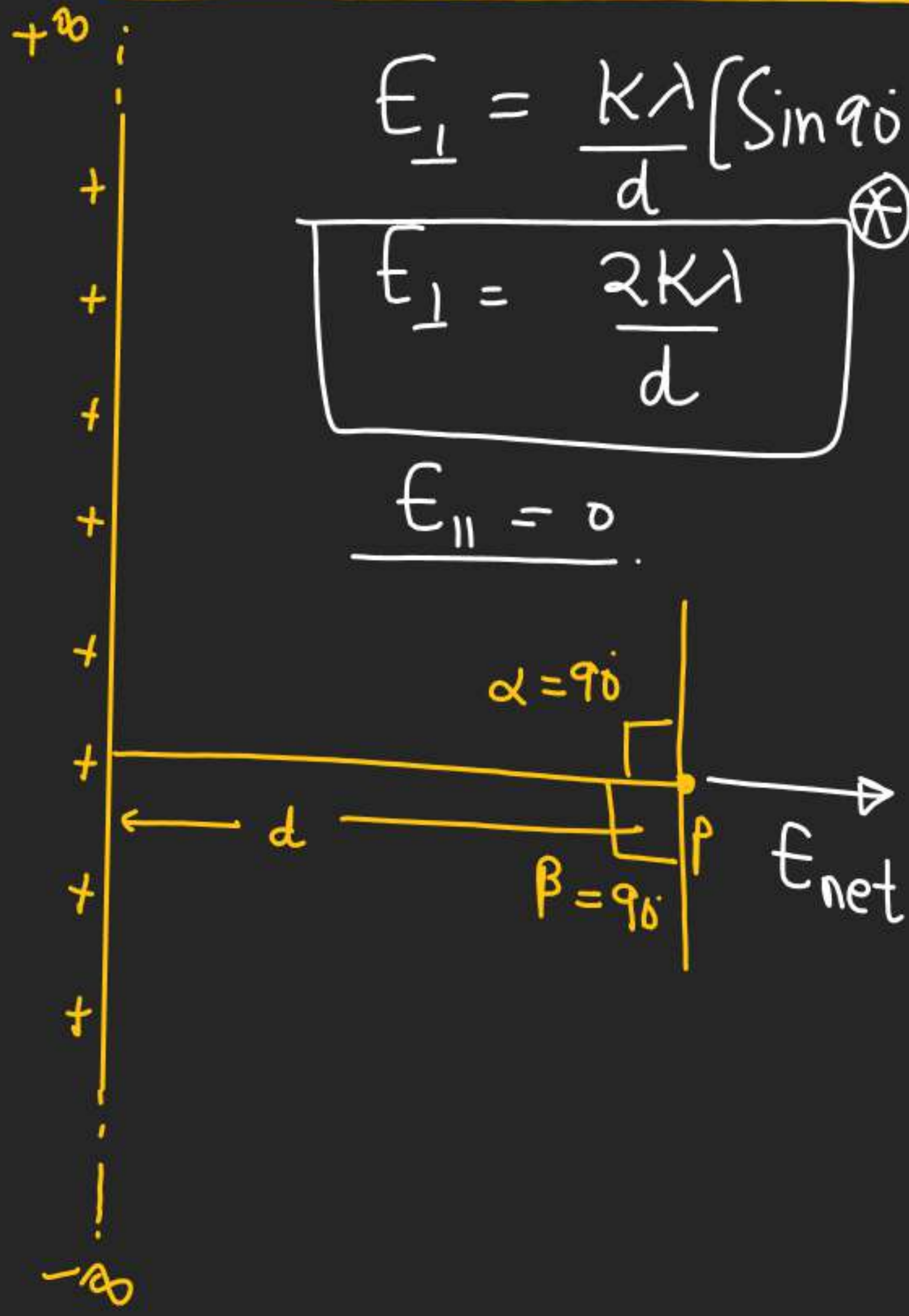
Nishant Jindal

ELECTROSTATICS

(*) Electric field due to infinte line charge:-

L >> d
↓
length of line charge

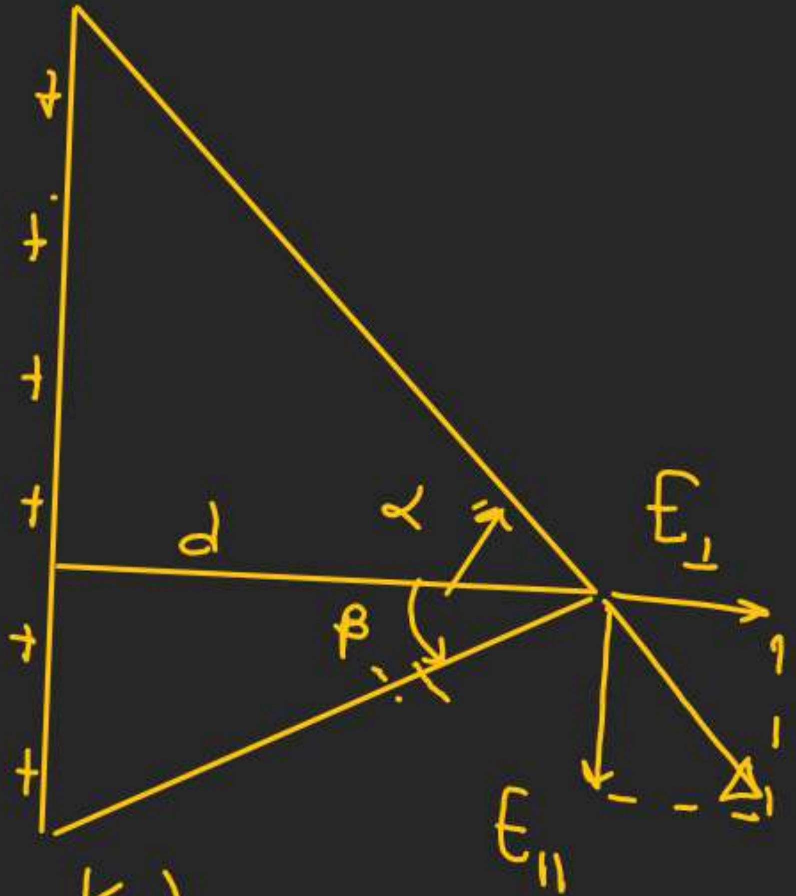


$$E_\perp = \frac{K\lambda}{d}\left[\sin 90° + \sin 90°\right]$$

$$\boxed{E_\perp = \frac{2K\lambda}{d}}$$ (*)

$$E_\parallel = 0$$

$$E_{net} = E_\perp = \frac{2K\lambda}{d}$$



$$E_\perp = \frac{K\lambda}{d}\left[\sin\alpha + \sin\beta\right]$$

$$E_\parallel = \frac{K\lambda}{d}\left[\cos\beta - \cos\alpha\right]$$

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Electric field due to Semiinfinite wire :-

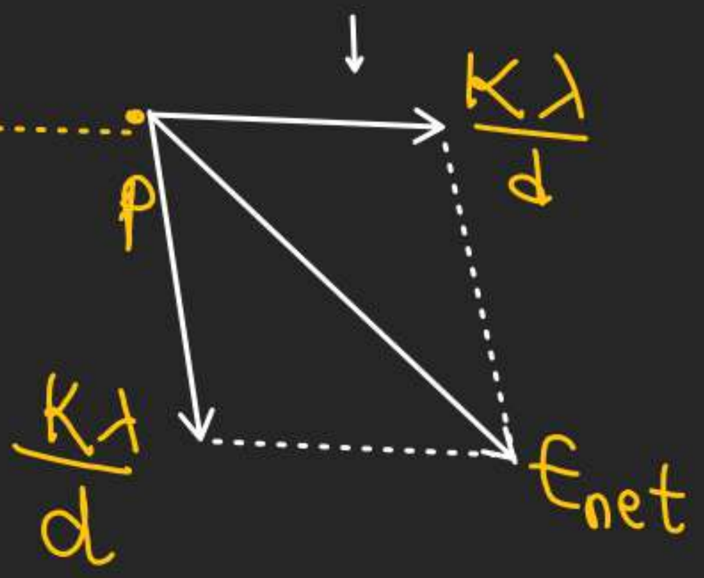
$\alpha = 90^\circ$

$\beta = 0^\circ$

$$E_\perp = \frac{K\lambda}{d}\left[\sin 90^\circ + \sin 0\right]$$

$$E_\perp = \frac{K\lambda}{d}$$

$$E_{\parallel} = \frac{K\lambda}{d}\left[\cos 0^\circ - \cos 90^\circ\right] = \frac{K\lambda}{d}$$



$$E_{net} = \sqrt{\left(\frac{K\lambda}{d}\right)^2 + \left(\frac{K\lambda}{d}\right)^2}$$

$$= \sqrt{2}\left(\frac{K\lambda}{d}\right)$$

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$l = R\theta$

$\lambda = \lambda_0 \cos\theta$

(8) Electric field due to an uniformly charged arc at its Center :-

$$E_{net} = \int_{-\theta/2}^{+\theta/2} dE \cos\phi$$

$$dE = \frac{K\,dq}{R^2}$$

$$dq = \lambda R\, d\phi$$

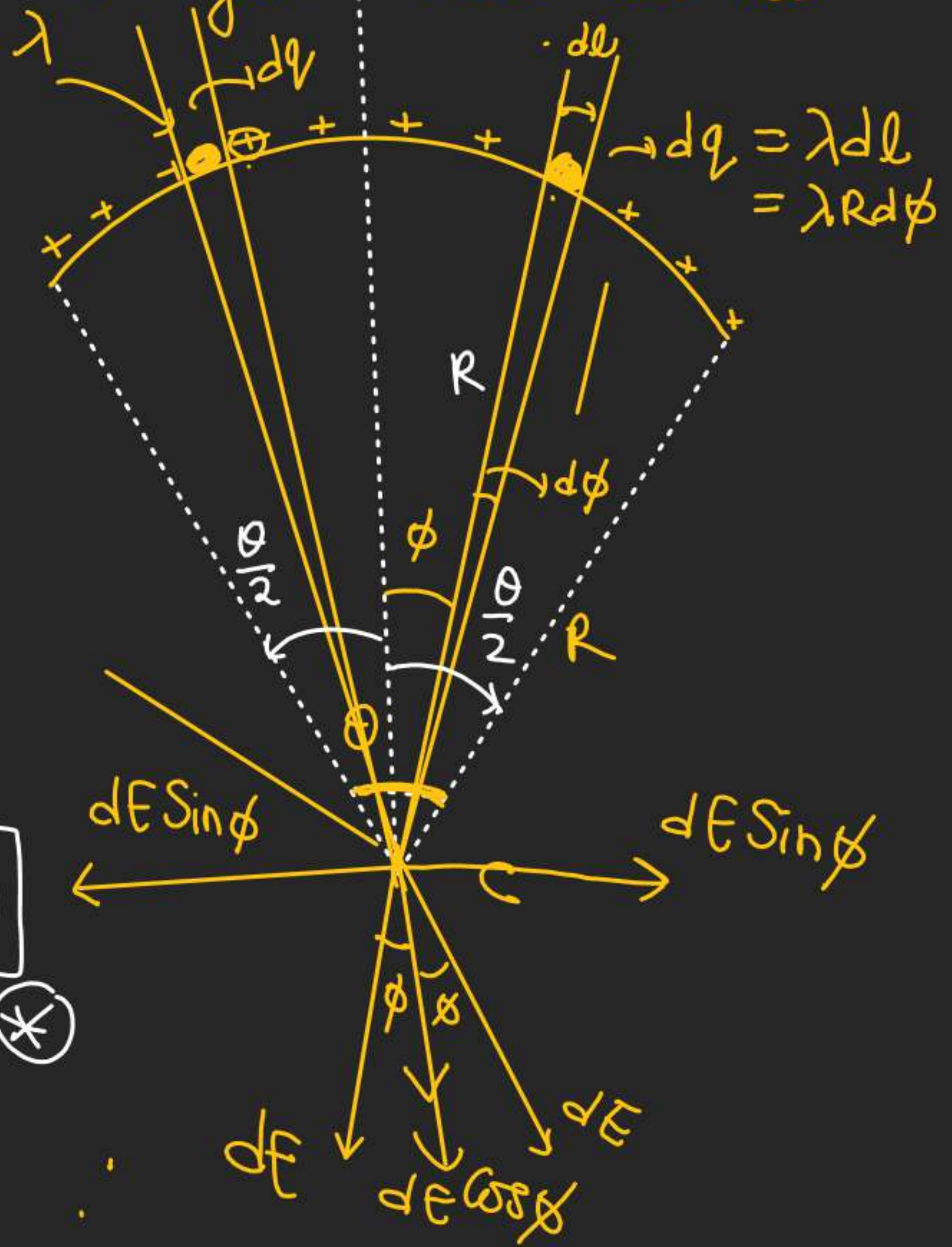
$$dE = \frac{K}{R^2}(\lambda R\, d\phi)$$

$$dE = \left(\frac{K\lambda}{R}\, d\phi\right)$$

$$E_{net} = \frac{K\lambda}{R}\int_{-\theta/2}^{+\theta/2} \cos\phi\, d\phi$$

$$= \frac{K\lambda}{R}\left[\sin\phi\right]_{-\theta/2}^{+\theta/2} = \frac{K\lambda}{R}\left[\sin\frac{\theta}{2} - \sin\left(-\frac{\theta}{2}\right)\right]$$

$$\boxed{E_{net} = \frac{2K\lambda}{R}\sin\left(\frac{\theta}{2}\right)}$$



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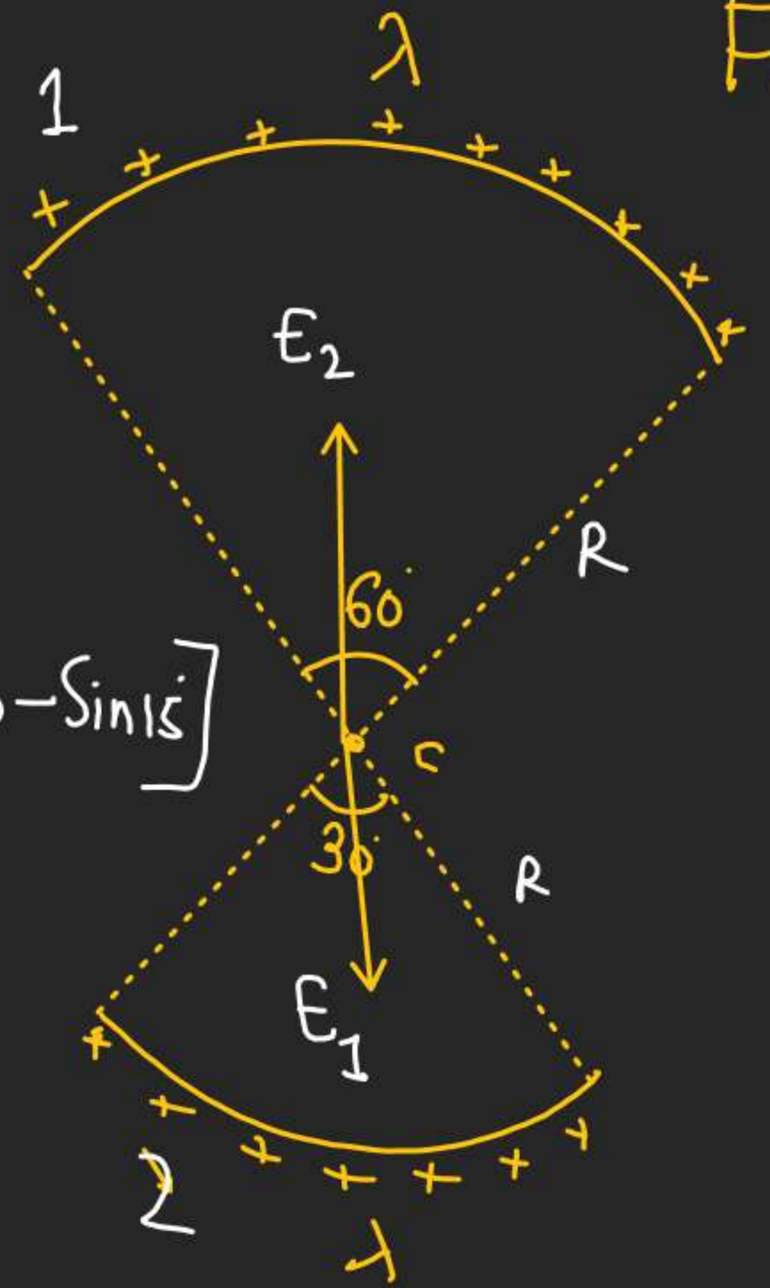
$$\boxed{E = \frac{2K\lambda}{R}\sin\left(\frac{\theta}{2}\right)}$$

Electric field due to an arc at its Center.

Find Electric field at c.



$$E_{net} = \frac{2K\lambda}{R}\left[\sin 30^\circ - \sin 15^\circ\right]$$

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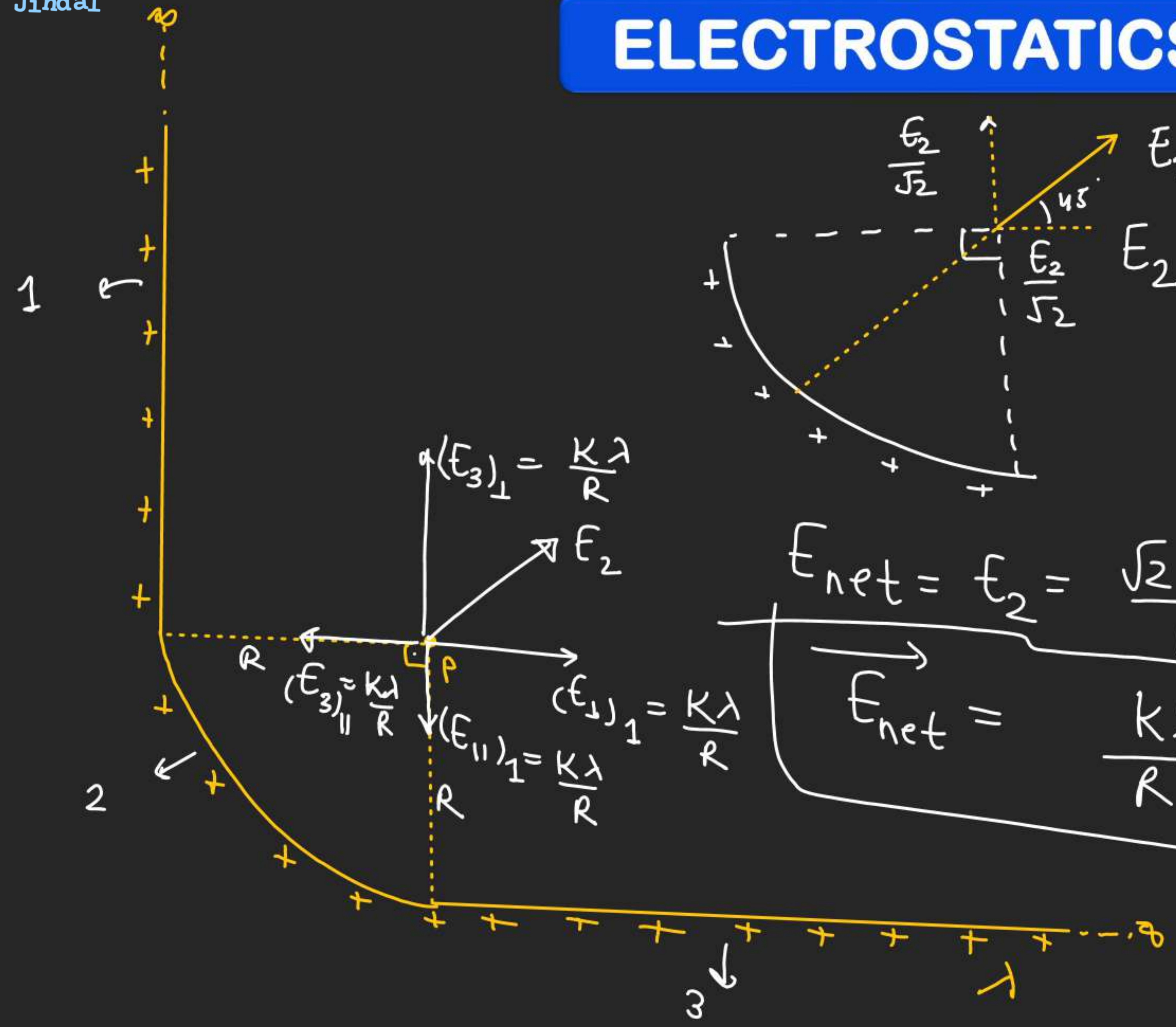

$$E_2 = \frac{2K\lambda}{R}\sin\left(\frac{90^\circ}{2}\right)$$

$$E_2 = \frac{2K\lambda}{R} \times \frac{1}{\sqrt{2}}$$

$$= \frac{\sqrt{2}\,K\lambda}{R}$$

$$E_{net} = E_2 = \frac{\sqrt{2}\,K\lambda}{R}$$

$$\boxed{\vec{E}_{net} = \frac{K\lambda}{R}\left(\hat{i} + \hat{j}\right)}$$

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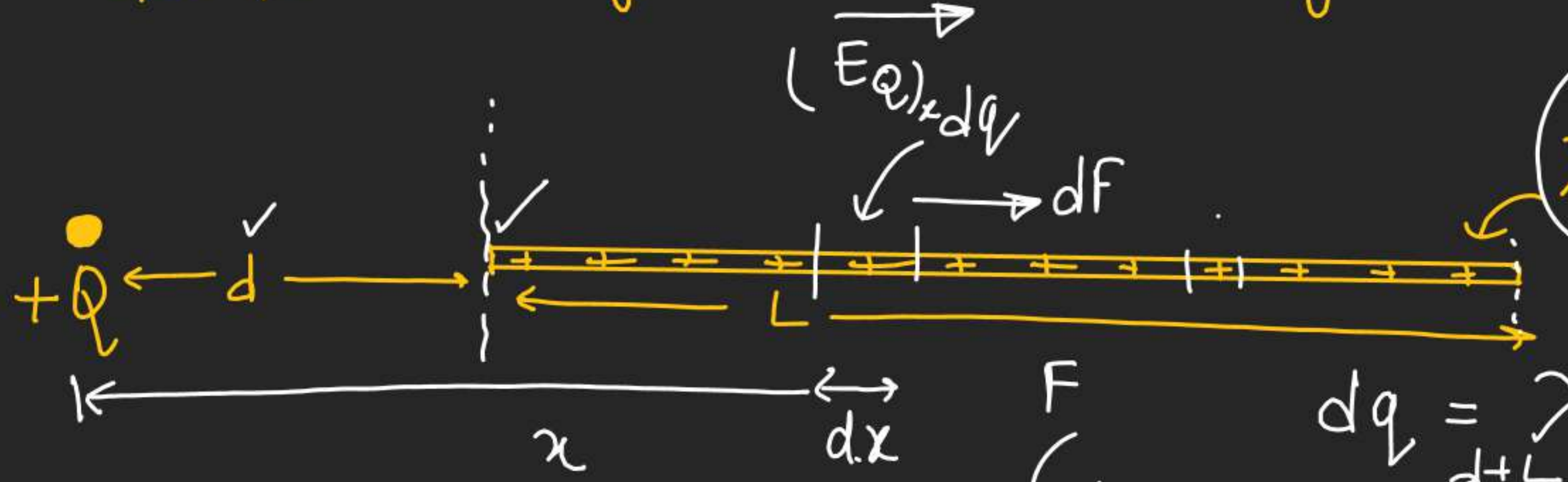
$$\vec{F} = q\vec{E}$$

Force acting b/w point charge and line charge.



$$dF = dq\cdot(E_Q)_x$$

$$dF = (\lambda dx)\frac{KQ}{x^2}$$

$$dq = \lambda dx$$

$$\int_0^F dF = K\lambda Q\int_d^{d+L}\frac{dx}{x^2}$$

$$F_{net} = K\lambda Q\left[-\frac{1}{x}\right]_d^{d+L}$$

$$F_{net} = K\lambda Q\left[\frac{-1}{(d+L)}+\frac{1}{d}\right]$$

$$\boxed{F_{net} = K\lambda Q\left[\frac{1}{d}-\frac{1}{(d+L)}\right]}$$

F

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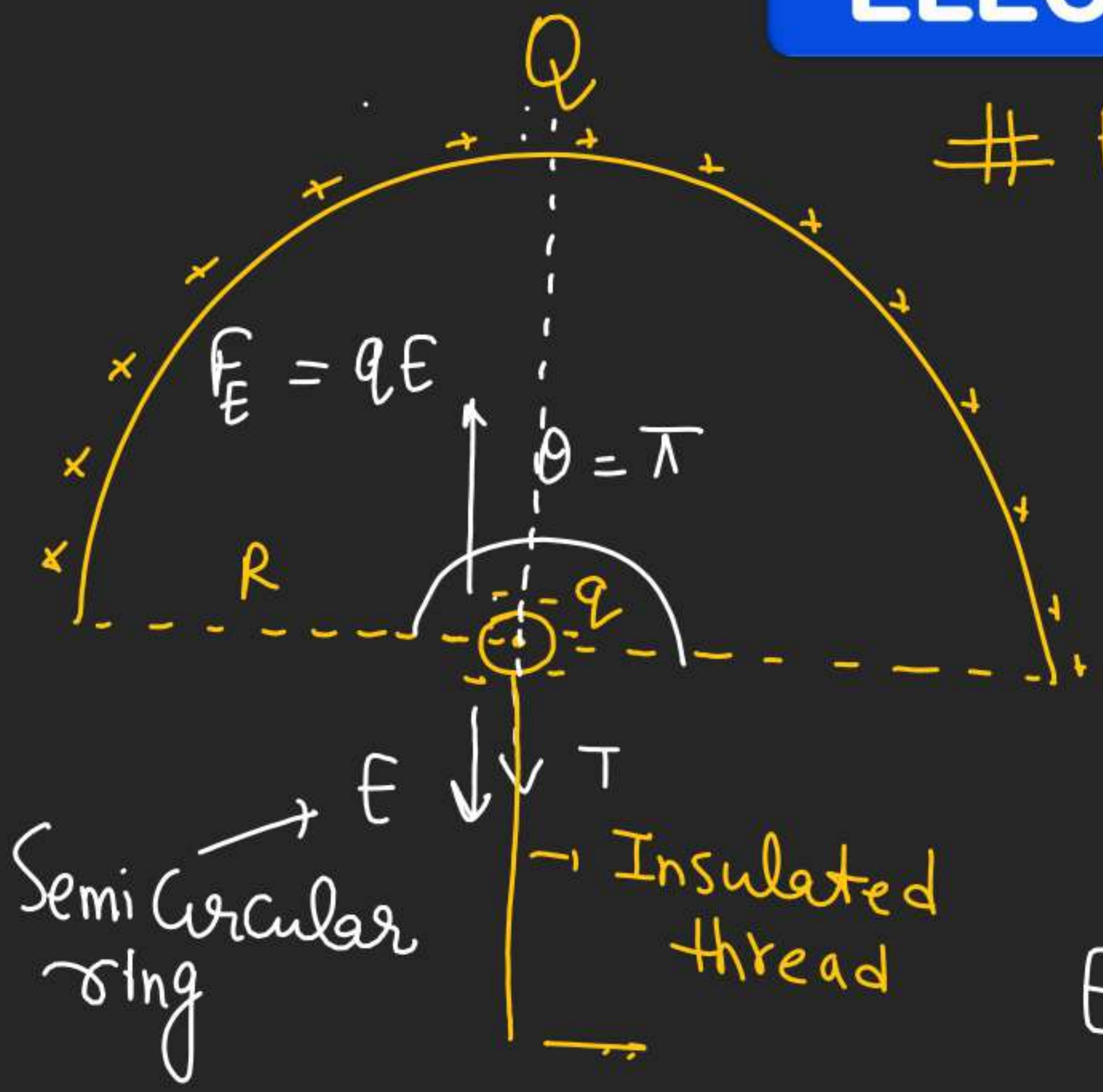
ELECTROSTATICS

\# Find the tension in the string gravity neglected.

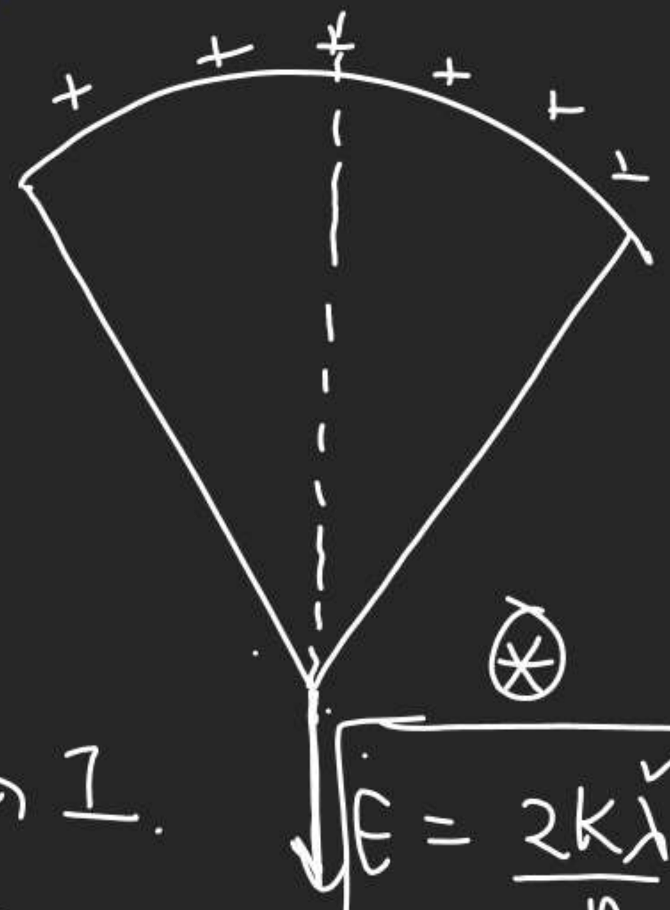


$$\vec{F} = q\vec{E}$$

$$\vec{F} = -q\vec{E}$$

$$\lambda = \left(\frac{Q}{\pi R}\right)$$

$$E = \frac{2K}{R}\left(\frac{Q}{\pi R}\right)\sin\left(\frac{\pi}{2}\right) \rightarrow 1.$$



$$\boxed{E = \frac{2K\lambda}{R}\sin\left(\frac{\theta}{2}\right)}$$

$$T = qE = \frac{2KQq}{\pi R^2} \qquad E = \frac{2KQ}{\pi R^2}$$

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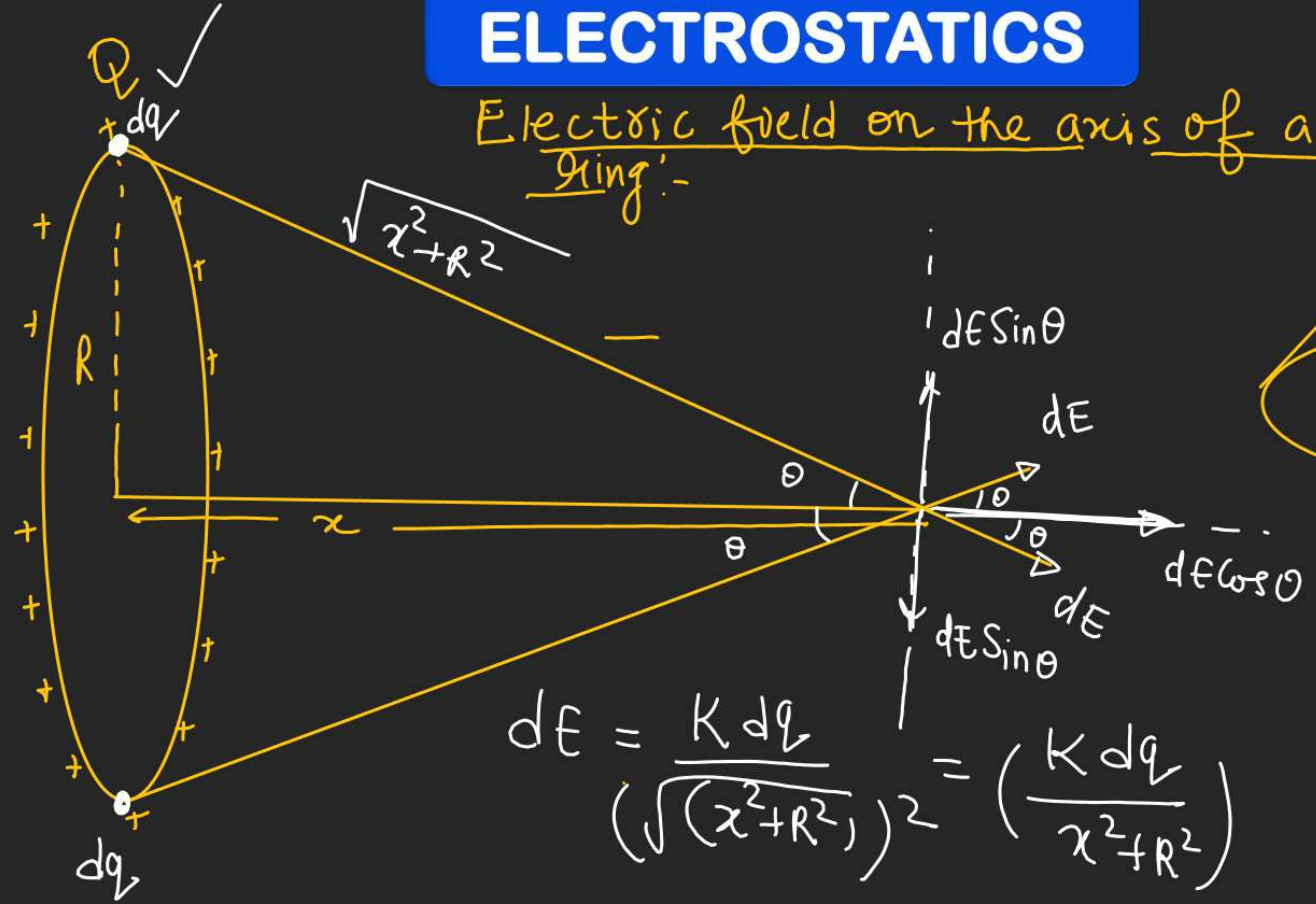
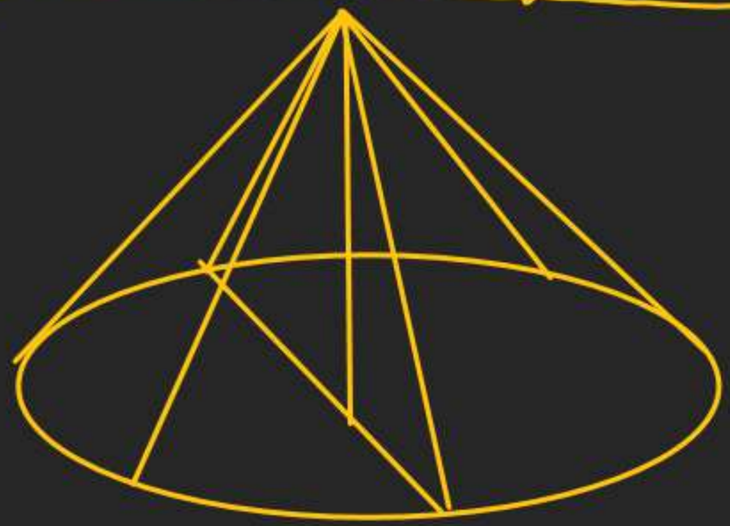
ELECTROSTATICS

Electric field on the axis of a Uniformly charge Ring :-



$$dE = \frac{K\,dq}{\left(\sqrt{(x^2+R^2)}\right)^2} = \left(\frac{K\,dq}{x^2+R^2}\right)$$



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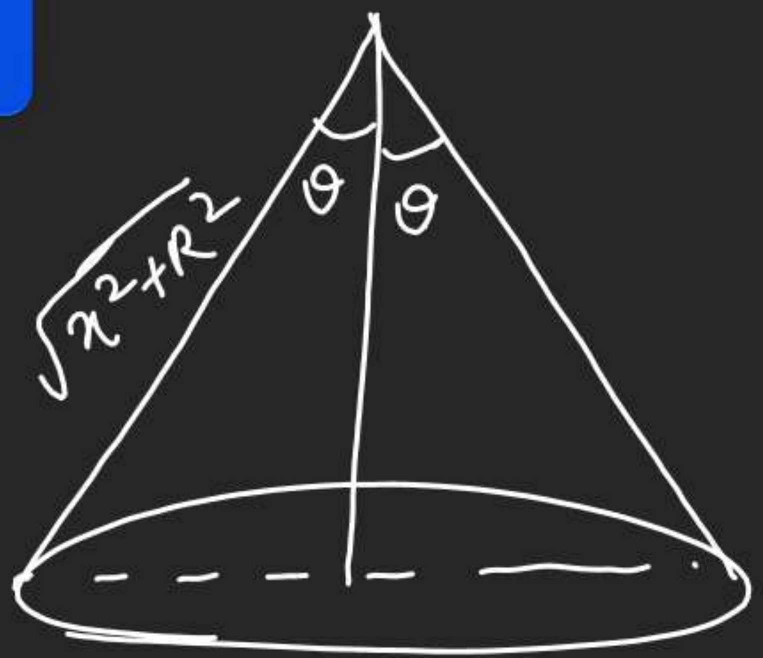
$$dE = \frac{K\,dq}{x^2+R^2}$$

$$\cos\theta = \frac{x}{\sqrt{x^2+R^2}}$$



$$E_{net} = \int dE\cos\theta = \frac{Kx}{(x^2+R^2)^{3/2}}\int_0^Q dq$$

$$\boxed{E_{net} = \frac{KQ\,x}{(x^2+R^2)^{3/2}}}$$

↳ H.W. for $x = ??$ E_{max} ✓