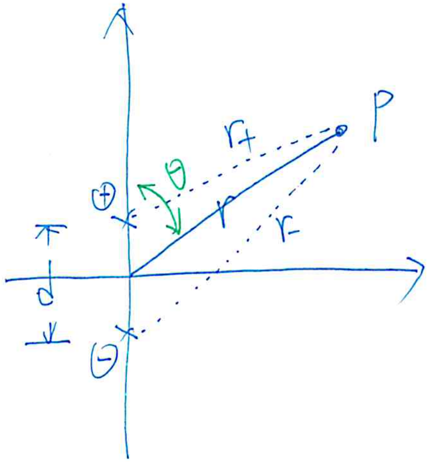

$$r_+ \cong r - \frac{d}{2}\cos\theta \qquad r_- \cong r + \frac{d}{2}\cos\theta$$

$\because$ we assume

$r >> d$

$$\frac{1}{r_+} \cong \left(r - \frac{d}{2}\cos\theta\right)^{-1} \qquad \frac{1}{r_-} \cong \left(r + \frac{d}{2}\cos\theta\right)^{-1}$$

$$= \frac{1}{r}\left(1 - \frac{d}{2r}\cos\theta\right)^{-1} \qquad = \frac{1}{r}\left(1 + \frac{d}{2r}\cos\theta\right)^{-1}$$

$$\cong \frac{1}{r}\left(1 + \frac{d}{2r}\cos\theta\right) \qquad \cong \frac{1}{r}\left(1 - \frac{d}{2r}\cos\theta\right)$$

$$\phi(P) = \frac{q}{4\pi\epsilon_0}\left(\frac{1}{r_+} - \frac{1}{r_-}\right)$$

$$= \frac{q}{4\pi\epsilon_0} \times \frac{d\cos\theta}{r^2}$$

$$= \frac{\vec{P} \cdot \hat{a}_r}{4\pi\epsilon_0 r^2}$$

$$\left(\frac{1}{r_+} - \frac{1}{r_-}\right) = \cancel{\frac{1}{r}} + \frac{d}{2r^2}\cos\theta - \cancel{\frac{1}{r}} + \frac{d}{2r^2}\cos\theta$$

$$= \frac{d}{r^2}\cos\theta$$