Consider the cube shown in the figure. It has sides of length \( L \) and is positioned in a coordinate system as shown in the figure. At the center of the cube \((x, y, z) = (L/2, L/2, L/2)\) is a charge \( +Q \).

(a) In unit vector notation, what is the electric field at the center of the top \((x, y, z) = (L/2, L/2, L)\) of the cube?

\[
E = \frac{kQ}{r^2} = \frac{1}{4\pi \varepsilon_0} \cdot \frac{+Q}{(L/2)^2} \hat{z} = \frac{+Q}{4\pi \varepsilon_0 L^2} \hat{z}
\]

(b) In unit vector notation, what is the electric field at the upper, front, right hand corner \((x, y, z) = (L, L, L)\)?

\[
\Gamma = \sqrt{\left(\frac{L}{2}\right)^2 + \left(\frac{L}{2}\right)^2} = \sqrt{2} \frac{L}{2}
\]

\[
E = \frac{1}{4\pi \varepsilon_0} \cdot \frac{+Q}{(\sqrt{2}/2)^2} = \frac{1}{4\pi \varepsilon_0} \cdot \frac{4Q}{3L^2} = \frac{1}{3\pi \varepsilon_0} \frac{Q}{L^2}
\]

(c) What is the flux (including the sign explicitly (i.e., put either a + or a − on your answer) through the top of the cube?

\[
\Phi_{\text{total}} = \frac{Q}{\varepsilon_0} = \frac{+Q}{\varepsilon_0}
\]

\[
\Phi_{\text{face}} = \frac{\Phi_{\text{total}}}{6} = \frac{Q}{6\varepsilon_0}
\]