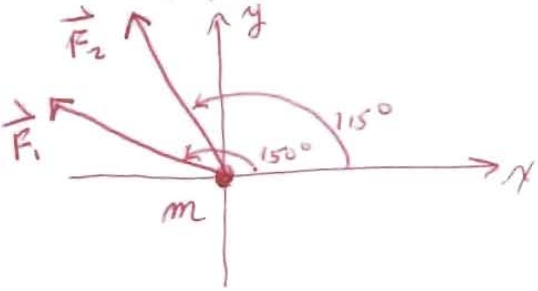
2. (30 pts.) A 3kg object out in space is subject to two forces, $\vec{F}_1 = 4\text{N}$ at 150° and $\vec{F}_2 = 7\text{N}$ at 115°, where all angles are measured in degrees from the positive x axis. There are no other forces of any kind acting on the object. At time $t = 0\text{s}$, the object is at $x_0 = -2$, $y_0 = 0$, and is moving with velocity of 2 m/s in the negative y direction.

a. (20 pts.) What are the x and y coordinates of the object at $t = 5\text{s}$?

b. (10 pts.) What are the *magnitude* and *direction* (measured in degrees from the positive x-axis) of the vector giving the position of the object at $t = 5\text{s}$?

2. (30 pts.) A 3kg object out in space is subject to two forces, $\vec{F}_1 = 4\text{N}$ at 150° and $\vec{F}_2 = 7\text{N}$ at 115°, where all angles are measured in degrees from the positive x axis. There are no other forces of any kind acting on the object. At time $t = 0\text{s}$, the object is at $x_0 = -2$, $y_0 = 0$, and is moving with velocity of 2 m/s in the negative y direction.

a. (20 pts.) What are the x and y coordinates of the object at $t = 5\text{s}$?



$\vec{F}_1 = 4 @ 150°$

$\vec{F}_2 = 7 @ 115°$

$x_0 = -2$ $\quad y_0 = 0$

$v_{0x} = 0$ $\quad v_{0y} = -2$

x-components

$\sum F_x = ma_x$

$4\cos 150 + 7\cos 115 = 3a_x$

$-2.141\ m/s^2 = a_x$

y-components

$\sum F_y = ma_y$

$4\sin 150° + 7\sin 115° = 3a_y$

$2.78\ m/s^2 = a_y$

$x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$

$x = -2 + 0 + \frac{1}{2}(-2.14)(5)^2$

$\boxed{x = -28.8}$

$y = y_0 + v_{0y}t + \frac{1}{2}a_y t^2$

$y = 0 - 2(5) + \frac{1}{2}(2.78)(5)^2$

$\boxed{y = 24.77\text{m}}$

[Note: Most people who tried to "simplify" the problem by looking at other angles (such as angle from y-axis or from negative x-axis) got it wrong. Often it's easier to just keep it simple.]

b. (10 pts.) What are the *magnitude* and *direction* (measured in degrees from the positive x-axis) of the vector giving the position of the object at $t = 5\text{s}$?

$\boxed{\vec{r} = 37.98 @ 139°}$

Note $\tan^{-1}\left(\frac{24.77}{-28.8}\right) = -40.7°$, or

$-40.7° + 180° = \boxed{+139.3°}$

This one, because $x<0, y>0$.