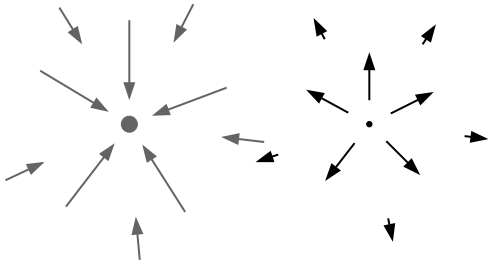
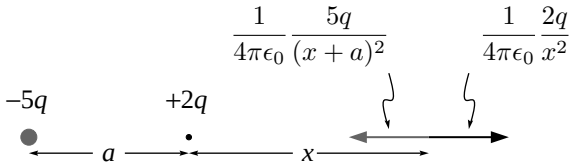
Electric field due to two charges

(a.)



In this sketch, grey lines represent field due to the $-5q$ charge and black lines represent field due to the $+2q$ charge. The sketch makes it clear that the total electric field due to the two sources will cancel only on axis, and to the right of the $+2q$ charge.



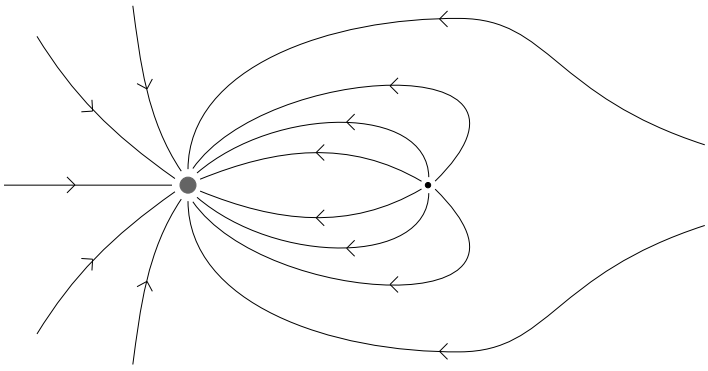
The two fields sum to zero when

$$\frac{5q}{(x+a)^2} = \frac{2q}{x^2} \quad \Longrightarrow \quad \tfrac{5}{2}x^2 = (x+a)^2 \quad \Longrightarrow \quad \pm\sqrt{\tfrac{5}{2}}x = x + a \quad \Longrightarrow \quad \left(\pm\sqrt{\tfrac{5}{2}} - 1\right)x = a$$

or finally (taking the + sign so that $x > 0$, i.e. to the right of the $+2q$ charge)

$$x = \left(\frac{2+\sqrt{10}}{3}\right)a = 1.72\,a.$$

(b.)



Grading: 2 points for qualitative "to right of the $+2q$ charge"; 2 points for using Coulomb's law as in the figure; 2 points for setting the two fields equal; 2 points for solving for x; 2 points for figure.