4. Find the *x* and *y* components of each electric field vector.

For $\mathbf{E_1}$: $E_{x,1} = 0$ N/C

$E_{y,1} = 3.93 \times 10^5$ N/C

For $\mathbf{E_2}$: $E_{x,2} = (E_2)\ (\cos 53.1°) = (1.80 \times 10^5\ \text{N/C})(\cos 53.1°) = 1.08 \times 10^5$ N/C

$E_{y,2} = -(E_2)\ (\sin 53.1°) = -(1.80 \times 10^5\ \text{N/C})(\sin 53.1°) = -1.44 \times 10^5$ N/C

5. Calculate the total electric field strength in both directions.

$E_{x,tot} = E_{x,1} + E_{x,2} = 0\ \text{N/C} + 1.08 \times 10^5\ \text{N/C} = 1.08 \times 10^5\ \text{N/C}$

$E_{y,tot} = E_{y,1} + E_{y,2} = 3.93 \times 10^5\ \text{N/C} - 1.44 \times 10^5\ \text{N/C} = 2.49 \times 10^5\ \text{N/C}$

6. Use the Pythagorean theorem to find the magnitude of the resultant electric field strength vector.

$$E_{tot} = \sqrt{(E_{x,tot})^2 + (E_{y,tot})^2} = \sqrt{(1.08 \times 10^5\ \text{N/C})^2 + (2.49 \times 10^5\ \text{N/C})^2}$$

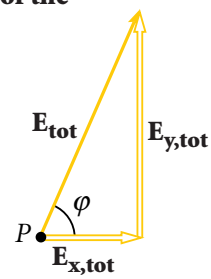
$$\boxed{E_{tot} = 2.71 \times 10^5\ \text{N/C}}$$

7. Use a suitable trigonometric function to find the direction of the resultant electric field strength vector.

In this case, you can use the inverse tangent function:

$$\tan \varphi = \frac{E_{y,tot}}{E_{x,tot}} = \frac{2.49 \times 10^5\ \text{N/C}}{1.08 \times 10^5\ \text{N/C}}$$

$$\boxed{\varphi = 66.6°}$$



8. Evaluate your answer.

The electric field at point *P* is pointing away from the charge q_1, as expected, because q_1 is a positive charge and is larger than the negative charge q_2.

PRACTICE D

Electric Field Strength

1. A charge, $q_1 = 5.00\ \mu$C, is at the origin, and a second charge, $q_2 = -3.00\ \mu$C, is on the *x*-axis 0.800 m from the origin. Find the electric field at a point on the *y*-axis 0.500 m from the origin.
2. A proton and an electron in a hydrogen atom are separated on the average by about 5.3×10^{-11} m. What is the magnitude and direction of the electric field set up by the proton at the position of the electron?
3. An electric field of 2.0×10^4 N/C is directed along the positive *x*-axis.
   a. What is the electric force on an electron in this field?
   b. What is the electric force on a proton in this field?