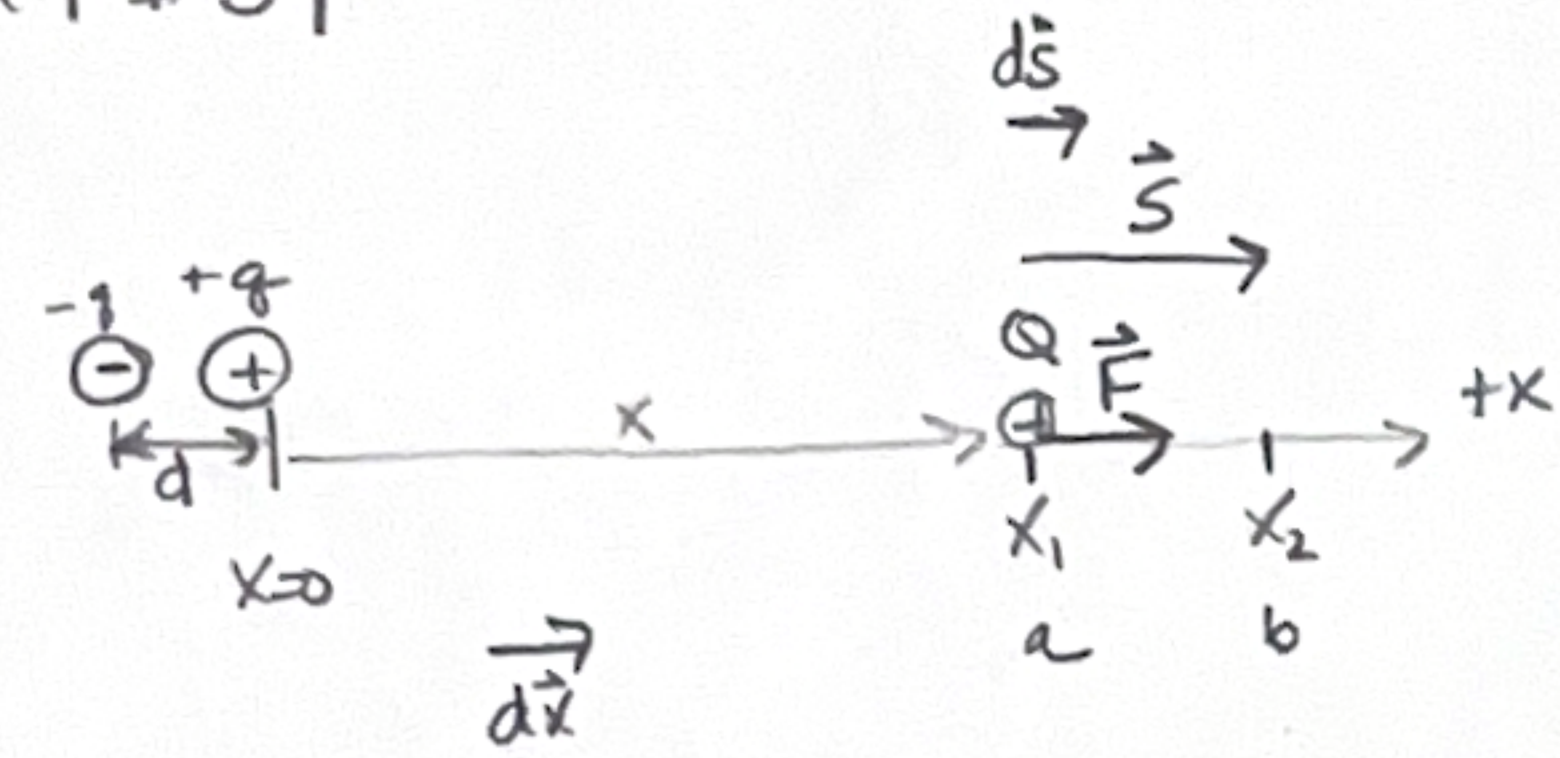
Ch9 #54



$$F = \frac{kqQd}{x^3}$$

$$W = \int_a^b \vec{F} \cdot d\vec{s}$$

$$W = \int_a^b F ds \cos\theta$$

$$W = \int_a^b \left(\frac{kqQd}{x^3}\right)(ds)\cos 0$$ $\theta = 0$ because $\vec{F}$ and $d\vec{s}$ point in same direction

$$W = \int_a^b \left(\frac{kqQd}{x^3}\right) ds$$

$$W = kqQd \int_{x_i}^{x_f} \left(\frac{1}{x^3}\right) dx$$ converted to all x-variables. Put constants out front.

$$W = kqQd \int_{x_i}^{x_f} x^{-3} dx$$ rewrote $\frac{1}{x^3}$ as x^{-3} to make it easier to think about integral

$$W = kqQd \left(\frac{1}{-3+1} x^{-3+1}\right)\Big|_{x_i}^{x_f}$$ integrated x^{-3} with respect to x

$$W = kqQd \left[\frac{x^{-2}}{-2}\right]\Big|_{x_i}^{x_f}$$ simplified the result

$$W = -\frac{kqQd}{2}\left(\frac{1}{x^2}\right)\Big|_{x_i}^{x_f}$$ put the negative and the 2 out front

$$W = -\frac{kqQd}{2}\left(\frac{1}{x_f^2} - \frac{1}{x_i^2}\right)$$ evaluated $\frac{1}{x^2}$ at x_f and x_i

$$\boxed{W = \frac{kqQd}{2}\left(\frac{1}{x_i^2} - \frac{1}{x_f^2}\right)}$$ distributed the negative

(I used x_i and x_f instead of x_1 and x_2)