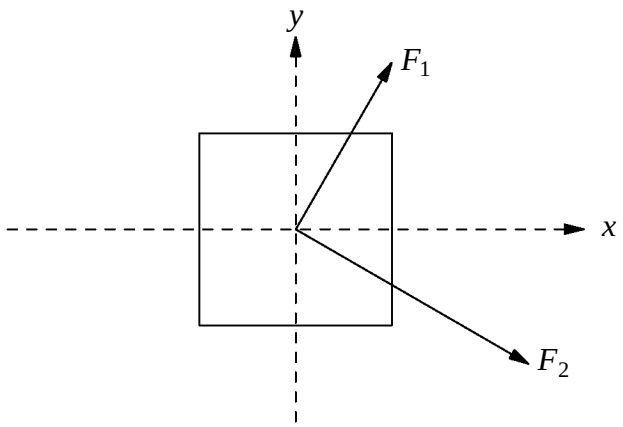
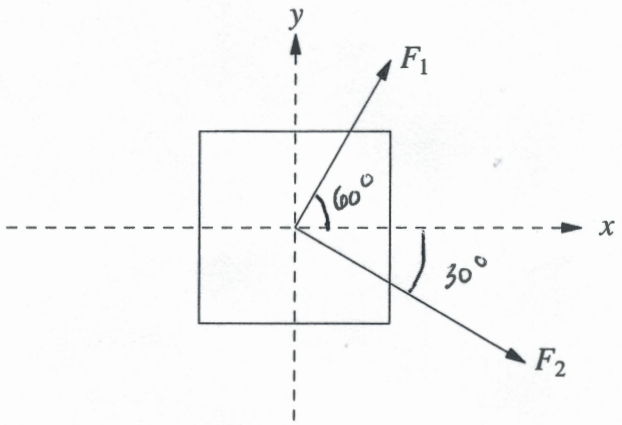
3. (30 pts.) Three workers want to push a 120 kg box in the x-direction in the figure. The first two push with forces $\vec{F}_1$ and $\vec{F}_2$ as shown in the figure: $\vec{F}_1 = 100\,\text{N}$ at 60°, and $\vec{F}_2 = 140\,\text{N}$ at −30°. To make the acceleration purely in the x-direction, the third worker pushes with a force $\vec{F}_3$ in the y-direction.



a. (15 pts.) What is $\vec{F}_3$? Pay attention to the sign. Call up in the figure positive, and down in the figure negative. Ignore friction. All motion is in the horizontal plane, so you should ignore gravity as well.

b. (15 pts.) If the third worker pushes with the force $\vec{F}_3$ you found in part (a), what is the position of the box at 5 seconds? Assume the box starts from rest at the origin.

3. (30 pts.) Three workers want to push a 120 kg box in the x-direction in the figure. The first two push with forces $\vec{F}_1$ and $\vec{F}_2$ as shown in the figure: $\vec{F}_1 = 100\,\text{N}$ at 60°, and $\vec{F}_2 = 140\,\text{N}$ at –30°. To make the acceleration purely in the x-direction, the third worker pushes with a force $\vec{F}_3$ in the y-direction.



a. (15 pts.) What is $\vec{F}_3$? Pay attention to the sign. Call up in the figure positive, and down in the figure negative. Ignore friction. All motion is in the horizontal plane, so you should ignore gravity as well.

$\vec{F}_{total} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$. want $\vec{F}_3 = F_{3y}\hat{j}$.

want $F_{total,y} = 0 = F_{1y} + F_{2y} + F_{3y}$

$0 = 100\sin 60° + 140\sin(-30°) + F_{3y}$

$\boxed{-16.6\,\text{N} = F_{3y}}$

(4) Now find x-component of acceleration.

$F_{total,x} = F_{1x} + F_{2x} + F_{3x} = m a_x$

$100\cos 60° + 140\cos(-30°) + 0 = 120\, a_x$

$1.427\ \text{m/s}^2 = a_x$

Then $x = x_0 + v_{0x} t + \frac{1}{2} a_x t^2 = 0 + 0 + \frac{1}{2}(1.427)(5)^2 = \boxed{17.8\,\text{m}}$

b. (15 pts.) If the third worker pushes with the force $\vec{F}_3$ you found in part (a), what is the position of the box at 5 seconds? Assume the box starts from rest at the origin.