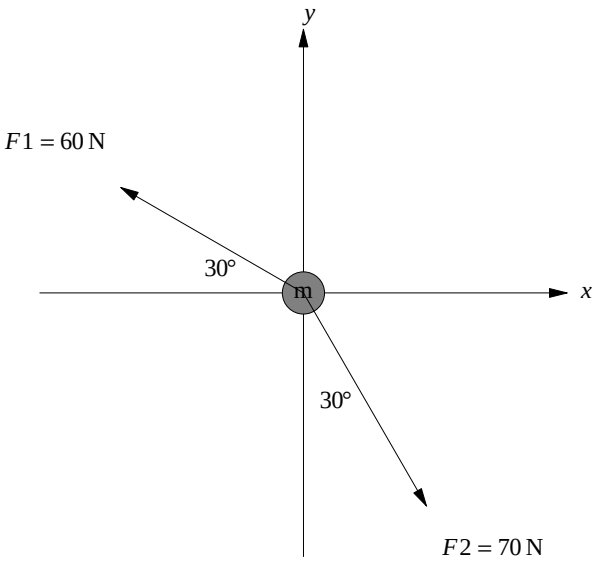
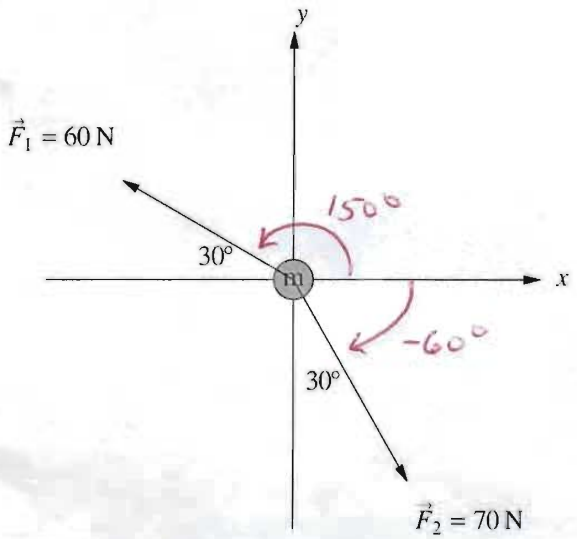
Problem 3: (30 pts.) The figure shows an overhead view of a 2.50 kg box on a horizontal frictionless table. There are three forces acting on it, $\vec{F}_1$, $\vec{F}_2$, and $\vec{F}_3$, but only $\vec{F}_1$ and $\vec{F}_2$ are shown in the figure. $\vec{F}_1$ is 60 N at 30° above the negative x-axis, and $\vec{F}_2$ is 70 N at 30° measured counter-clockwise from the negative y-axis. The velocity of the box is observed to be $\vec{v} = 1.30t\hat{i} - 1.40t\hat{j}$. What is $\vec{F}_3$? (It is sufficient to just give the x and y components of $\vec{F}_3$.)



3. (30 pts.) The figure shows an overhead view of a 2.50 kg box on a horizontal frictionless table. There are three forces acting on it, $\vec{F}_1$, $\vec{F}_2$, and $\vec{F}_3$, but only $\vec{F}_1$ and $\vec{F}_2$ are shown in the figure. $\vec{F}_1$ is 60 N at 30° above the negative x-axis, and $\vec{F}_2$ is 70 N at 30° measured counter-clockwise from the negative y-axis. The velocity of the box is observed to be $\vec{v} = 1.30\,t\,\hat{i} - 1.40\,t\,\hat{j}$. What is $\vec{F}_3$? (It is sufficient to just give the x and y components of $\vec{F}_3$.)



$\sum \vec{F} = m\vec{a}$

$\vec{F}_1 + \vec{F}_2 + \vec{F}_3 = m\vec{a}$

x-components: $F_{1x} + F_{2x} + F_{3x} = ma_x$

$F_{3x} = ma_x - F_{1x} - F_{2x}$

$F_{3x} = (2.50)(1.30) - 60\cos 150° - 70\cos(-60°) =$

$\boxed{F_{3x} = +20.2\,N}$

Note:

$\vec{v} = a_x t\,\hat{i} + a_y t\,\hat{j}$

$a_x = 1.30$

$a_y = -1.40$

y-components: $F_{1y} + F_{2y} + F_{3y} = ma_y$

$F_{3y} = ma_y - F_{1y} - F_{2y}$

$= (2.50)(-1.40) - 60\sin(150°) - 70\sin(-60°)$

$\boxed{F_{3y} = +27.1\,N}$

OR: $\boxed{\vec{F}_3 = 33.8\,N \text{ @ } 53.3°}$