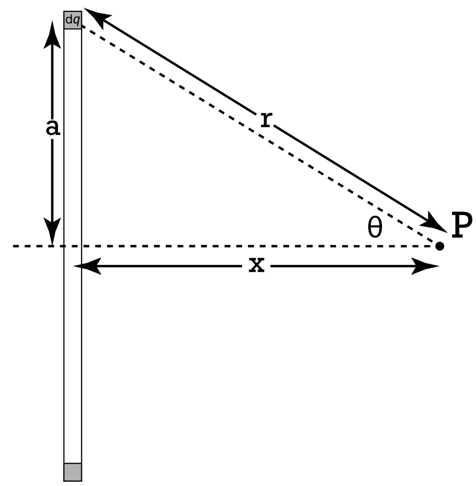
Flipping Physics Lecture Notes:
Thin Ring Electric Field using Electric Potential
http://www.flippingphysics.com/thin-ring-electric-potential.html

Because electric potential and electric potential energy are scalar values, determining those values for multiple particles uses superposition. You just add all the values together.



In order to understand how useful it is that electric potential is a scalar and not a vector, let's revisit an example from before.[1] Let's determine the electric potential caused by a uniformly charged, thin ring of charge +Q, with radius a, at point P, which is located on the axis of the ring a distance x from the center of the ring.

Because this is a continuous charge distribution, we need to break the uniformly charged thin ring of charge +Q into an infinite number of infinitesimally small charges, dQ.

$$V_{\text{point charge}}=\frac{kq}{r}\Rightarrow V_{\text{continuous charge distribution}}=\int\left(\frac{k}{r}\right)\mathrm{d}q=\frac{k}{r}\int\mathrm{d}q=\frac{kQ}{r}\Rightarrow V_P=\frac{kQ}{\sqrt{a^2+x^2}}$$

And from there we can determine the electric field at point P.

$$E_r=-\frac{\mathrm{d}V}{\mathrm{d}r}=-\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{kQ}{\sqrt{a^2+x^2}}\right)=-kQ\frac{\mathrm{d}}{\mathrm{d}x}\left(a^2+x^2\right)^{-\frac{1}{2}}=-kQ\left(-\frac{1}{2}\right)\left(a^2+x^2\right)^{-\frac{3}{2}}(2x)$$

$$\Rightarrow E_P=\frac{kQx}{\left(a^2+x^2\right)^{\frac{3}{2}}}$$

Notice that this derivation of the electric field at point P is much easier than deriving the electric field directly like we did before. Therefore, I would recommend that you remember that, for a continuous charge distribution, you can first determine the electric potential and then the electric field, and that is often easier than solving for the electric field directly.

[1] Thin Ring Electric Field - http://www.flippingphysics.com/thin-ring-electric-field.html