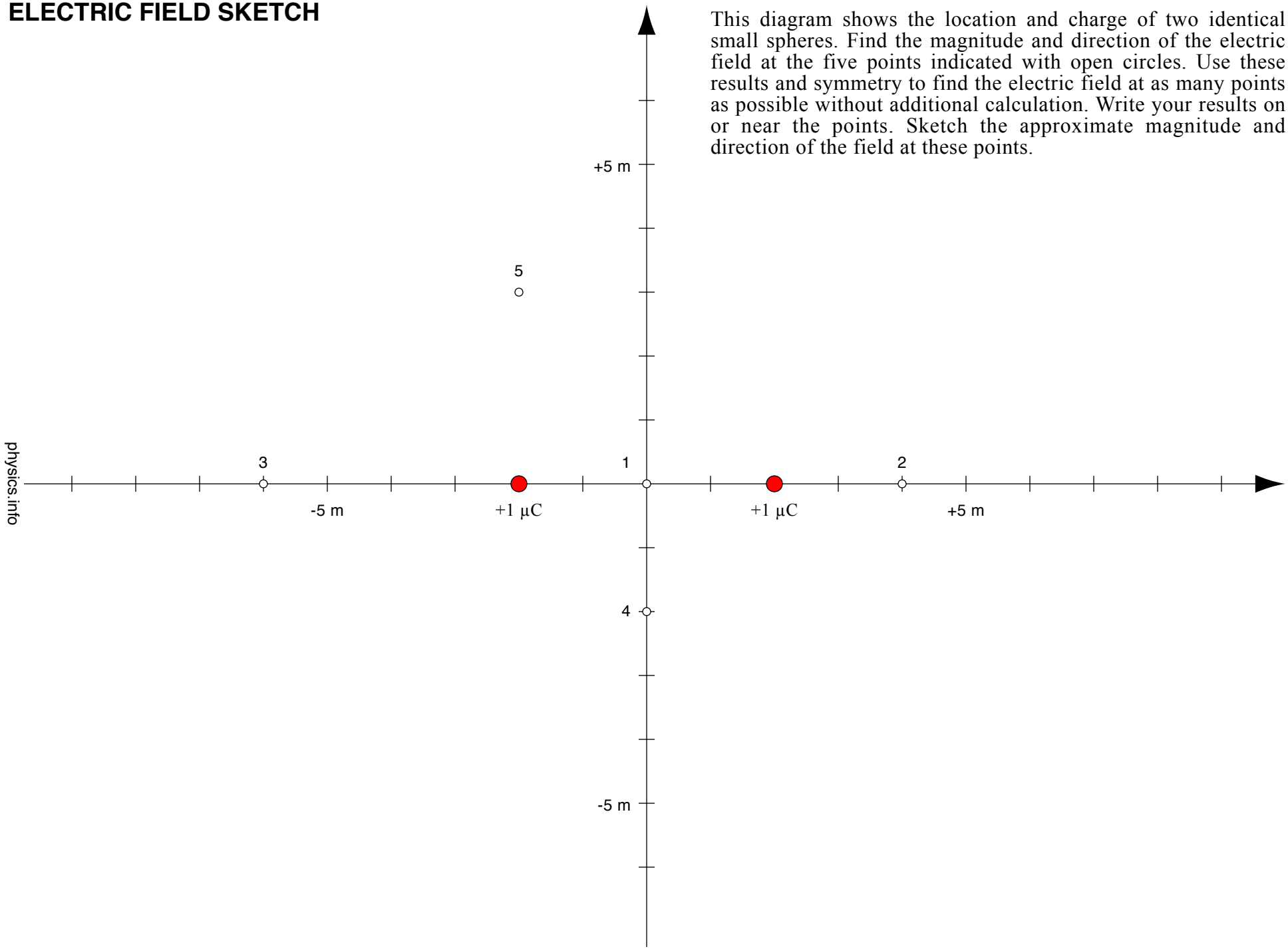
ELECTRIC FIELD SKETCH

This diagram shows the location and charge of two identical small spheres. Find the magnitude and direction of the electric field at the five points indicated with open circles. Use these results and symmetry to find the electric field at as many points as possible without additional calculation. Write your results on or near the points. Sketch the approximate magnitude and direction of the field at these points.



1

$$E = \sum \frac{kq}{r^2} = 0 \text{ N/C}$$

2

$$E = \sum \frac{kq}{r^2} = (9 \times 10^9 \text{ Nm}^2/\text{C}^2)(1 \times 10^{-6} \text{ C})\left[\frac{1}{(6 \text{ m})^2} + \frac{1}{(2 \text{ m})^2}\right] = 2{,}500 \text{ N/C}$$

3

$$E = \sum \frac{kq}{r^2} = (9 \times 10^9 \text{ Nm}^2/\text{C}^2)(1 \times 10^{-6} \text{ C})\left[\frac{1}{(4 \text{ m})^2} + \frac{1}{(8 \text{ m})^2}\right] = 703 \text{ N/C}$$

4

$$E = \sum \frac{kq}{r^2} = (9 \times 10^9 \text{ Nm}^2/\text{C}^2)(1 \times 10^{-6} \text{ C})\left[\frac{1}{(2\sqrt{2} \text{ m})^2}\right]\sqrt{2} = 1{,}590 \text{ N/C}$$

5

$$E_{left} = \frac{kq}{r^2} = \frac{(9\times10^9\ \text{Nm}^2/\text{C}^2)(1\times10^{-6}\ \text{C})}{(3\ \text{m})^2} = 1000\ \text{N/C}$$

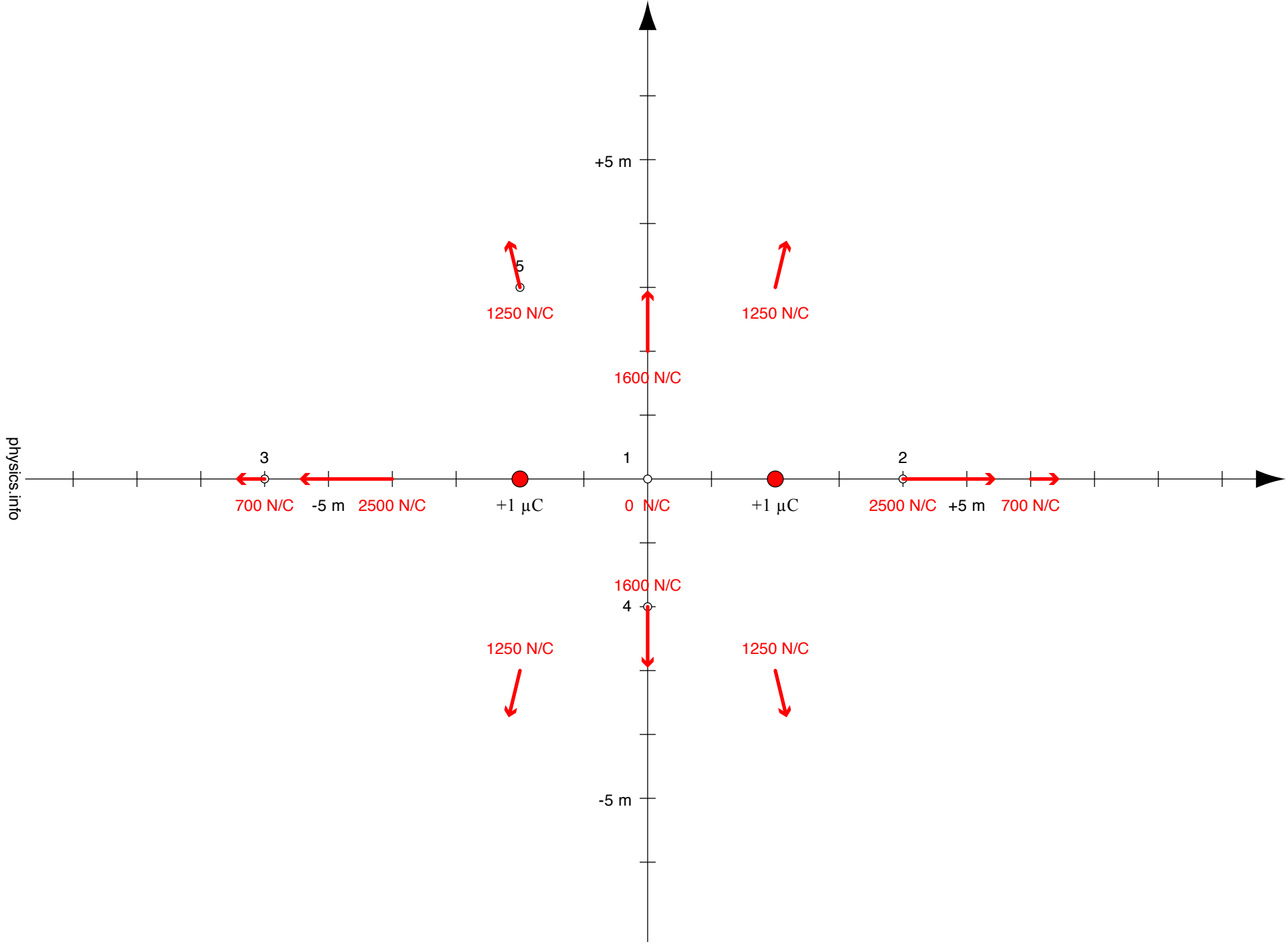
$$E_{left\,x} = E_{left}\cos\theta = (1000\ \text{N/C})(0) = 0\ \text{N/C} \quad E_{left\,y} = E_{left}\sin\theta = (1000\ \text{N/C})(1) = +1000\ \text{N/C}$$

$$E_{right} = \frac{kq}{r^2} = \frac{(9\times10^9\ \text{Nm}^2/\text{C}^2)(1\times10^{-6}\ \text{C})}{(5\ \text{m})^2} = 360\ \text{N/C}$$

$$E_{right\,x} = E_{right}\cos\theta = (360\ \text{N/C})(4/5) = -288\ \text{N/C} \quad E_{right\,y} = E_{right}\sin\theta = (360\ \text{N/C})(3/5) = +216\ \text{N/C}$$

$$E = \sqrt{(E_{left\,x} + E_{right\,x})^2 + (E_{left\,y} + E_{right\,y})^2} = \sqrt{(0\ \text{N/C} - 288\ \text{N/C})^2 + (+1000\ \text{N/C} + 216\ \text{N/C})^2} = 1250\ \text{N/C}$$

$$\tan\theta = \frac{E_{left\,y} + E_{right\,y}}{E_{left\,x} + E_{right\,x}} = \frac{+1000\ \text{N/C} + 216\ \text{N/C}}{0\ \text{N/C} - 288\ \text{N/C}} \quad \theta = 103^\circ$$


+5 m
5
1250 N/C
1250 N/C
1600 N/C
3
1
2
700 N/C
-5 m
2500 N/C
+1 μC
0 N/C
+1 μC
2500 N/C
+5 m
700 N/C
1600 N/C
4
1250 N/C
1250 N/C
-5 m
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