

On Wednesday, you took an assessment of electromagnetism concepts.

**How did that assessment feel for you?**

- A. I think it went fine; I felt like I knew most of the answers.
- B. I was concerned about one or two questions; but most of the questions were familiar.
- C. I guessed (or left blank) most of the questions; none of the questions really felt familiar.

Given that we do not have class on Monday (Labor Day holiday), would you be more comfortable turning in this first homework set on Fri. Sept. 8 instead of Wed. Sept. 13?

*(This gives us another lecture on math review before the homework is due.)*

A. Yes

B. No

C. I don't really care either way; I'll finish it by Wednesday anyway

*Week 2's homework will still be assigned Wed. Sept. 6 and due the following Wed. Sept. 13.*

# ANNOUNCEMENTS

- Exams!!!
  - Evening Exams
  - Oct 4 (A149 PSS) and Nov 8 (1415 BPS), 7pm-9pm
- Homework Help Session
  - Monday 4-5pm in 1420 BPS
  - Tuesday 4-5pm in 1300 BPS
- Danny also has open door office hours
  - Mornings are good and Tuesdays

# MATHEMATICAL PRELIMINARIES

$$\nabla \cdot \mathbf{E} = \frac{\rho}{\epsilon_0} \qquad \int \mathbf{E} \cdot d\mathbf{A} = \int \frac{\rho}{\epsilon_0} d\tau$$

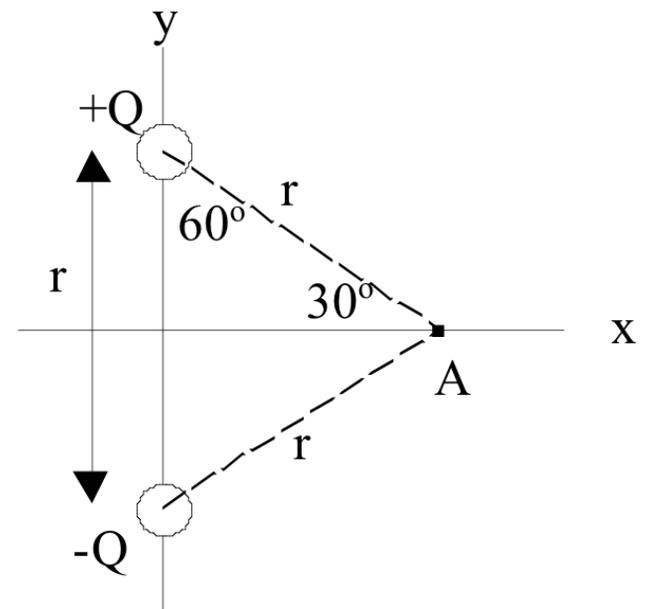
$$\nabla \cdot \mathbf{B} = 0 \qquad \int \mathbf{B} \cdot d\mathbf{A} = 0$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \qquad \int \mathbf{E} \cdot d\mathbf{l} = -\int \frac{\partial \mathbf{B}}{\partial t} \cdot d\mathbf{A}$$

$$\nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \mu_0 \epsilon_0 \frac{\partial \mathbf{E}}{\partial t} \qquad \int \mathbf{B} \cdot d\mathbf{A} = \mu_0 \int \left( \mathbf{J} + \epsilon_0 \frac{\partial \mathbf{E}}{\partial t} \right)$$

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  $F = 0$



In a typical Cartesian coordinate system, vector **A** lies along the  $+\hat{x}$  direction and vector **B** lies along the  $-\hat{y}$  direction.

What is the direction of  $\mathbf{A} \times \mathbf{B}$ ?

- A.  $-\hat{x}$
- B.  $+\hat{y}$
- C.  $+\hat{z}$
- D.  $-\hat{z}$
- E. Can't tell

In a typical Cartesian coordinate system, vector **A** lies along the  $+\hat{x}$  direction and vector **B** lies along the  $-\hat{y}$  direction.

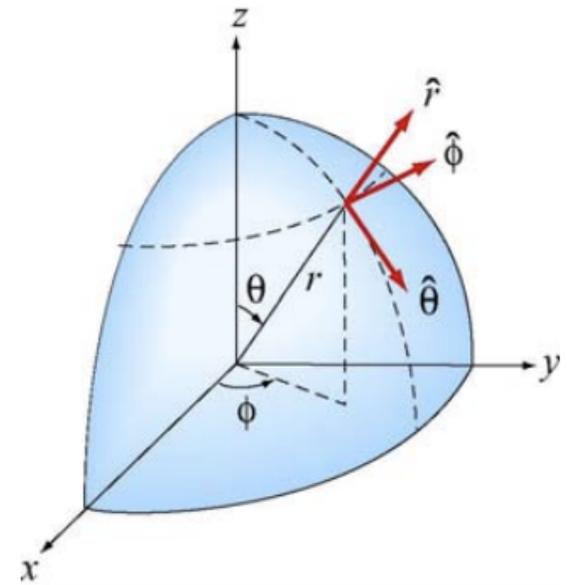
What is the direction of  $\mathbf{B} \times \mathbf{A}$ ?

- A.  $-\hat{x}$
- B.  $+\hat{y}$
- C.  $+\hat{z}$
- D.  $-\hat{z}$
- E. Can't tell

## YOU DERIVE IT

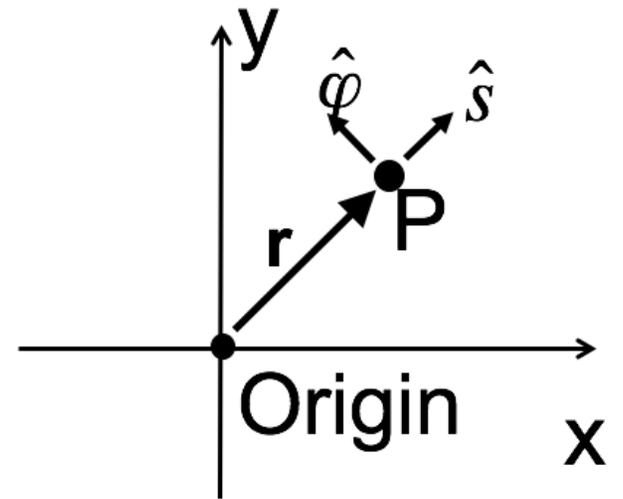
Consider the radial unit vector ( $\hat{r}$ ) in the spherical coordinate system as shown in the figure to the right.

Determine the  $z$  component of this unit vector in the Cartesian  $(x, y, z)$  system as a function of  $r$ ,  $\theta$ ,  $\phi$ .



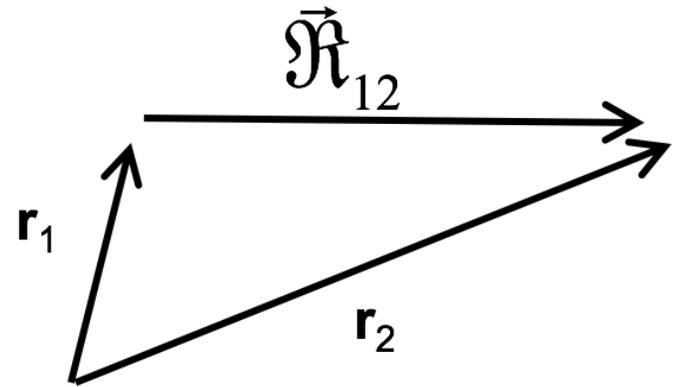
In cylindrical (2D) coordinates, what would be the correct description of the position vector  $\mathbf{r}$  of the point P shown at  $(x, y) = (1, 1)$ ?

- A.  $\mathbf{r} = \sqrt{2}\hat{s}$
- B.  $\mathbf{r} = \sqrt{2}\hat{s} + \pi/4\hat{\phi}$
- C.  $\mathbf{r} = \sqrt{2}\hat{s} - \pi/4\hat{\phi}$
- D.  $\mathbf{r} = \pi/4\hat{\phi}$
- E. Something else entirely

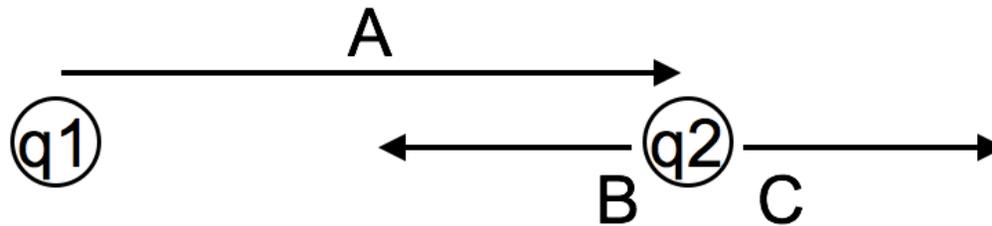


How is the vector  $\mathfrak{R}_{12}$  related to  $\mathbf{r}_1$  and  $\mathbf{r}_2$ ?

- A.  $\mathfrak{R}_{12} = \mathbf{r}_1 + \mathbf{r}_2$
- B.  $\mathfrak{R}_{12} = \mathbf{r}_1 - \mathbf{r}_2$
- C.  $\mathfrak{R}_{12} = \mathbf{r}_2 - \mathbf{r}_1$
- D. None of these



Coulomb's Law:  $\mathbf{F} = \frac{kq_1q_2}{|\mathcal{R}|^2} \hat{\mathcal{R}}$  where  $\mathcal{R}$  is the relative position vector. In the figure,  $q_1$  and  $q_2$  are 2 m apart. Which arrow can represent  $\hat{\mathcal{R}}$ ?



- A. A
- B. B
- C. C
- D. More than one (or NONE) of the above
- E. You can't decide until you know if  $q_1$  and  $q_2$  are the same or opposite charges