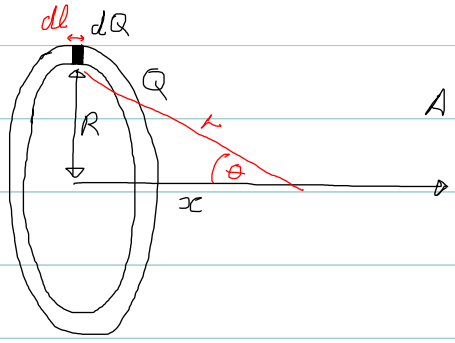

A VERY THIN RING OF RADIUS R CARRIES A TOTAL CHARGE OF Q. THE AXIS OUT FROM THE CENTER OF THE RING PERPENDICULAR TO THE RADIUS IS THE x-AXIS (AS DRAWN TO THE LEFT)

(1) WHAT IS THE ELECTRIC FIELD A DISTANCE x ALONG THE x-AXIS? (2) WHAT IS THE ELECTRIC POTENTIAL A DISTANCE x ALONG THE x-AXIS?

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(1) THE ELECTRIC FIELD

(a) THIS IS A CONTINUOUS CHARGE PROBLEM. WRITE DOWN Q, THE TOTAL CHARGE IN TERMS OF λ, THE ONE-D CHARGE DENSITY (NOTE THAT THE RING IS VERY THIN SO THE CHARGE DENSITY IS ONE-D BECAUSE THE CHARGE IS SPREAD OVER THE RING CIRCUMFERENCE, $2\pi R$)

(b) WRITE DOWN THE MAGNITUDE OF THE ELECTRIC FIELD (c) WRITE DOWN E_x, THE COMPONENT OF THE E-FIELD IN THE x-DIRECTION (THIS WILL DEPEND ON SOME $\cos\theta = \frac{x}{L}$) (d) THE E-FIELD DEPENDS ON INTEGRATING INFINITESIMAL CHARGE dQ AROUND THE RING. RELATE dE_x TO dQ TO λdl AND INTEGRATE dE_x AROUND THE RING TO FIND E_x

(e) DON'T FORGET TO INDICATE THE DIRECTION OF THE E-FIELD IN YOUR FINAL ANSWER!

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(2) THE ELECTRIC POTENTIAL

BY DEFINITION, $V = \int \vec{E} \cdot d\vec{l} = \int E_x dx$, SO USE YOUR EXPRESSION FOR E_x FROM (1) TO FIND $V(x)$

THE CONVENTION, ALTHOUGH NOT REQUESTED IN THIS QUESTION, WOULD BE TO SET $V = 0$ AT ∞. THEN $V = \int_x^\infty \vec{E} \cdot d\vec{l} = \int_x^\infty E_x dx$