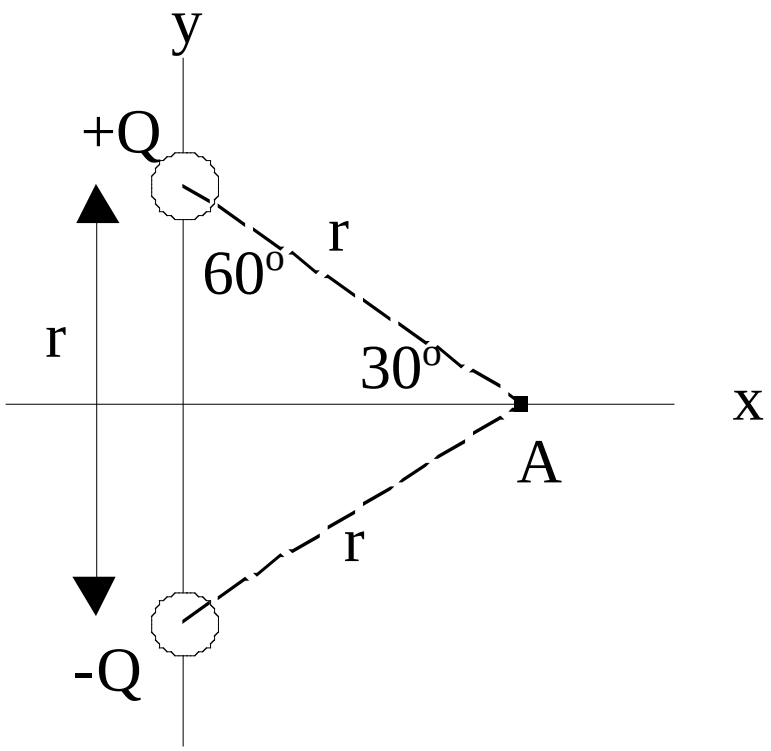
Chapter 1

Mathematical background

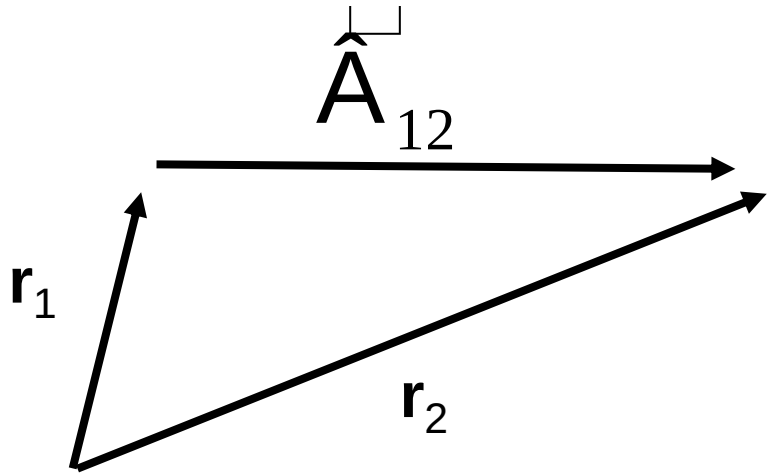
Vector Algebra

Two charges +Q and -Q are fixed a distance r apart. The direction of the force on a test charge -q at A is…

A. Up
B. Down
C. Left
D. Right
E. Some other direction, or F =0



How is the vector $\hat{\vec{A}}_{12}$ related to $\mathbf{r}_1$ and $\mathbf{r}_2$?



A) $\hat{\vec{A}}_{12} = \vec{r}_1 + \vec{r}_2$

B) $\hat{\vec{A}}_{12} = \vec{r}_1 - \vec{r}_2$

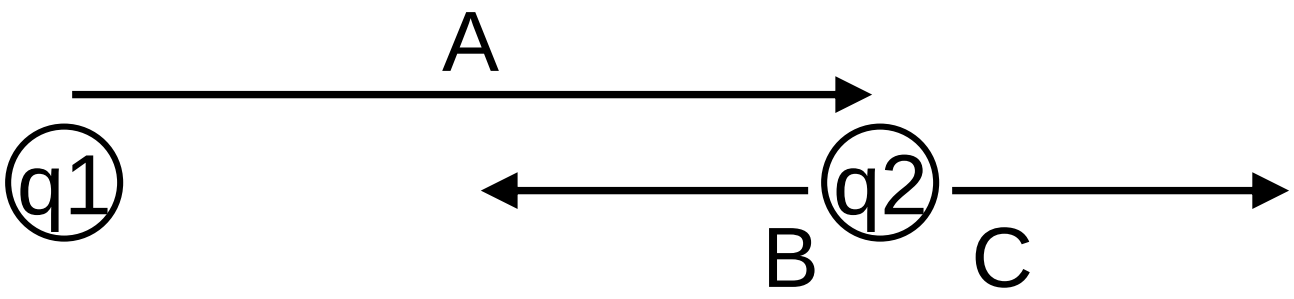
C) $\hat{\vec{A}}_{12} = \vec{r}_2 - \vec{r}_1$

D) None of these

Coulomb's law: $\vec{\mathbf{F}}(\text{by 1 on 2}) = \frac{kq_1q_2}{\hat{A}_{12}^2}\hat{\hat{A}}_{12}$

In the fig, q1 and q2 are 2 m apart.

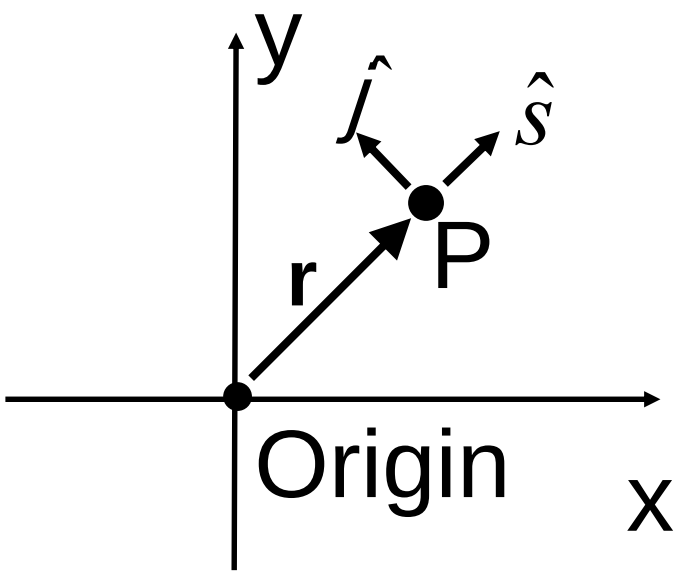
Which arrow *can* represent $\hat{\hat{A}}_{12}$?



D) More than one (or NONE) of the above

E) You can't decide until you know if q1 and q2 are the same or opposite signed charges

In cylindrical (2D) coordinates, what would be the correct description of the position vector **"r"** of the point P shown at (x,y) = (1, 1)



A) $\vec{\mathbf{r}} = \sqrt{2}\ \hat{s}$

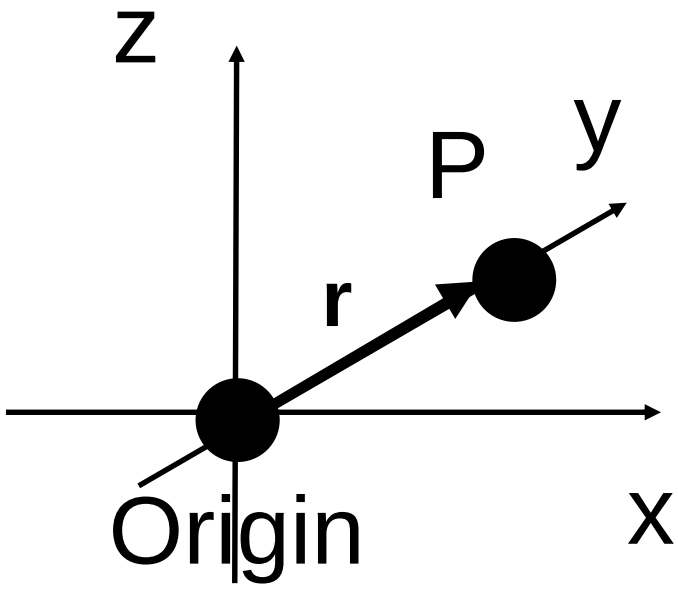
B) $\vec{\mathbf{r}} = \sqrt{2}\ \hat{s} + \pi / 4\, \hat{j}$

C) $\vec{\mathbf{r}} = \sqrt{2}\ \hat{s} - \pi / 4\, \hat{j}$

D) $\vec{\mathbf{r}} = \pi / 4\, \hat{j}$

E) Something else entirely

In spherical coordinates, what would be the correct description of the position vector **"r"** of the point P shown at (x,y,z) = (0, 2 m, 0)



A) $\mathbf{r} = (2\ m)\,\hat{r}$

B) $\mathbf{r} = (2\ m)\,\hat{r} + \pi/2\ \hat{\theta}$

C) $\mathbf{r} = (2\ m)\,\hat{r} + \pi/2\ \hat{\varphi}$

D) $\mathbf{r} = (2\ m)\,\hat{r} + p\,\hat{q} + p/2\,\hat{j}$

E) None of these