$(WD)_f = -40 \times 10 = -400$$

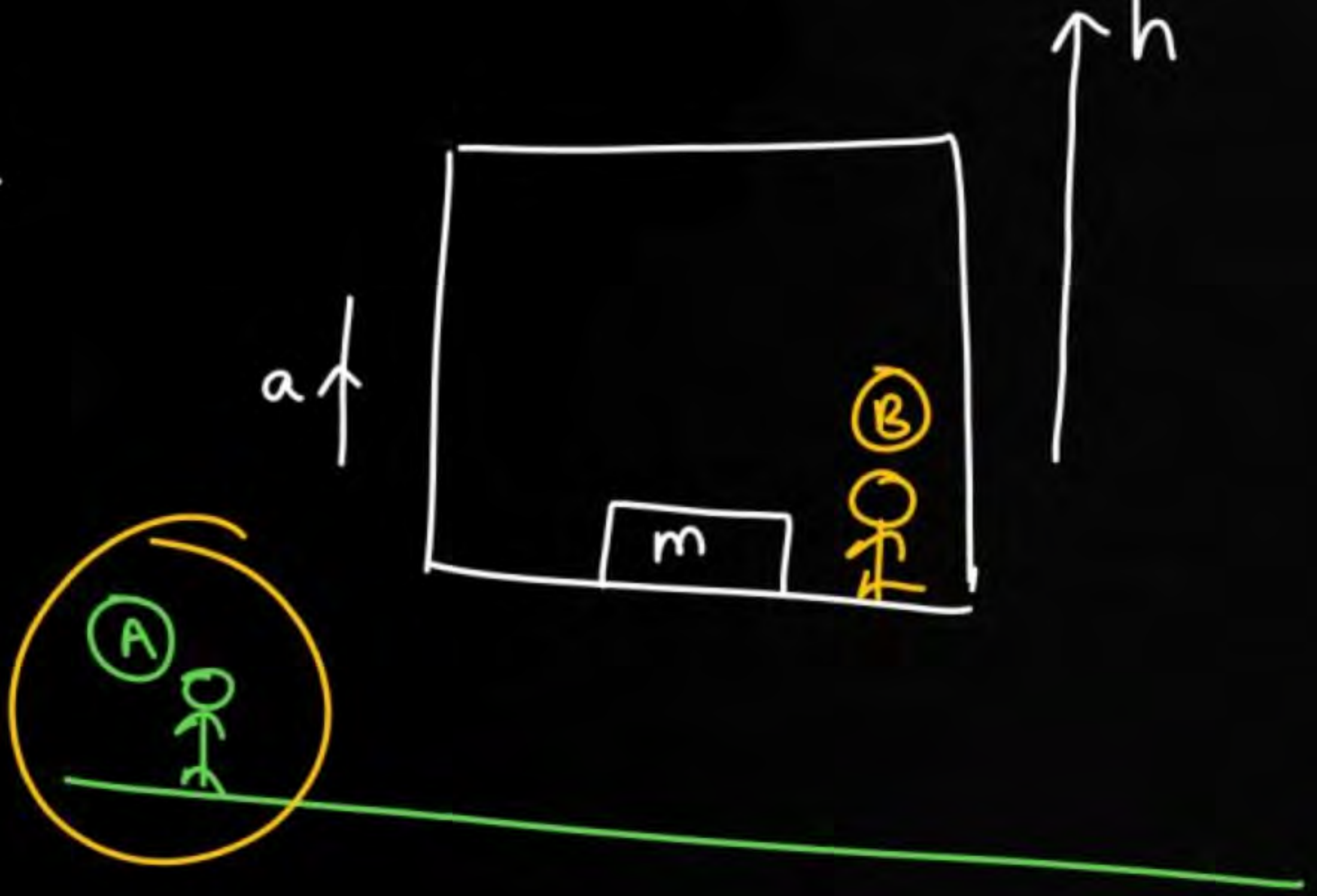
$$W_g = 0 = W_N$$

$$(WD)_{\text{by all the force}} = 600 = \Delta K.E.$$

$$600 = \frac{1}{2} \times 10 \times v^2 - 0$$

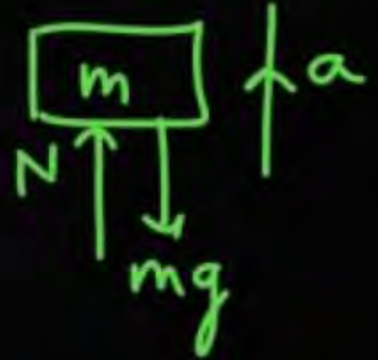
$$v = \sqrt{120}$$

Q



$$w_g = -mgh$$

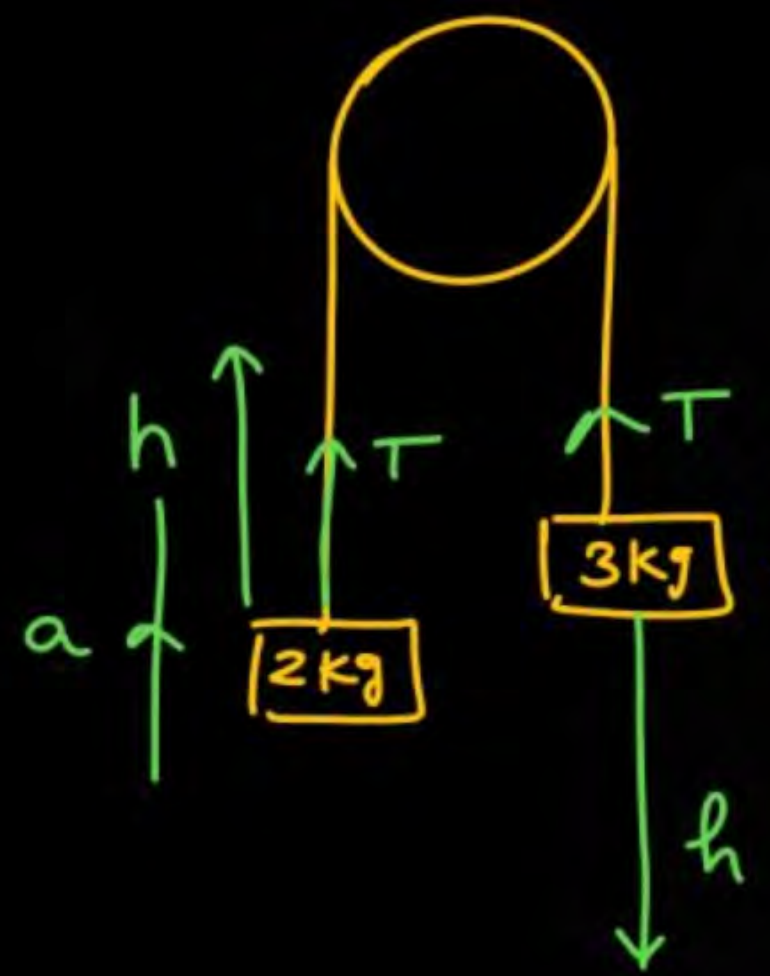
$$(w_D)_{\text{by normal on block}} = +Nh$$
$$= (mg+ma)h$$



$$N = mg + ma$$

$$\text{B} \equiv \left.\begin{aligned} w_g &= 0 \\ w_N &= 0 \\ w_{pseudo} &= 0 \end{aligned}\right\}$$

#



$$\downarrow a = \frac{30-20}{2+3} = 2$$

$t=0 \longrightarrow t=4$

$$h = 0 + \frac{1}{2} \times 2 \times 4^2 = 16m$$

$$\left.\begin{aligned} W_g &= +30 \times 16 \\ W_T &= -Th \end{aligned}\right\} 3kg$$

$$\left.\underbrace{W_T = +Th}\right\} 2kg$$

$$WD = \int F\,dx$$

$$= \int_{x_i}^{x_f} -kx\,dx$$

$$\boxed{(WD)_{sp} = -\frac{1}{2}k\left(x_f^2 - x_i^2\right)}$$

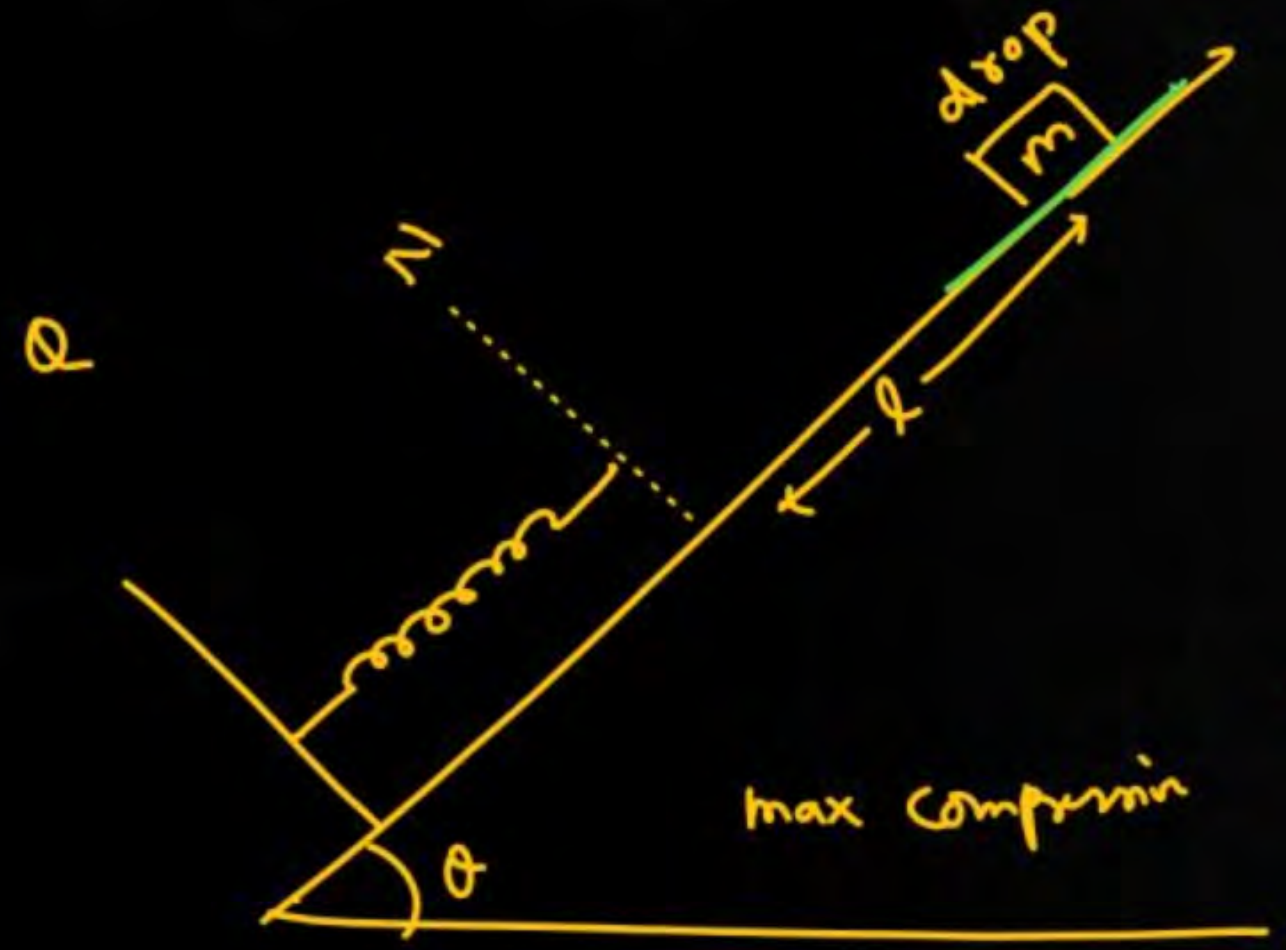
$(WD)_{\text{by all the forces}} = \Delta K.E.$

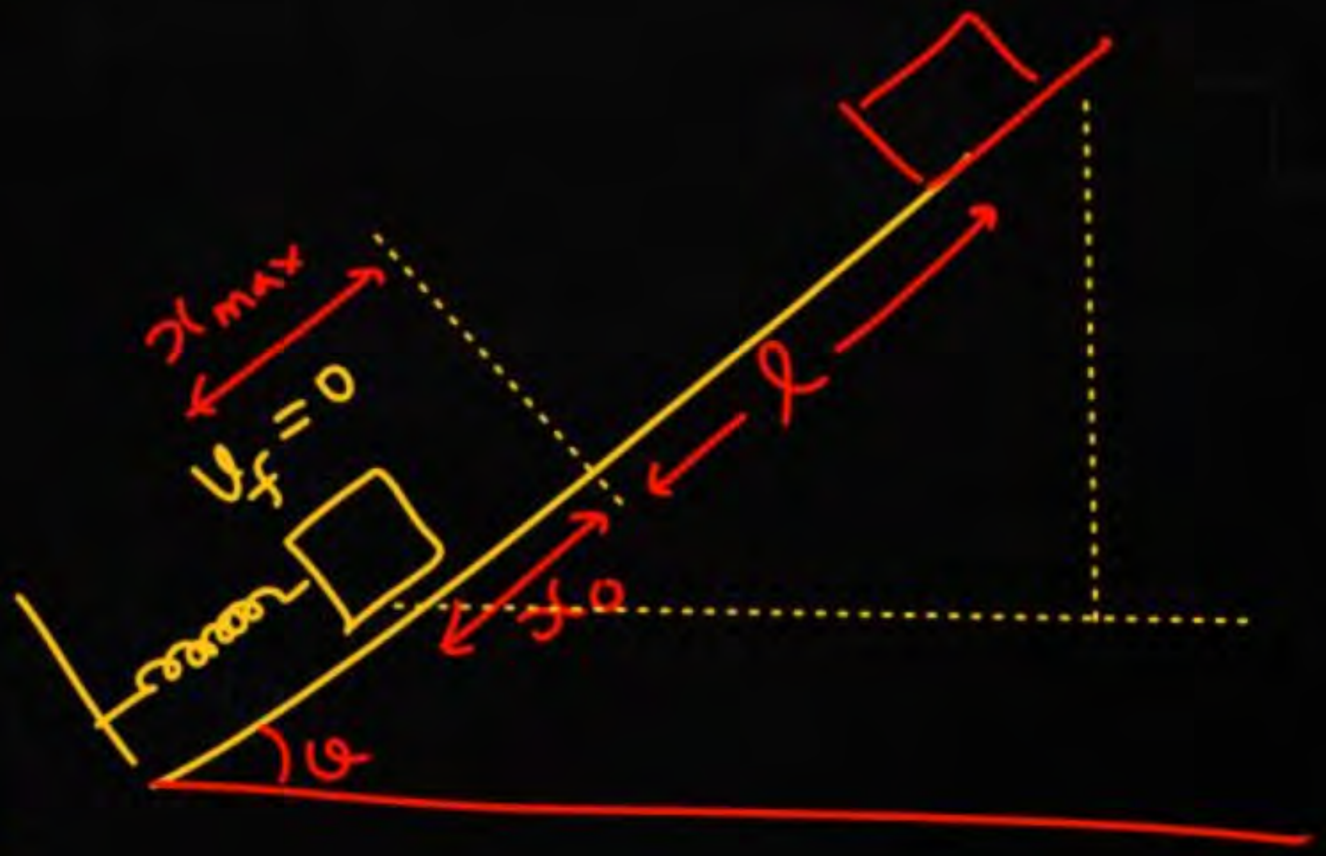
max compression in spring

Q

$$W_g + W_N + W_f + W_{sp} = \Delta K.E.$$

$$0 + 0 - \mu m g x_{max} - \frac{1}{2}K(x_{max}^2 - 0^2) = 0 - \frac{1}{2}mV_0^2$$



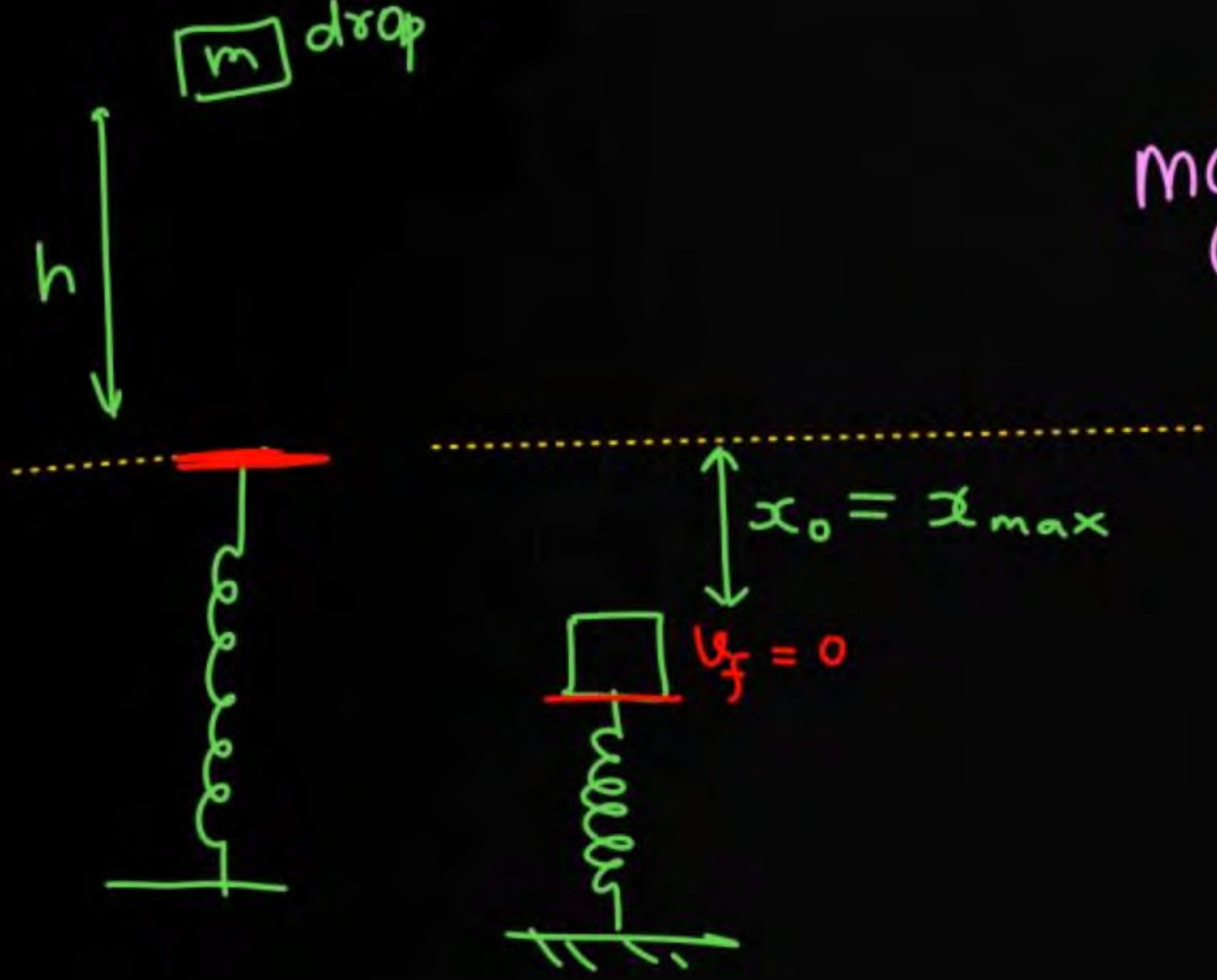


$$w_g + w_N + w_f + w_{sp} = \Delta K.E.$$

$$+mg(l+x_0)\sin\theta + 0 - \mu_k mg\cos\theta\,(l+x_0) - \frac{1}{2}k\left(x_0^2 - 0^2\right)$$

$$= 0 - 0$$

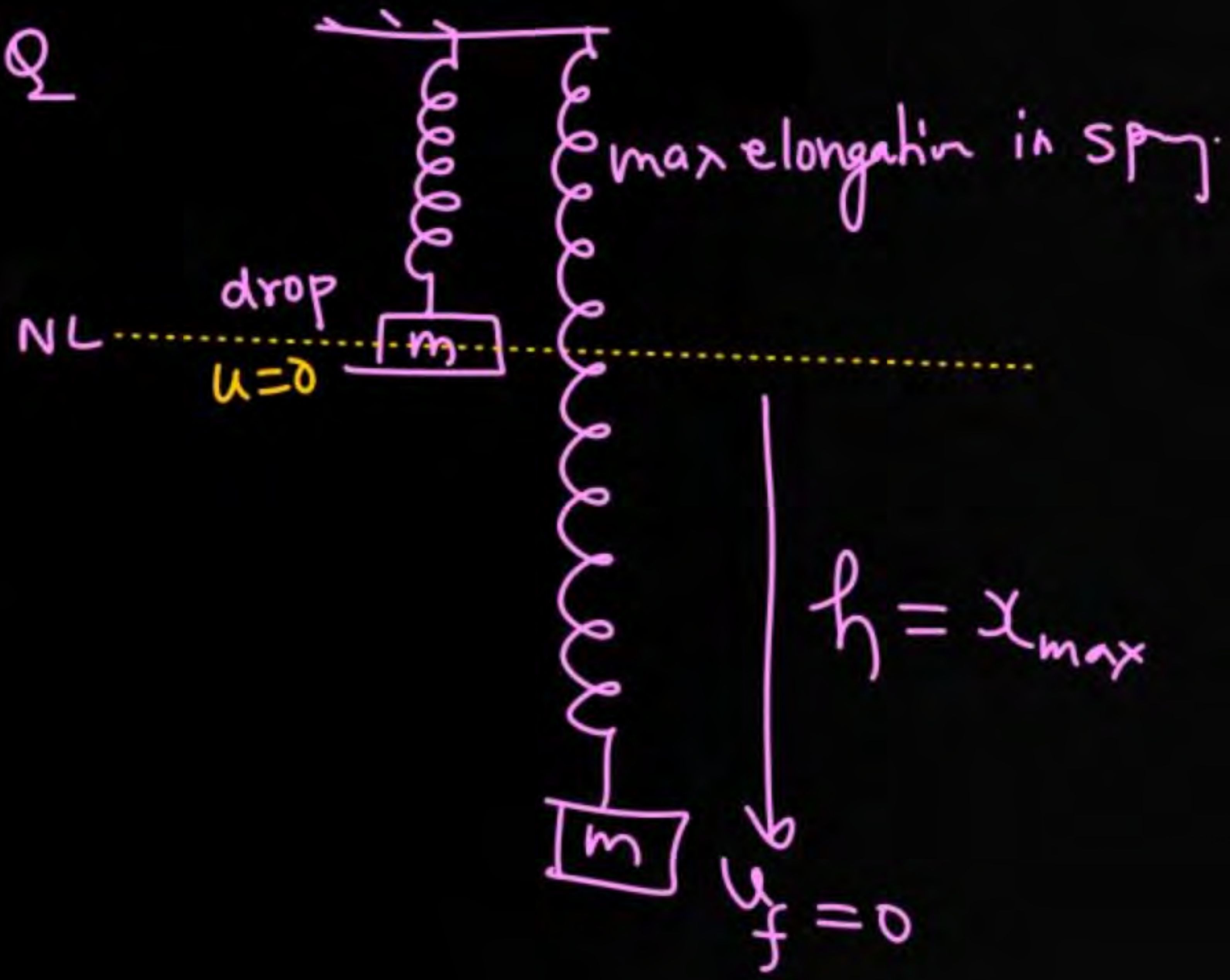
Q2



max Compression

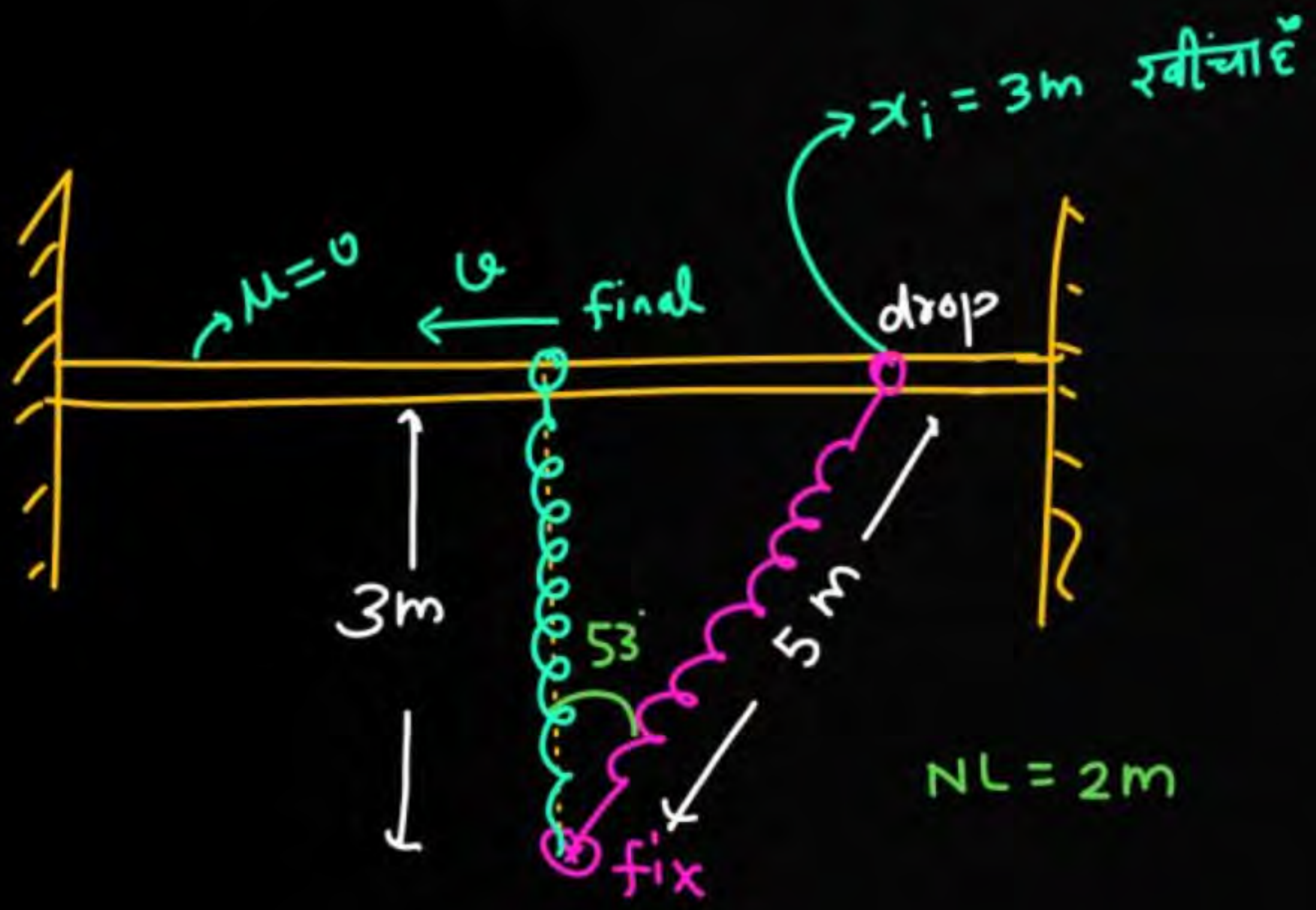
$$mg(h+x_0) - \frac{k}{2}(x_0^2 - 0^2)$$
$$= 0 - 0$$

Q



$$mgh - \frac{1}{2}K(h^2 - 0^2)$$
$$= 0 - 0$$
$$h = \frac{2mg}{K}$$

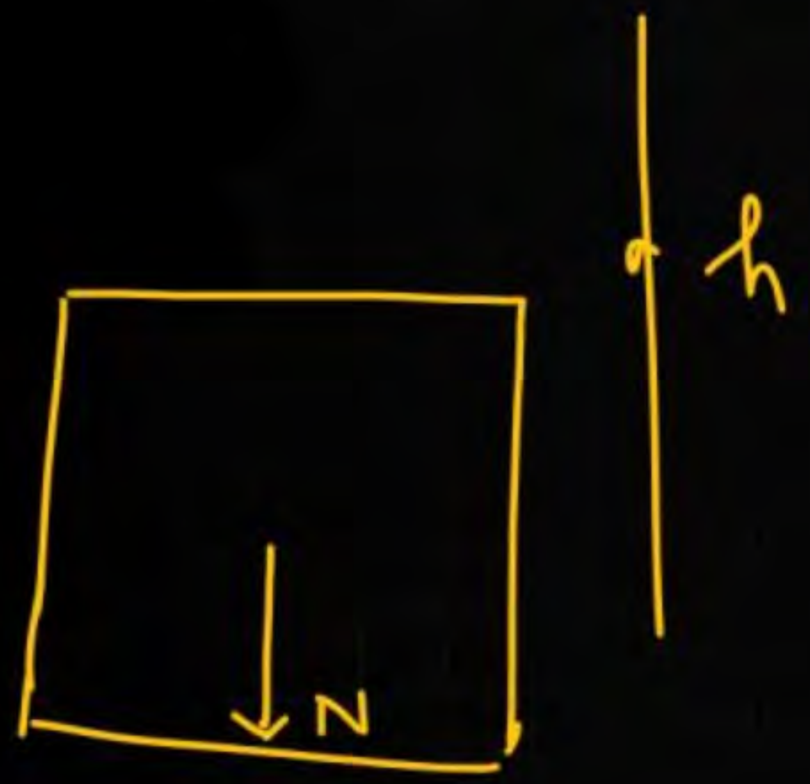
Q



$$W_g + W_N + W_{sp} + W_f = \Delta K.E.$$

$$0 + 0 - \frac{1}{2}K(1^2 - 3^2) + 0$$

$$= \frac{1}{2}mV^2 - 0$$


N
h

Q $\vec{F} = 3\hat{i} + 4\hat{j} + 5\hat{k}$

$\vec{d} = 2\hat{i} + 6\hat{j} + 5\hat{k}$

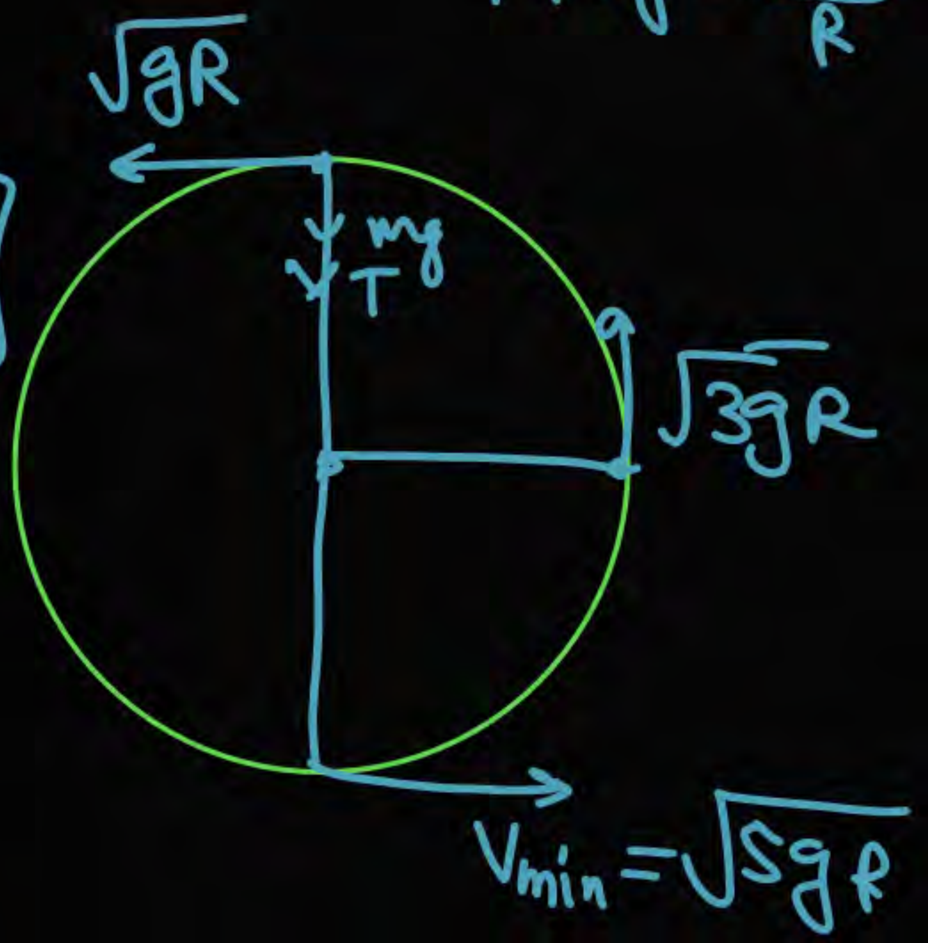
Q $\vec{F} = 3x^2\hat{i} + 4y^3\hat{j} + 2z\hat{k}$

(WD) force $\vec{F}$ if particle move from $(1,2,3)$ to $(4,5,6)$

$$T - mg\cos\theta = \frac{mv^2}{R}$$

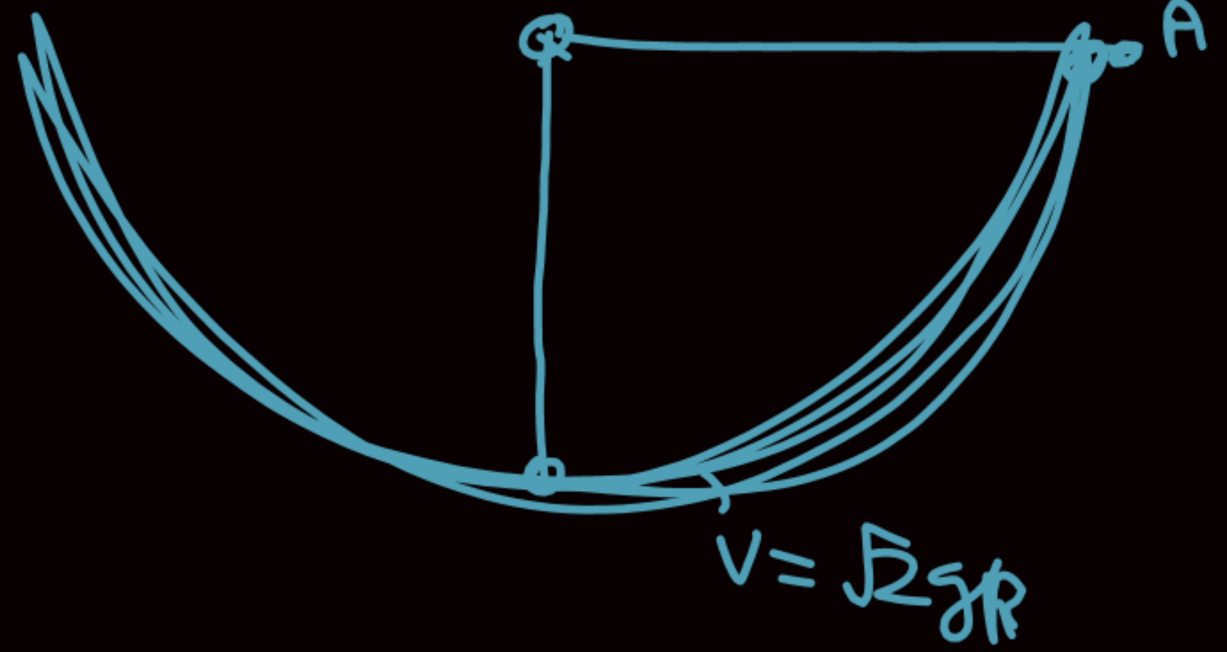
$$\boxed{T = mg\cos\theta + \frac{mv^2}{R}}$$

$$T + mg = \frac{mv^2}{R}$$



$$mg = \frac{mv^2}{R}$$

$$v = \sqrt{gR}$$



$$-mgR + 0 = 0 - \frac{1}{2}mv^2$$

$$V = \sqrt{2gR}$$

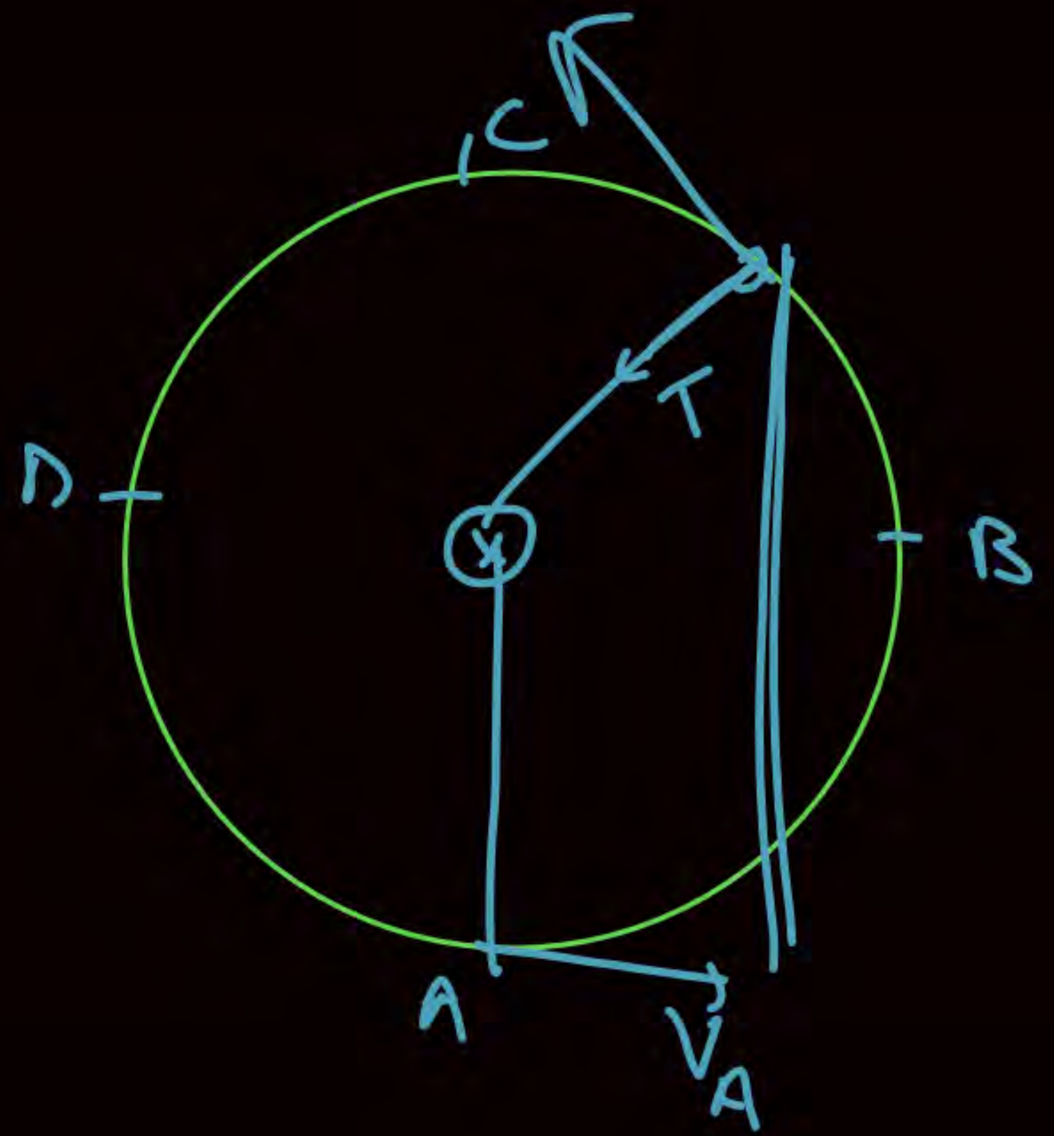
$v_A < \sqrt{2gR}$

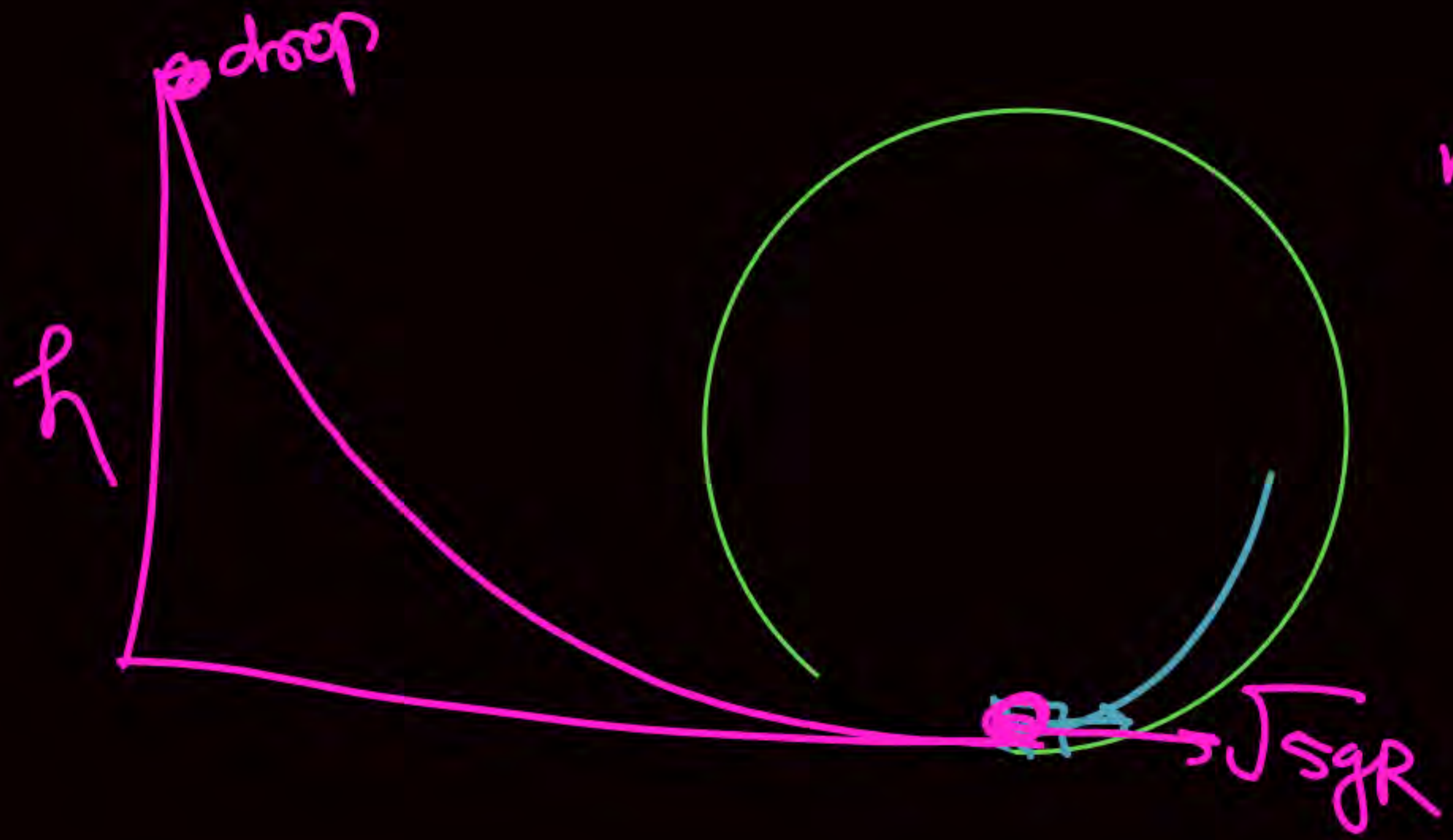
$v_A = \sqrt{2gR}$ $\quad v_B = 0$

$< \cancel{v_A} \quad \sqrt{2gR} < v_A < \sqrt{5gR}$

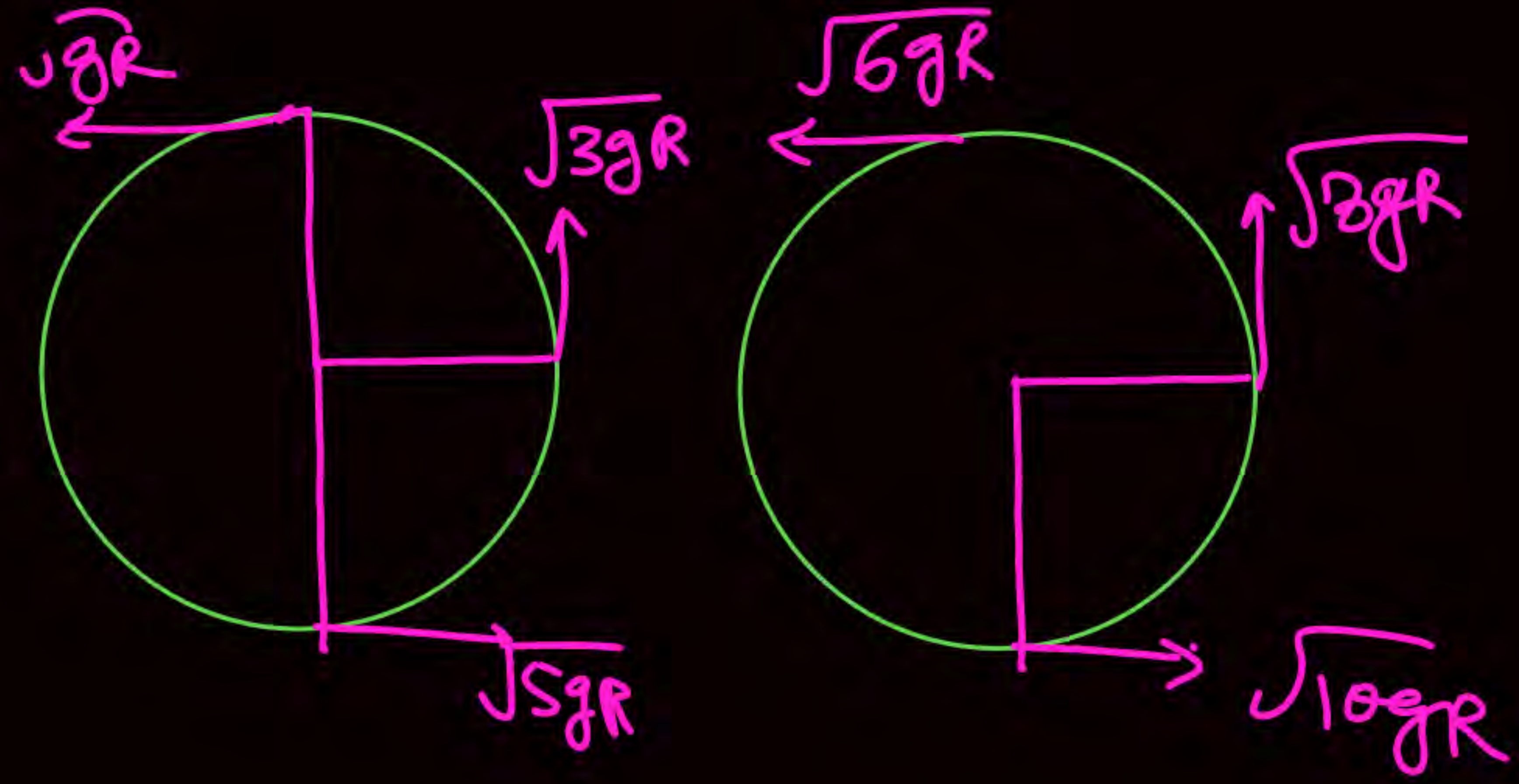
$v_A = \sqrt{5gR}$

$v_A > \sqrt{5gR}$





$$mgh + 0 = \frac{1}{2}m\,5gR - 0$$



√gR
√3gR
√5gR
√6gR
√3gR
√10gR

$$\boxed{\begin{aligned} dU &= -(WD)_{i.c.F.} \\ \Delta U &= -\int \vec{F}_{i.c.f} \cdot d\vec{r} \end{aligned}}$$

$$dU = \vec{F}\cdot d\vec{r}$$

$$\Delta U = -\int \vec{F}\cdot d\vec{r}$$

$$\vec{F} = 2\hat{i} + 3\hat{j} + 4\hat{k}$$

$$(1,2,3) \longrightarrow (5,7,8)$$

$$\vec{F} = F_x\hat{i} + F_y\hat{j} + F_z\hat{k}$$

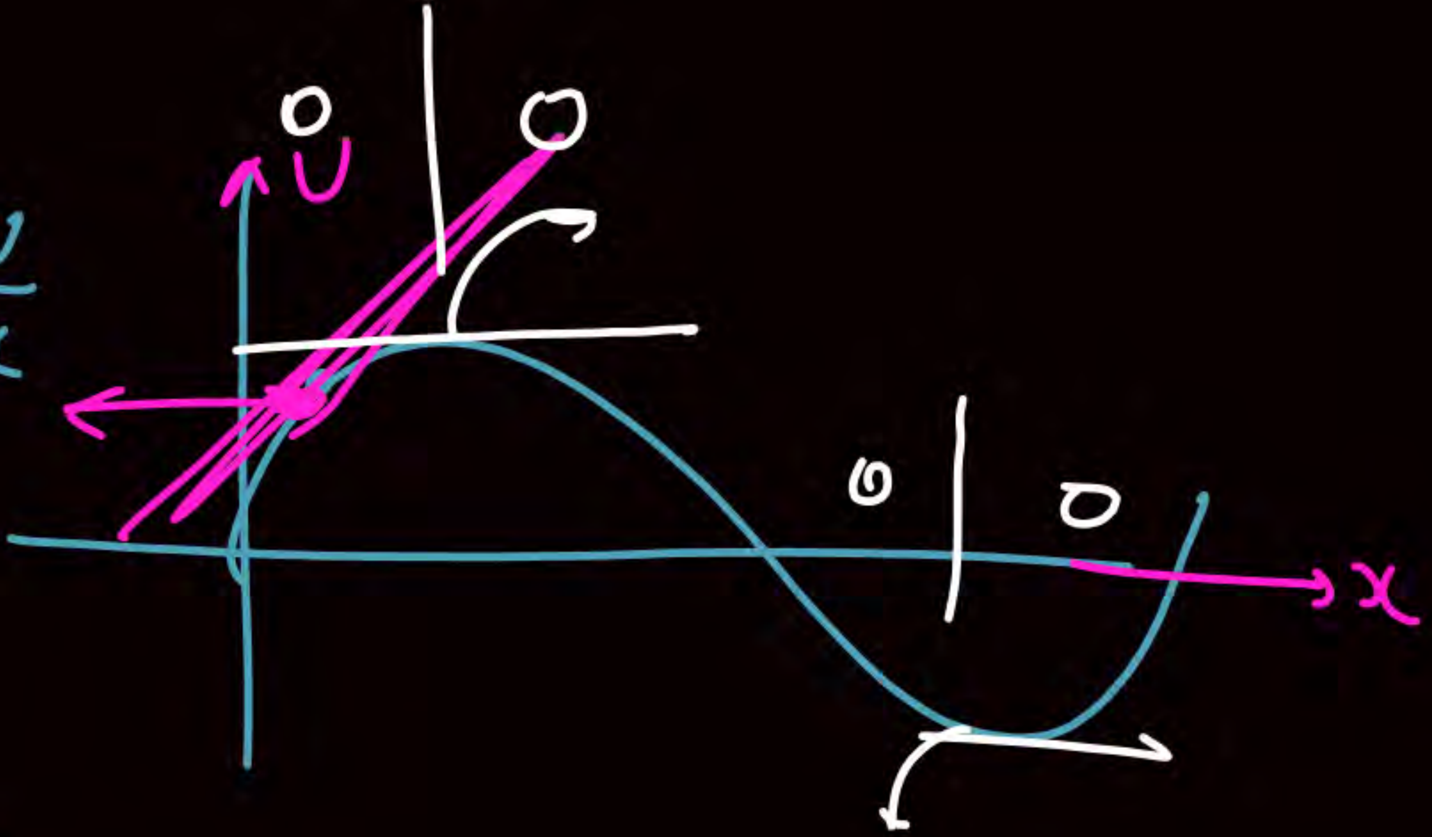
$$d\vec{r} = dx\,\hat{i} + dy\,\hat{j} + dz\,\hat{k}$$

$$\int_{U_0}^{U} dU = -\left[\int_1^5 F_x\,dx + \int_2^7 F_y\,dy + \int_3^8 F_z\,dz\right]$$

∂

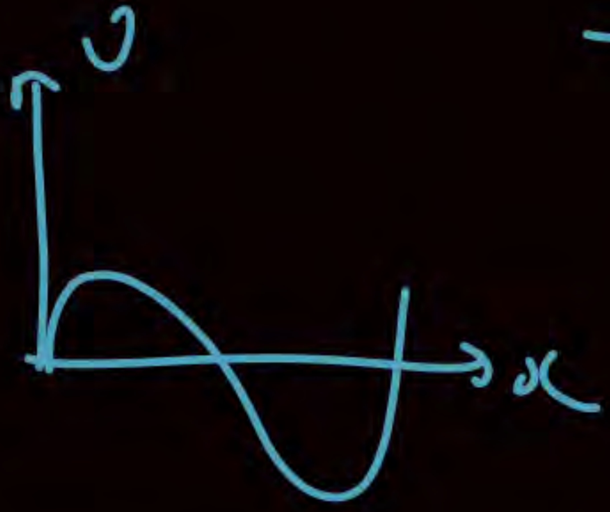
$$F = -\frac{dU}{dr}$$

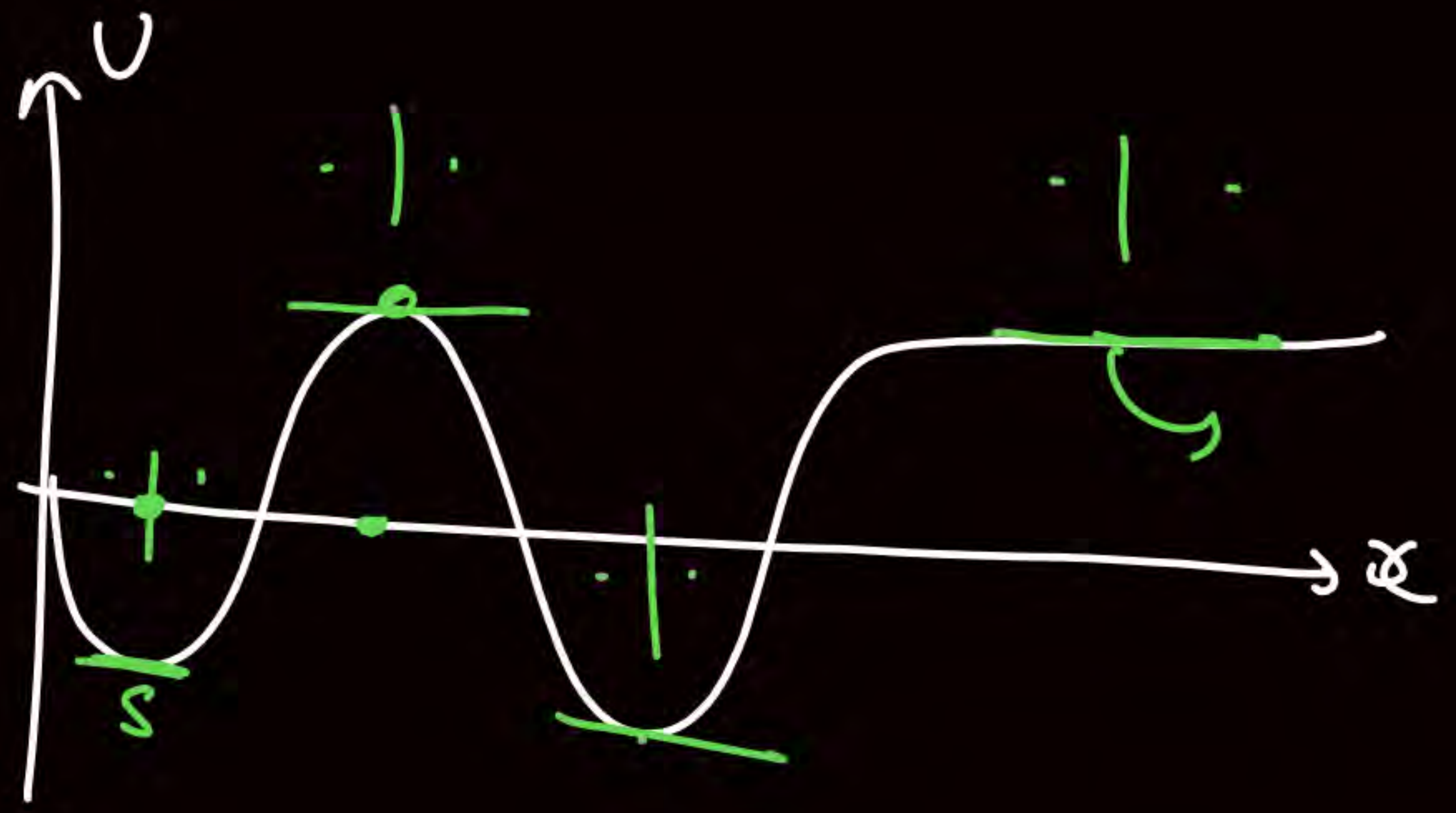
$$F_x = -\frac{dU}{dx}$$



$$F_x = -\frac{\partial U}{\partial x}$$

$$F_x = -\frac{dU}{dx}$$





$$F = \frac{dU}{dx} = 0$$

$$\frac{d^2U}{dx^2} > 0 \quad \text{stable}$$

$$\frac{d^2U}{dx^2} < 0 \quad \text{Unstable}$$

$$U = x^2 - 4x$$

$$\frac{dU}{dx} = 2x - 4$$

$$\frac{d^2U}{dx^2} = 2 \quad > 0$$

$$F = -\frac{dU}{dx} = -(2x-4)$$

(i) $F = 0$, $x = 2$

$t = 5$ Power supplied by tension to block

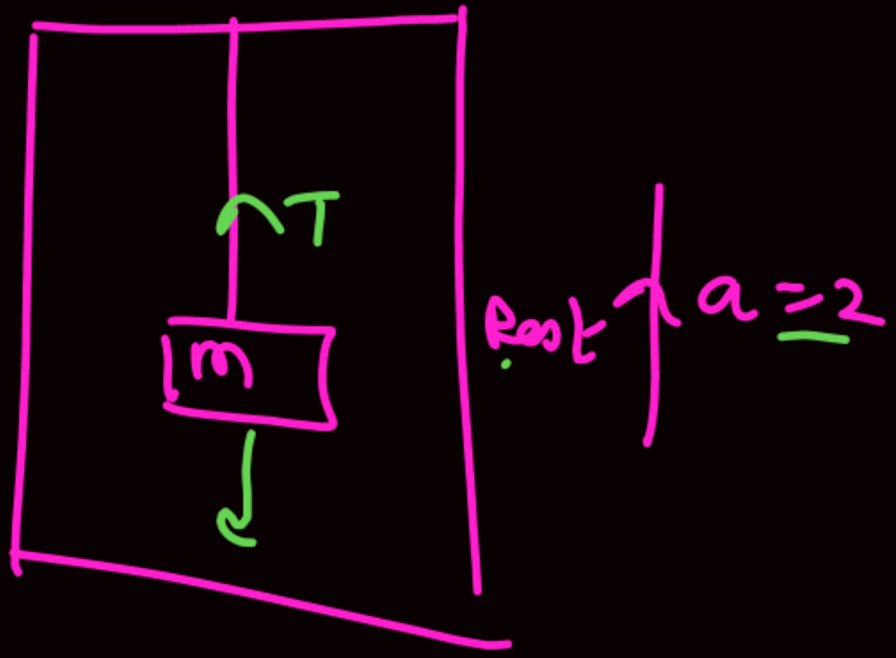
$\vec{v} = +10\hat{j}$

$T = \checkmark$

$$\boxed{P = \frac{dw}{dt} = \vec{F}\cdot\vec{v}}$$

$$\int dw = \int P\,dt$$

$$WD = \int P\,dt$$



THANK YOU