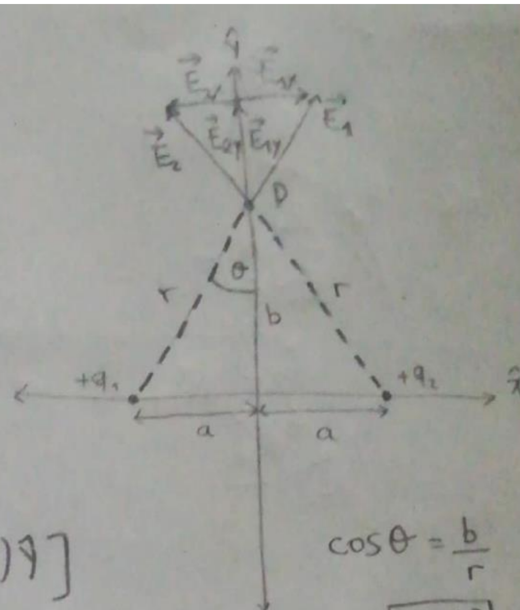
Preguntas descriptivas:

Problema 1.

a) $q_1 = q_2 = +q$



$$\cos\theta = \frac{b}{r}$$

$$r = \sqrt{a^2+b^2}$$

$$\Rightarrow E_1 = E_2 = \frac{k_e q}{r^2}$$

$$\vec{E} = \vec{E}_1 + \vec{E}_2$$

$$\vec{E} = \vec{E}_{1x} + \vec{E}_{1y} + \vec{E}_{2x} + \vec{E}_{2y}$$

$$\vec{E} = E_1 \operatorname{sen}\theta\,\hat{x} + E_1\cos\theta\,\hat{y} - E_2 \operatorname{sen}\theta\,\hat{x} + E_2\cos\theta\,\hat{y}$$

$$\vec{E} = \frac{k_e q}{r^2}\left[(\operatorname{sen}\theta - \operatorname{sen}\theta)\hat{x} + (\cos\theta + \cos\theta)\hat{y}\right]$$

$$\vec{E} = \frac{k_e q}{r^2}(2\cos\theta\,\hat{y})$$

$$\vec{E} = 2\frac{k_e q}{r^2}\frac{b}{r}\hat{y}$$

$$\vec{E} = \frac{2k_e q b}{r^3}\hat{y}$$

$$\vec{E} = \frac{2k_e q b}{(a^2+b^2)^{3/2}}\hat{y}$$

b) $$\vec{F}_{(q/2)} = \frac{q}{2}\vec{E}$$

$$\vec{F}_{(q/2)} = \frac{\cancel{2}k_e q b}{(a^2+b^2)^{3/2}}\frac{q}{\cancel{2}}\hat{y}$$

$$\vec{F}_{(q/2)} = \frac{k_e q^2 b}{(a^2+b^2)^{3/2}}\hat{y}$$

c) Para $b >> a$

$$\vec{E} = \frac{2k_e q b}{(b^2)^{3/2}}\hat{y}$$

$$\vec{E} = \frac{2k_e q b}{b^3}\hat{y}$$

$$\vec{E} = \frac{2k_e q}{b^2}\hat{y}$$

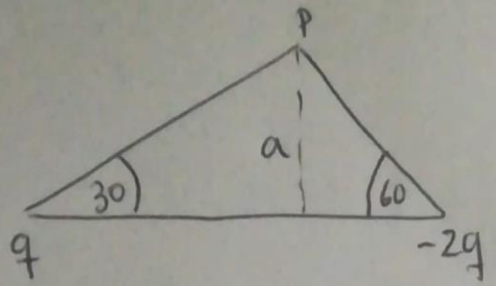
Equivalente al campo generado por una única carga $+2q$ localizada en el origen.

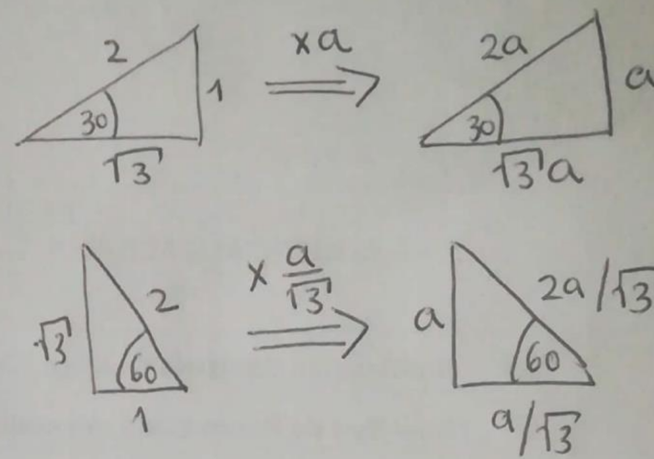
$$\vec{F}_{(q/2)} = \frac{\cancel{2}k_e q}{b^2}\frac{q}{\cancel{2}}\hat{y}$$

$$\vec{F}_{(q/2)} = \frac{k_e q^2}{b^2}\hat{y}$$

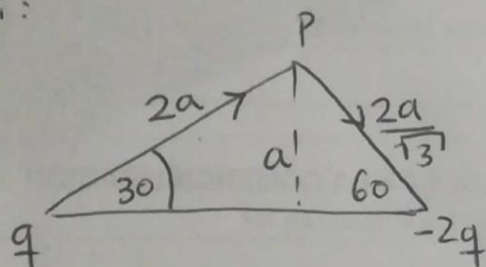
Equivalente a la fuerza entre dos partículas con carga $+q/2$ y $2q$ ó ambas con carga $+q$ localizadas en 'P' y en el origen respectivamente

2.





Asi :



$$E_{(q)} = \frac{k_e\, q}{(2a)^2} = \frac{k_e\, q}{4a^2}$$

$$E_{(-2q)} = \frac{2 k_e\, q}{(2a/\sqrt{3})^2} = \frac{3 k_e\, q}{2a^2}$$

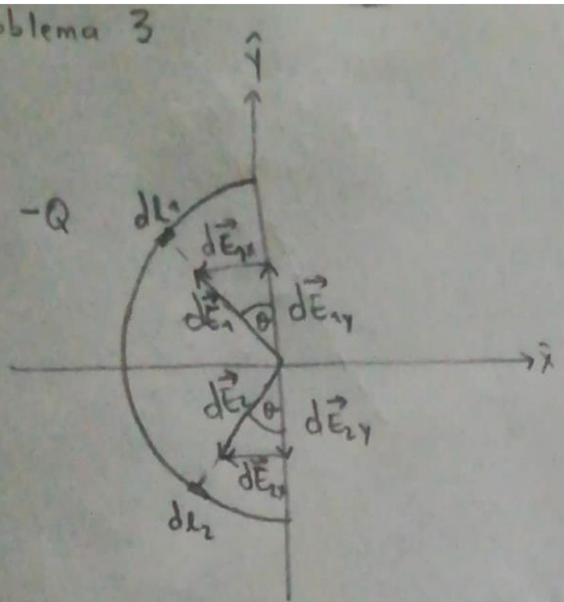
$$\vec{E}_{(q)} = E_{(q)} \cos 30\, \hat{x} + E_{(q)} \operatorname{sen} 30\, \hat{y}$$

$$\vec{E}_{(-2q)} = E_{(-2q)} \cos 60\, \hat{x} - E_{(-2q)} \operatorname{sen} 60\, \hat{y}$$

$$\vec{E}_{Total} = \frac{k_e q}{4a^2} \frac{\sqrt{3}}{2}\, \hat{x} + \frac{3 k_e q}{2a^2} \cdot \frac{1}{2}\, \hat{x} + \frac{k_e q}{4a^2} \cdot \frac{1}{2}\, \hat{y} - \frac{3 k_e q}{2a^2} \frac{\sqrt{3}}{2}\, \hat{y}$$

$$\boxed{\vec{E}_{total} = \frac{k_e\, q}{4a^2} \left[\left(\frac{\sqrt{3}}{2} + 3 \right) \hat{x} + \left(\frac{1}{2} - 3\sqrt{3} \right) \hat{y} \right]}$$

Problema 3



Por simetría las componentes en $\hat{y}$ se anulan y en $\hat{x}$ se suman.

$$d\vec{E} = d\vec{E}_x + d\vec{E}_y$$

$$\int d\vec{E} = \int d\vec{E}_x + \cancel{\int d\vec{E}_y}^{\,0}$$

$$\vec{E} = \int d\vec{E}_x \quad ; \quad d\vec{E}_x = dE\,\text{sen}\theta\,(-\hat{x})$$

$$\Rightarrow \vec{E} = -\int dE\,\text{sen}\theta\,\hat{x} \quad ; \quad dE = \frac{k_e\,dq}{R^2}$$

$$\Rightarrow \vec{E} = -\int \frac{k_e\,dq}{R^2}\,\text{sen}\theta\,\hat{x} \quad ; \quad dq = |\lambda|\,dl$$

$$\Rightarrow \vec{E} = -\int \frac{k_e|\lambda|\,dl}{R^2}\,\text{sen}\theta\,\hat{x} \quad ; \quad \begin{array}{l} l = R\theta \\ dl = R\,d\theta \end{array}$$

$$\Rightarrow \vec{E} = -\int_0^{\pi} \frac{k_e|\lambda|\cancel{R}\,d\theta}{R^{\cancel{2}}}\,\text{sen}\theta\,\hat{x}$$

$$\vec{E} = -\frac{k_e|\lambda|\hat{x}}{R}\int_0^{\pi}\text{sen}\theta\,d\theta$$

$$\vec{E} = \cancel{-}\frac{k_e|\lambda|\hat{x}}{R}\left(\cancel{-}\cos\theta\Big|_0^{\pi}\right) \ , \quad |\lambda| = \frac{Q}{\pi R}$$

$$\vec{E} = \frac{k_e\,Q}{\pi R^2}(\cos\pi - \cos 0)\,\hat{x}$$

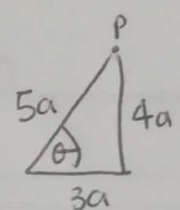
$$\vec{E} = -\frac{2\,k_e\,Q}{\pi R^2}\,\hat{x} \quad \Rightarrow \quad \boxed{E = \frac{2\,k_e\,Q}{\pi R^2}}$$

Selección Múltiple

	1	2	3	4	5	6	7
A	**X**				**X**		**X**
B			**X**	**X**			
C							
D		**X**				**X**	
E							

Pregunta 6.

Por simetría los campos en $\hat{x}$ se cancelan y en $\hat{y}$ se suman



$$\sin\theta = \frac{4a}{5a} = \frac{4}{5}$$

$$\Rightarrow \vec{E} = 2\vec{E}_y$$

$$\vec{E} = 2\,E\,\text{sen}\,\theta\,\hat{y}$$

$$\vec{E} = 2\,\frac{K_e q}{(5a)^2}\cdot\frac{4}{5}\,\hat{y}$$

$$\boxed{\vec{E} = \frac{8\,K_e q}{125\,a^2}\,\hat{y}}$$

Pregunta 7.

$$F_{23} = \frac{3qq\,k_e}{x^2}$$

$$F_{13} = \frac{3q\,q_1\,k_e}{4x^2}$$

$$F_{23} = F_{13} \Rightarrow \frac{\cancel{3}q^{\cancel{2}}\,\cancel{k_e}}{\cancel{x^2}} = \frac{\cancel{3}\cancel{q}q_1\,\cancel{k_e}}{4\cancel{x^2}}$$

$$\boxed{4q = q_1}$$