6. The net force applied on the chopping block is $\vec{F}_{\rm net} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$, where the vector addition is done using unit-vector notation. The acceleration of the block is given by $\vec{a} = \left(\vec{F}_1 + \vec{F}_2 + \vec{F}_3\right)/m$.

(a) The forces exerted by the three astronauts can be expressed in unit-vector notation as follows:

$$\begin{aligned} \vec{F}_1 &= 32(\cos 30^\circ\,\hat{\imath} + \sin 30^\circ\,\hat{\jmath}) \\ &= 27.7\,\hat{\imath} + 16\,\hat{\jmath} \\ \vec{F}_2 &= 55(\cos 0^\circ\,\hat{\imath} + \sin 0^\circ\,\hat{\jmath}) \\ &= 55\,\hat{\imath} \end{aligned}$$

in Newtons, and

$$\vec{F}_3 = 41\left(\cos(-60^\circ)\hat{\imath} + \sin(-60^\circ)\hat{\jmath}\right) = 20.5\,\hat{\imath} - 35.5\,\hat{\jmath}$$

in Newtons. The resultant acceleration of the asteroid of mass $m = 120$ kg is therefore

$$\begin{aligned} \vec{a} &= \frac{(27.7\,\hat{\imath} + 16\,\hat{\jmath}) + (55\,\hat{\imath}) + (20.5\,\hat{\imath} - 35.5\,\hat{\jmath})}{120} \\ &= 0.86\,\hat{\imath} - 0.16\,\hat{\jmath} \quad \text{m/s}^2 . \end{aligned}$$

(b) The magnitude of the acceleration vector is

$$|\vec{a}| = \sqrt{a_x^2 + a_y^2} = \sqrt{0.86^2 + (-0.16)^2} = 0.88 \text{ m/s}^2 .$$

(c) The vector $\vec{a}$ makes an angle θ with the $+x$ axis, where

$$\theta = \tan^{-1}\left(\frac{a_y}{a_x}\right) = \tan^{-1}\left(\frac{-0.16}{0.86}\right) = -11^\circ .$$