
समस्त बिहार, भरेगा हुंकार
HUNKAR
2025
में आपका स्वागत हैं
VIDYAKUL

HUNKAR 2025

VIDYAKUL

PHYSICS

JP UJALA Sir

अध्याय 02

Electric Potential Energy.

स्थिर वैद्युत ऊर्जा

आज का टॉपिक

आज समझेंगे

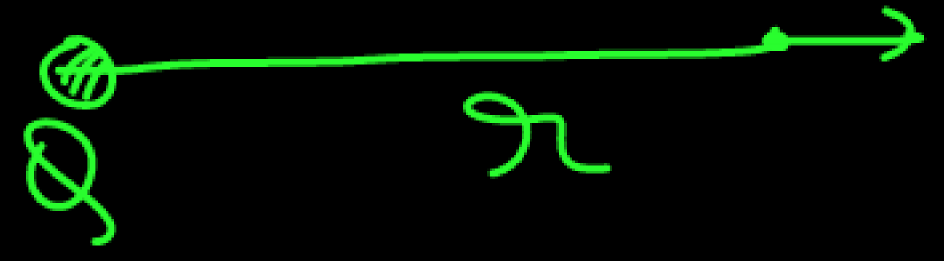
Potential Energy.

⊛ Revision

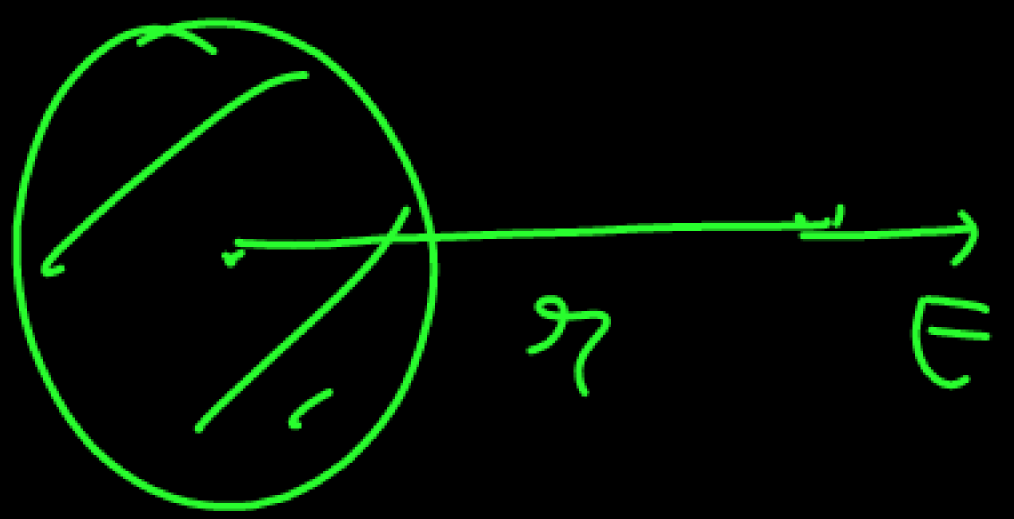
(i) $\phi = EA\cos\theta$ (v.v.g)

(ii) $\oint \vec{E}\cdot\vec{ds} = \frac{Q_{in}}{\varepsilon_0}$ Proof v.v.g

(iii) $E = \frac{KQ}{r^2}$



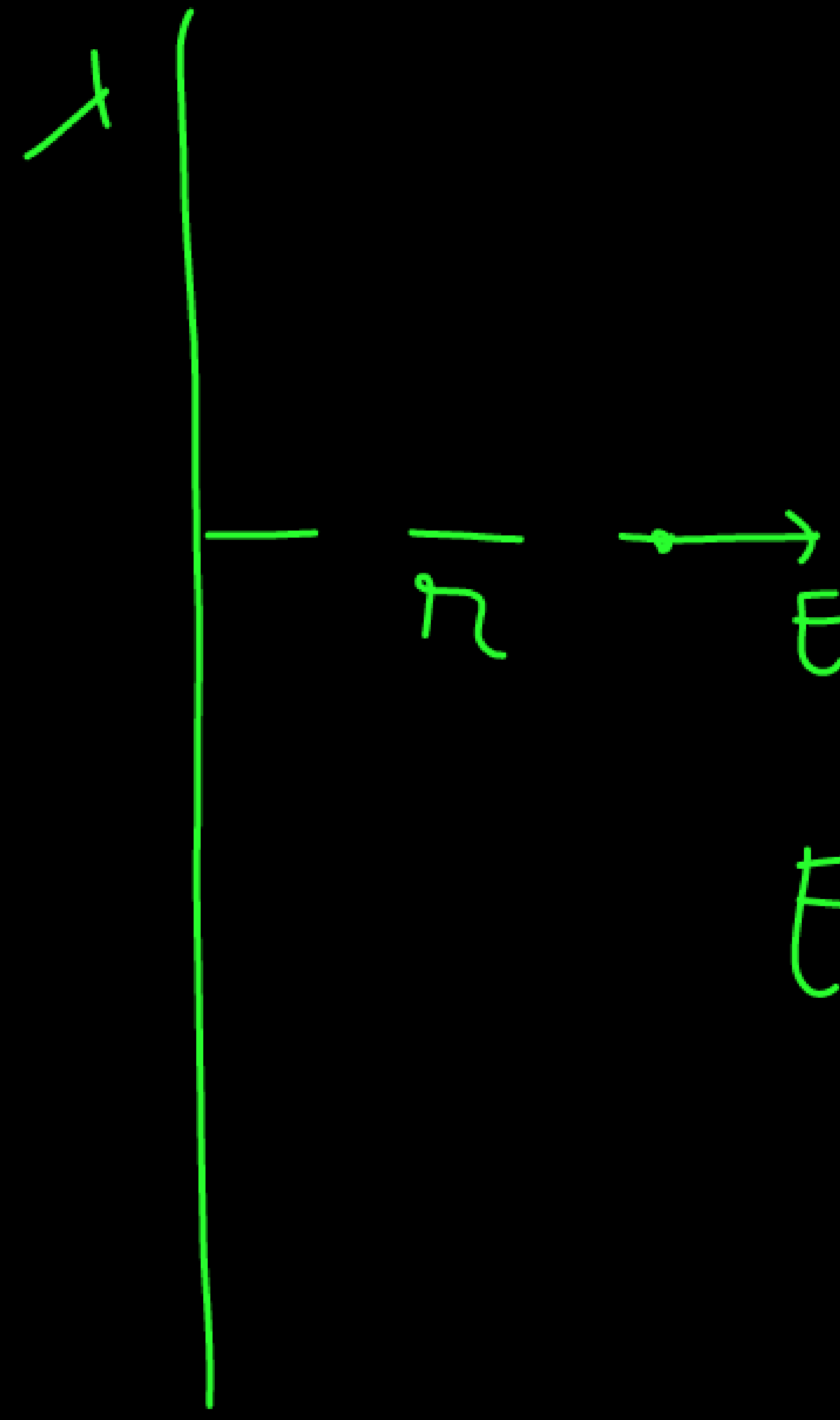
(iv) $E = \frac{KQ}{r^2}$



v)

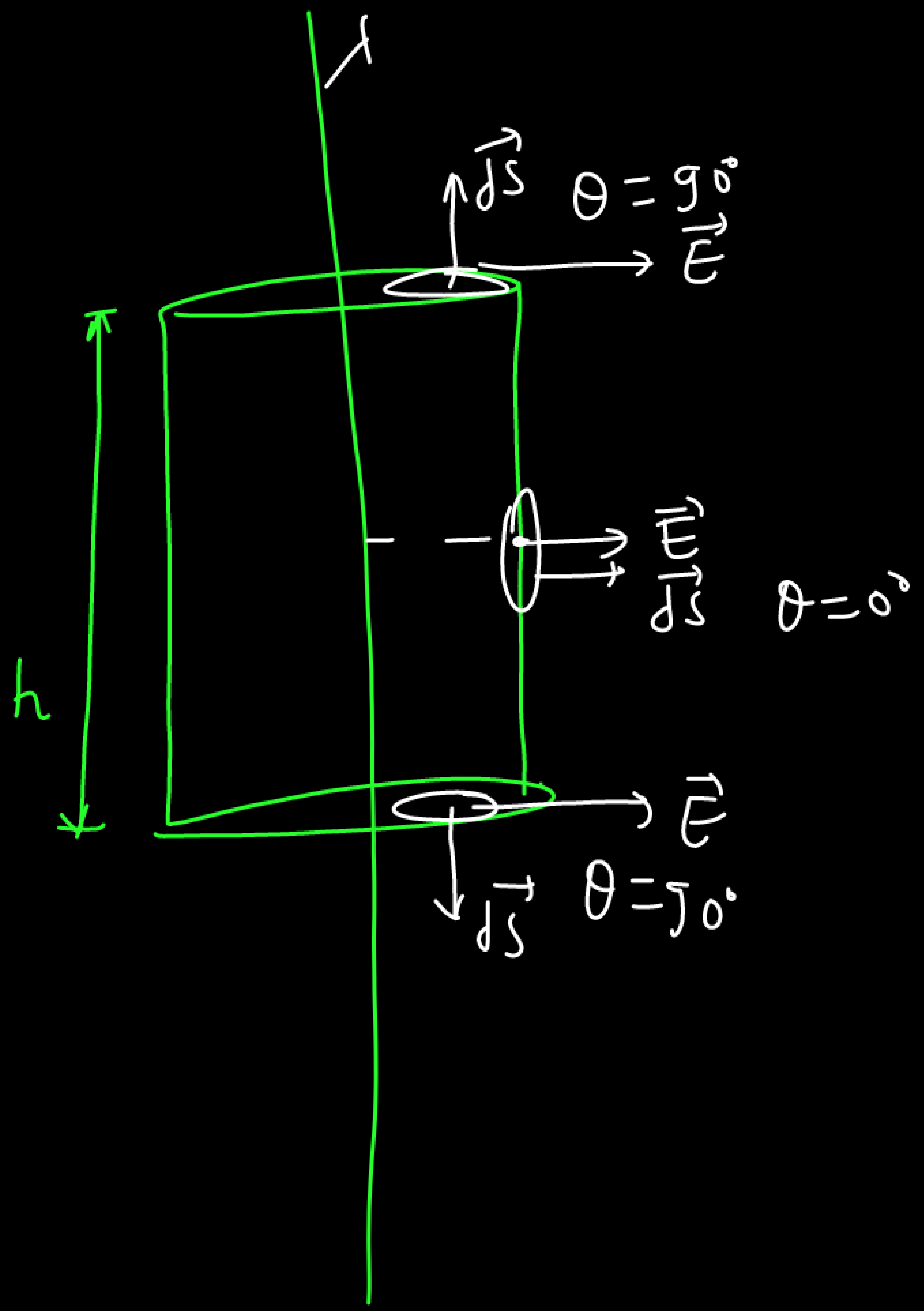
$E = \frac{KQr}{R^3}$

vi)



$E = \frac{\lambda}{2\pi r\varepsilon_0}$

$E = \frac{2K\lambda}{r}$



$$\oint \vec{E} \cdot \vec{ds} = \frac{Q_{in}}{\varepsilon_0}$$

$$\int_1 \vec{E} \cdot \vec{ds} + \int_2 \vec{E} \cdot \vec{ds} + \int_3 \vec{E} \cdot \vec{ds} = \frac{Q_{in}}{\varepsilon_0}$$

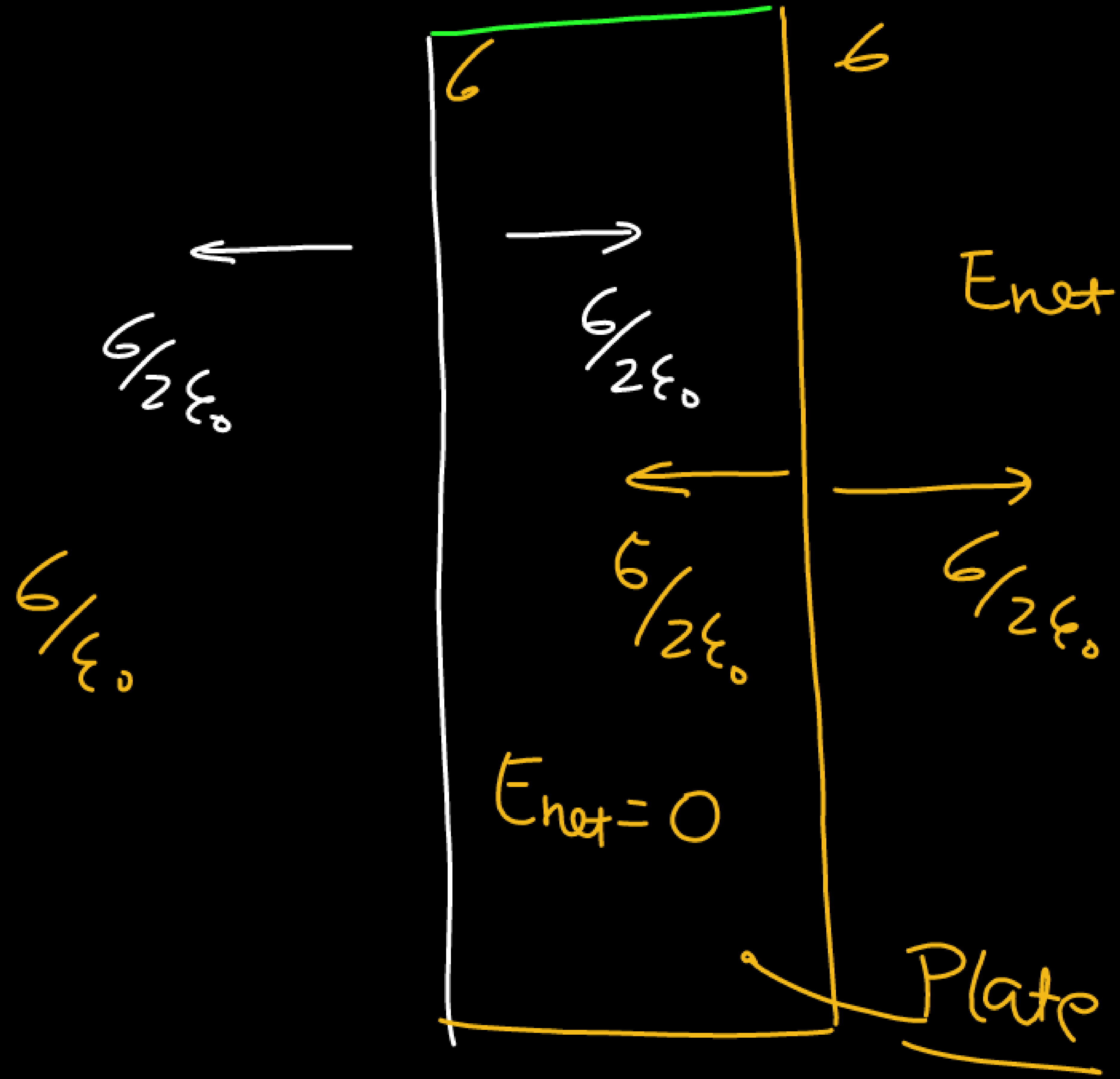
⊛ Electric field near Sheet

पतले चादर के करीब विद्युत क्षेत्र तीव्रता

$$\boxed{E = \frac{\sigma}{2\varepsilon_0}}$$

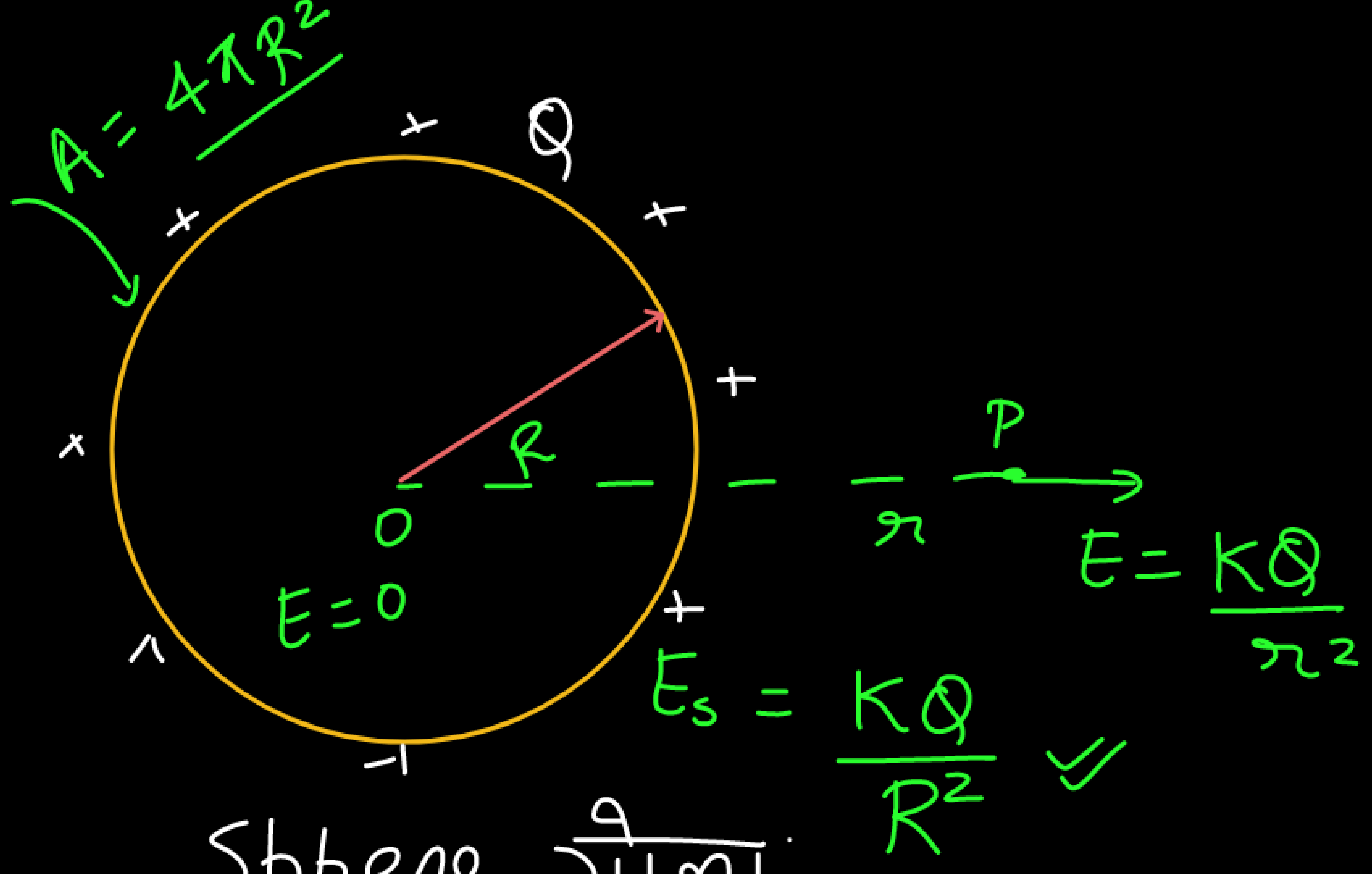
⊛ Plate

$$E = \frac{\sigma}{\varepsilon_0}$$



$$E_{net} = \frac{\sigma}{2\varepsilon_0} + \frac{\sigma}{2\varepsilon_0}$$

$$= \frac{\sigma}{\varepsilon_0}$$



Sphere वाला

$$\sigma = \frac{Q}{A} = \frac{Q}{4\pi R^2}$$

$$E_s = \frac{KQ}{R^2} = \frac{1}{4\pi\varepsilon_0} \cdot \frac{Q}{R^2}$$

$$= \left(\frac{Q}{4\pi R^2}\right) \times \frac{1}{\varepsilon_0}$$

$$\boxed{E_s = \frac{\sigma}{\varepsilon_0}}$$

ELECTRIC POTENTIAL ENERGY & POTENTIAL

FOR BOARD/ JEE MAIN AND NEET

* Integration समाकलन → जोड़

$$\int \text{sum} = \int dx$$

* $\int dx = x$

$\int 3\,dx = 3x$

$$\boxed{\int x^n\,dx = \frac{x^{n+1}}{n+1}} + C$$

* $\int x^4\,dx = \frac{x^{4+1}}{4+1} = \frac{x^5}{5}$

* $\int 4x^3\,dx = \cancel{4}\frac{x^4}{\cancel{4}} = x^4$

* $\int K\,x\,dx = K\frac{x^{1+1}}{1+1} = \frac{Kx^2}{2}$

* $\int K\,x^2\,dx = \frac{Kx^3}{3}$

$\circledast$

$$\int_A^B \frac{K}{x^2}\,dx = K\int_A^B x^{-2}\,dx$$

$$= K\,\frac{x^{-2+1}}{-2+1}$$

$x^{-1} = \frac{1}{x}$

$$= K\,\frac{x^{-1}}{-1}$$

$$= -K\,x^{-1}$$

$$= \left[\frac{-K}{x}\right]_A^B$$

$$= -K\left[\frac{1}{B} - \frac{1}{A}\right]$$

$\circledast$

$$\int_A^B \frac{K}{r^2}\,dr = \frac{-K}{r}$$

$$= -K\left[\frac{1}{r}\right]_A^B$$

$$= -K\left[\frac{1}{B} - \frac{1}{A}\right]$$

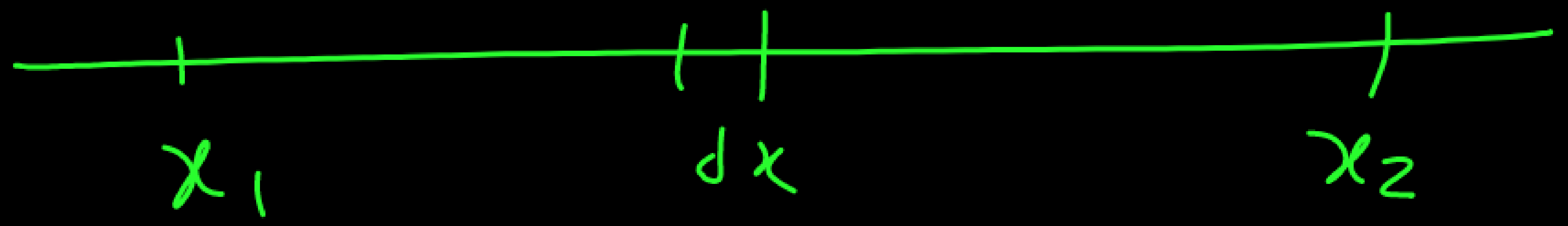
* Definit integration.

(Example)

$$\int_A^B Kx^2\,dx = K\left[\frac{x^3}{3}\right]_A^B$$

$$= K\left(\frac{B^3}{3} - \frac{A^3}{3}\right)$$

a



*

$$\int_A^B x^n\,dx = \left[\frac{x^{n+1}}{n+1}\right]_A^B$$

$$= \frac{B^{n+1}}{n+1} - \frac{A^{n+1}}{n+1}$$

$\circledast$

$$\int_{r_1}^{r_2} \frac{Kq_1q_2}{r^2}\,dr = Kq_1q_2 \int_{r_1}^{r_2} r^{-2}\,dr$$

$$= Kq_1q_2 \left(\frac{r^{-2+1}}{-2+1}\right)_{r_1}^{r_2}$$

$$= Kq_1q_2 \left(\frac{r^{-1}}{-1}\right)_{r_1}^{r_2}$$

$$= -Kq_1q_2 \left[\frac{1}{r}\right]_{r_1}^{r_2}$$

$$= -Kq_1q_2 \left[\frac{1}{r_2} - \frac{1}{r_1}\right]$$

$\circledast$

$$\int_{x_1}^{x_2} \frac{Kq_1q_2}{x^3}\,dx$$

$$Kq_1q_2 \int_{x_1}^{x_2} x^{-3}\,dx$$

$$Kq_1q_2 \left(\frac{x^{-3+1}}{-3+1}\right]_{x_1}^{x_2}$$

$$Kq_1q_2 \left[\frac{x^{-2}}{-2}\right]_{x_1}^{x_2}$$

$$-\frac{1}{2} Kq_1q_2 \left(\frac{1}{x^2}\right)_{x_1}^{x_2}$$

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Home work

(I) $$\int_A^B \frac{K}{x^2}\, dx$$

(III) $$\int_A^B \frac{K}{r^3}\, dr$$

(II) $$\int_{r_2}^{r_1} \frac{K q_1 q_2}{r^2}\, dr$$