Consider the current flowing clockwise around the right triangle as shown in the figure. The hypotenuses of this current loop is inclined at 30° relative to a 4 T magnetic field. The z-axis is out of the paper toward you.

(a) In unit vector notation, what is the force on the vertical wire segment?
\[ \vec{F} = i \vec{l} \times \vec{B} \]
\[ i \vec{l} = 3(\sin 30°) \hat{z}, \quad \vec{B} = 4 \hat{z} \]
\[ \vec{F} = 6 \hat{j} \times 4 \hat{z} = -24 \hat{k} \]

(b) In unit vector notation, what is the force on the horizontal wire segment?
\[ \vec{F} = i \vec{l} \times \vec{B} \]
\[ i \vec{l} = 3(\cos 30°) \hat{x}, \quad \vec{B} = 4 \hat{z} \]
\[ \vec{F} = 3\sqrt{3} \hat{c} \times 4 \hat{z} = 0 \]

(c) In unit vector notation, what is the force on the diagonal wire segment?
\[ \vec{F} = i \vec{l} \times \vec{B} \]
\[ i \vec{l} = 3(4)(\cos 30°) \hat{c}, \quad 3(4)(\sin 30°) \hat{j}, \quad \vec{B} = 4 \hat{z} \]
\[ \vec{F} = i \vec{l} \times \vec{B} = [12 \cos 30° \hat{c} + 12 \sin 30° \hat{j}] \times 4 \hat{z} = -18 \sin 30° \times 4 \hat{z} \]
\[ = -48(\frac{1}{2})(-\hat{k}) = 24 \hat{k} \]

(d) In unit vector notation, what is the torque on the system?
\[ \vec{r} = i \vec{A} \times \vec{B} \]
\[ i \vec{A} = 3 \sqrt{12} \hat{c} \]
\[ \vec{r} = (3 \sqrt{12} \hat{c}) \times 4 \hat{z} = -12 \sqrt{12} \hat{j} \]