Quiz 1

Honors Physics

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RULES:

- This is an open-book, open-notes quiz.
- The allowed time for this quiz is approximately 20 minutes.
- Show all your work on these sheets.
- Please print your name in the upper right corner of this sheet.

The figure on the next page shows two identical electric dipoles $\vec{p}$ centered at the origin of coordinates. One is oriented along the x axis and the other along the y axis. What is the force on a point charge $-q$ located at $y = d$? Specify F_x, F_y and $|F|$. You can use k for $1/4\pi\epsilon_0$.

SOLUTION:

The dipole pointing up gives rise to an electric field at $y = d$ that points up and has magnitude $2kp/d^3$. This gives rise to a force on $-q$ that points down. The dipole pointing to the right gives rise to an electric field at $y = d$ that points to the left and has magnitude kp/d^3. The corresponding force on the charge points to the right. Thus:

$$\vec{F} = \frac{kpq}{d^3}\hat{\mathbf{i}} - \frac{2kpq}{d^3}\hat{\mathbf{j}} \tag{1}$$

and $|F| = \sqrt{5}kpq/d^3$

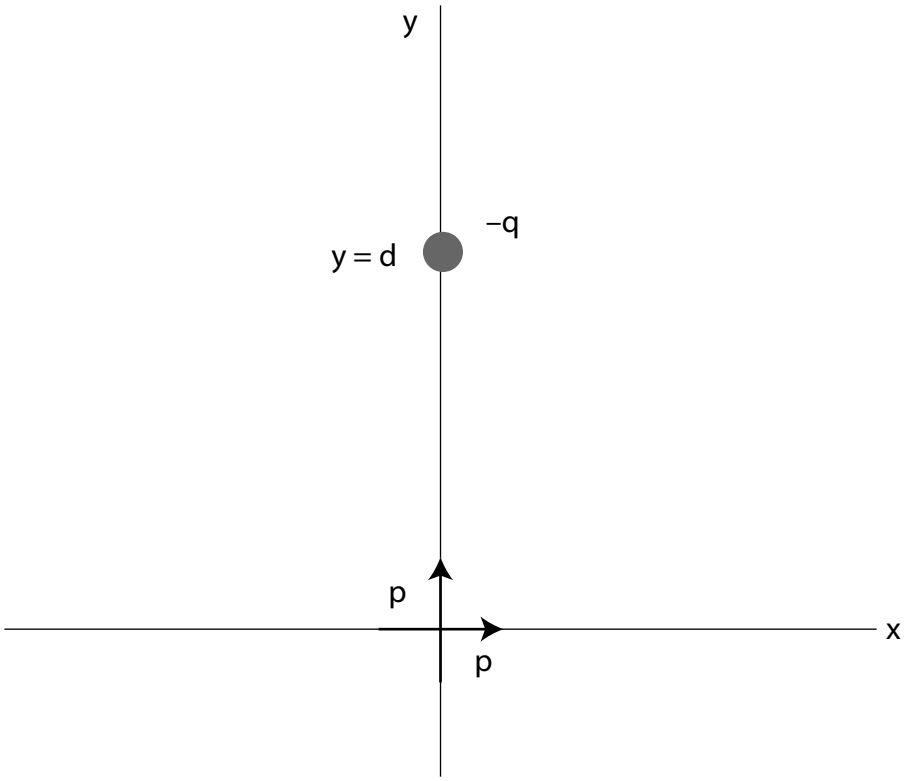

Figure 1: Figure for Quiz 1