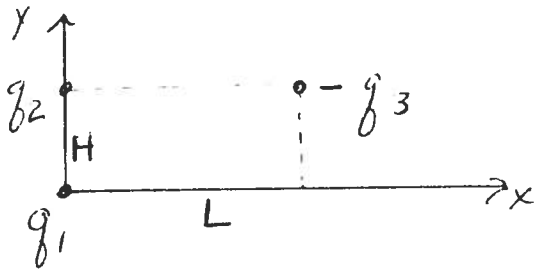
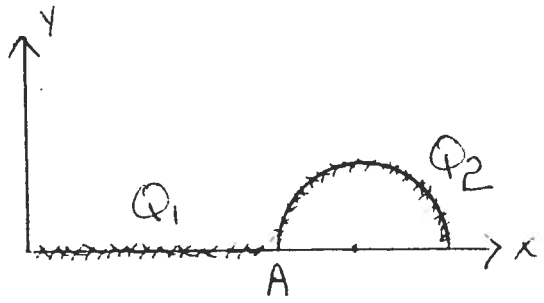
1. (25 points) Given the two positive charges, q_1 and q_2 and the negative charge $-q_3$, find the total electric force on the charge q_1.

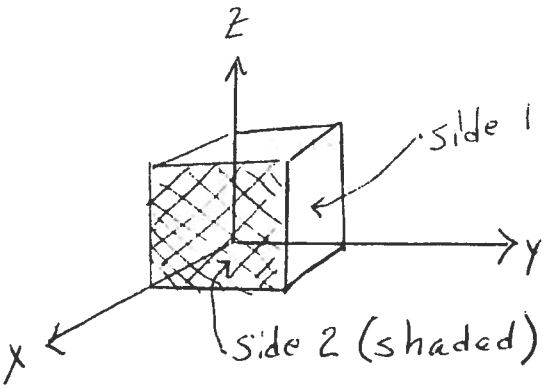


2. (25 points)A positive charge Q_1 is uniformly spread along the x axis from $x = 0$ to $x = A$. A positive charge Q_2 is uniformly spread along a semi-circle of radius R as shown below. Find the electric field at the center of the semi-circle which is at $x = A + R$.



3. (25 points)A cube of sides a is located at the origin as shown. There is an electric field present given by

$$\vec{E} = \alpha x^2 \vec{i}_x.$$

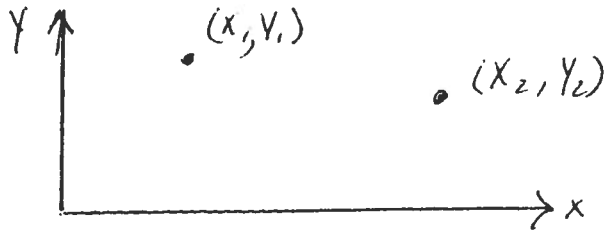


a. Find the electric flux out of side 1.

b. Find the electric flux out of side 2.

c. Find the charge inside the cube.

4. (25 points) For parts a. and b. consider the point with $x = x_1$ and $y = y_1$ and the point with $x = x_2$ and $y = y_2$.



a. If an electric field is given by $\vec{E} = E_0\vec{i}_x + \alpha y^2\vec{i}_y$, where E_0 and α are known constants, find $V(x_2, y_2) - V(x_1, y_1)$.

b. If an electric field is given by $\vec{E} = \frac{\beta}{r^6}\vec{i}_r$, where β is a known constant, find $V(x_2, y_2) - V(x_1, y_1)$.