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Assignment #11 7.4.2
http://people.tamu.edu/~rsm4368/math311/7_4_2.pdf

7.4.2) Write down an integral formula for the flux of an electric field through the can in the previous example. Consider the unspecified field $E(\vec{r})$.

$$\text{Flux} = \iint_S \vec{E}(\vec{r})\cdot d\vec{S} = \iint_S (\vec{E}(\vec{r})\cdot\hat{n})dS$$

$$\text{Where } \hat{n} = \frac{\vec{r}}{\|\vec{r}\|} = \hat{r}$$

And we know that for a cylinder of radius R, $dS = Rd\theta dz$, therefore:

$$\text{Flux} = 4\int_0^{15}\int_0^{2\pi}\vec{E}(\vec{r})\cdot\hat{r}d\theta dz + \int_0^{4}\int_0^{2\pi}\vec{E}(\vec{r})\cdot\hat{k}d\theta dr + \int_0^{4}\int_0^{2\pi}\vec{E}(\vec{r})\cdot -\hat{k}d\theta dr$$

The last two integrals account for the top and bottom of the cylinder. E(r) in these two needs to be evaluated at the points of z = 0 (for k) and z = 15 (for –k).