PHYS 259 L04: Assignment 2
Marking feedback (general to class)

For class on January 20, 2017

(1)

- We were looking for force on charge "1" (as labled in Fig.1a), so the relevant coulomb's law pairs were between charges 2 and 1, 3 and 1, & 4 and 1. We wanted you to identify the distances between each pair (Fig.1a) *Potential lost marks: wrong lines drawn, only one of several necessary lines drawn, etc.*
- Next was to get r in terms of d. From Fig.1b ,r is the hypotenuse, where:
  $rcos(30) = rsin(60) = d/2$
  $r\sqrt{3}/2 = d/2$
  $r = d/\sqrt{3}$
- *Potential lost marks: answer without support (math, clear drawing), incorrect final expression*

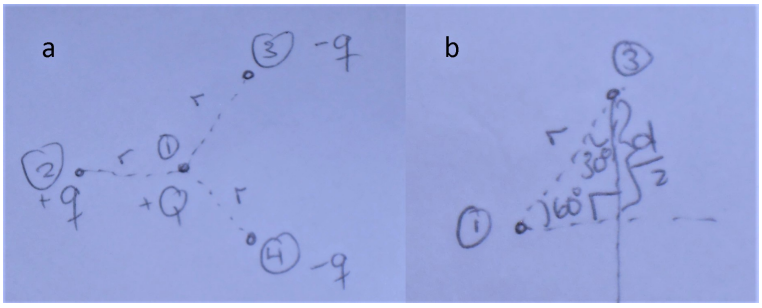

Figure 1: (a) Example of labeled charges with distances drawn between all coulomb law pairs and (b) one way to find r using the given distance, d, and the trigonometry that follows from knowing the outside charges create an equilateral triangle around the center charge.

[(1)] continued on next page...

(2)

- Here we asked you to draw **all** the forces on the central charge from surrounding charges - see Fig.2. *Potential lost marks: drawing only F_{net}, confusing or incorrect labeling of forces, wrong directions or magnitudes of forces, force being centered on the wrong charge*
- Tip & tail: be careful."The force q_1 due to q_2 has its tail on location 1 and points either towards q_2 or away from q_2". See your lecture notes.
- Careful with subscript labeling:

  F_{2on1} vs. F_{21} vs. F_{12}

  See $\sim$ slide 62 in your lecture ppt "group activity #1" : F_{2on1} and F_{21} imply the force OF 2 ON 1, where as F_{12} is the force OF 1 ON 2. *No marks deducted as long as you were consistent, but it would be good for you to notice the convention.*

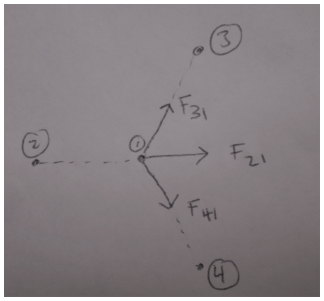

Figure 2: All the forces acting on the central charge

(3)

- It was not enough to say the j components cancel. *Why do they cancel?* Because of the equal magnitude and opposite direction (of the j components) for the two negative charges (symmetry argument). Missing the explanation resulted in lost marks.

continued on next page...

(4)

- The j-component of the forces from the negative charges cancel. This affects the **net force** but does not affect the **magnitude** of force from **each** of the surrounding charges (separately).

$$\begin{aligned} |F_{21}| &= |F_{31}| = |F_{41}| && (1)\\ &= \frac{kqQ}{r^2} && (2)\\ &= \frac{kqQ}{(d/\sqrt{3})^2} && (3) \end{aligned}$$

- Important notes:
  - $|F_{31}| = |F_{41}| \neq \frac{kqQ}{(d/\sqrt{3})^2} cos(60)$
  - Although, $|F_{31,x}| = |F_{41,x}| = \frac{kqQ}{(d/\sqrt{3})^2} cos(60)$
  - Many of you made a quantity "F_{total}" IN ADDITION to"F_{net}". The"total" force should be just another way to say"net force", so these should be one and the same.
  - "$\overrightarrow{F}_{total}$" = $\overrightarrow{F}_{net}$
  - $\overrightarrow{F}_{net} = \overrightarrow{F}_{21} + \overrightarrow{F}_{31} + \overrightarrow{F}_{41}$
  - However, $|\overrightarrow{F}_{net}| \neq |\overrightarrow{F}_{21}| + |\overrightarrow{F}_{31}| + |\overrightarrow{F}_{41}|$. Normally we would need to split into components and find the absolute value through dot products / pythagorean theorem.
  - *Potential lost marks: Not clearly identifying what the "magnitude" was or getting an incorrect value*

(4)

- Here the j-components all cancelled, so we did not need pythagorean theorem:

$$\begin{aligned} |\overrightarrow{F}_{net}| &= |\overrightarrow{F}_{21}| + |\overrightarrow{F}_{31,x}| + |\overrightarrow{F}_{41,x}| && (4)\\ &= |\overrightarrow{F}_{21}| + |\overrightarrow{F}_{31}|cos(60) + |\overrightarrow{F}_{41}|cos(60) && (5)\\ &= 2\frac{kqQ}{(d/\sqrt{3})^2} && (6)\\ &= 6\frac{kqQ}{d^2} && (7) \end{aligned}$$

- *Potential lost marks: Not showing superposition (adding), not adding the right components, arriving at an answer that did not follow from your work in previous steps*