Today's worksheet consists of a few questions related to the concepts covered in Lecture 6.

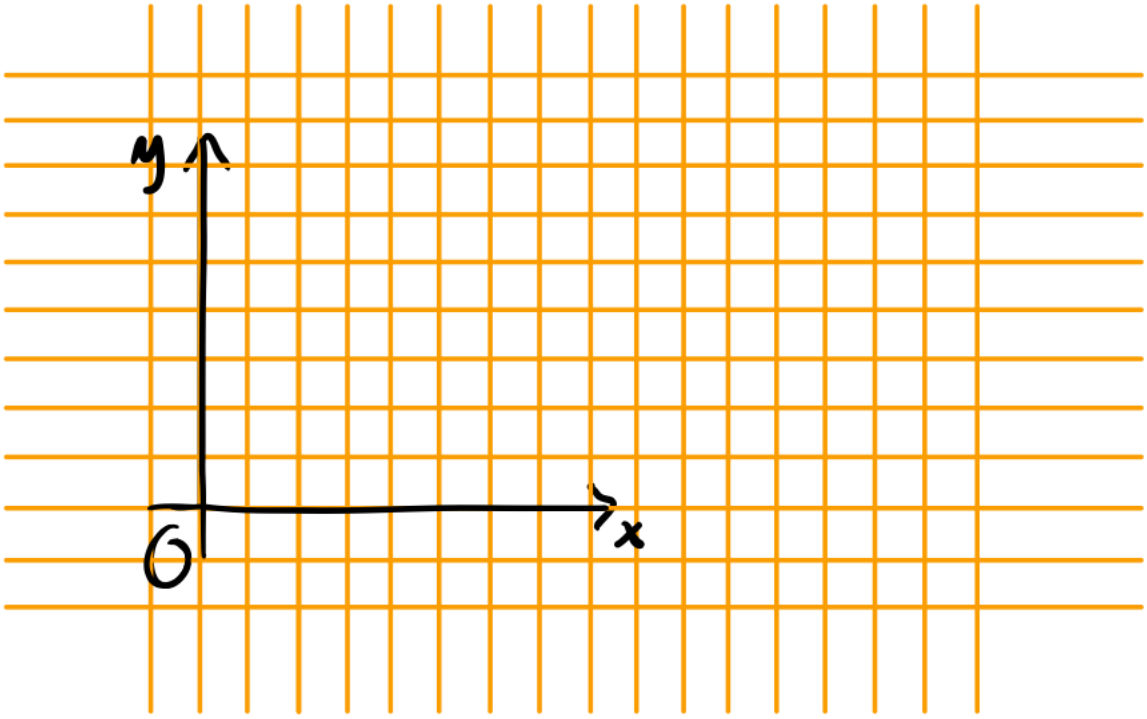
1. Suppose there are two forces acting on our object: $\vec{F}_1 = (2, -1, 6)\ N$ and $\vec{F}_2 = (0, 2, -1)\ N$. What is the total force $\vec{F}_{\text{total}} = \vec{F}_1 + \vec{F}_2$ acting on the object?

2. Now that we know the total force (or net force) acting on the object, we can apply Newton's second law to find out what the acceleration $\vec{a}$ is. Newton's second law tells us that $m\vec{a} = \vec{F}_{\text{total}}$. If the mass of the object is 2 kg, and the force being applied to it is the $\vec{F}_{\text{total}}$ from the previous exercise, calculate $\vec{a}$. Write down your answer with the corresponding units.

3. Suppose we double the mass of the object from the previous exercise but $\vec{F}_{\text{total}}$ remains the same. Will the acceleration increase or decrease? Calculate the new acceleration.

4. This exercise is about visualizing what happens when we add two vectors together. Suppose we have vector $\vec{A} = (6, 2)$ and vector $\vec{B} = (4, 6)$. Draw arrows corresponding to $\vec{A}$ and $\vec{B}$ in the figure below. Calculate $\vec{A} + \vec{B}$. Draw the arrow corresponding to $\vec{A} + \vec{B}$ in the same figure. (Note: all arrows should start at the origin (0,0))

NAME:



5. Calculate the magnitude of vector $\vec{A}$ above.

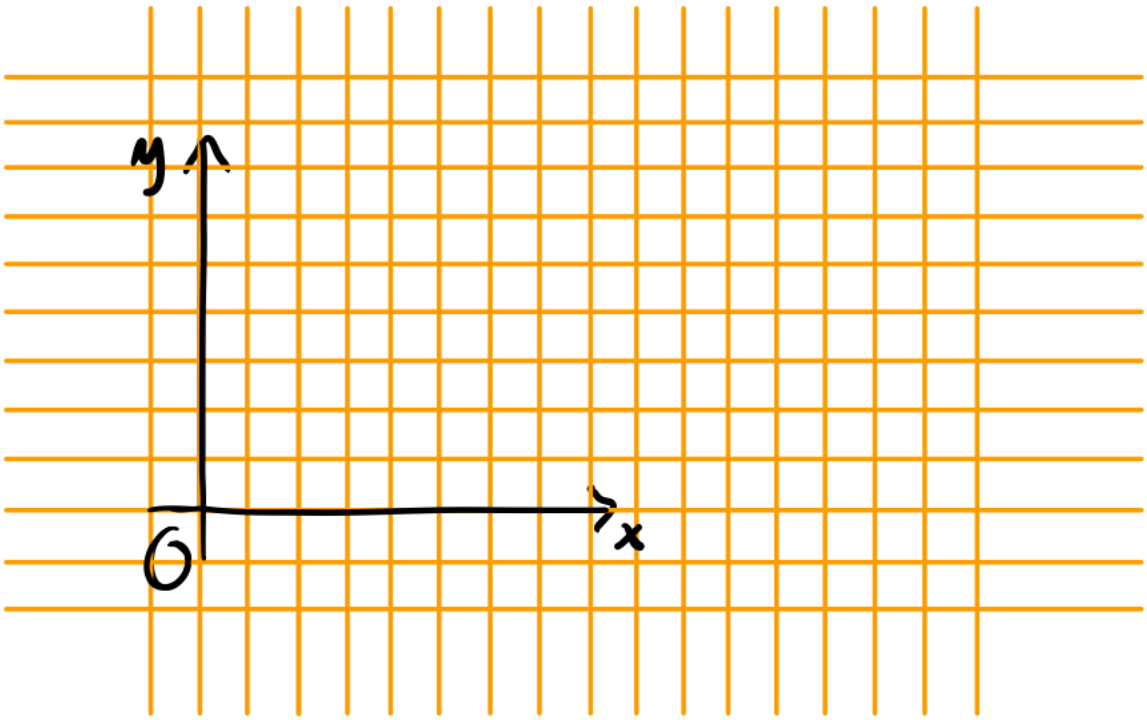
6. If the velocity of a particle is $\vec{v} = (3, 4, -2)\ m/s$, what is its speed? Remember to add units to the result.

7. Come up with your own example of a mathematical scalar function (i.e a relationship between two scalar quantities in the form of an equation). Make it realistic and write down the symbols you are going to use to represent each quantity.

8. Consider the following vector function describing the change in position of a particle in two dimensional space

$$\vec{x} = (1 + 2t, 3)\ m \tag{1}$$

What is the independent (input) variable?
What is the dependent (output) variable?
What is $\vec{x}$ at $t = 0\ s$?
What is $\vec{x}$ at $t = 1\ s$?
What is $\vec{x}$ at $t = 2\ s$?
What is $\vec{x}$ at $t = 3\ s$?
Draw each $\vec{x}$ on the grid below and try to guess what the path (or trajectory) of the particle is.



The particle is moving at a constant velocity. What is that velocity $\vec{v}$? (The velocity is the rate of change of the position vector with respect to time, $\vec{v} = \left(\frac{\Delta x}{\Delta t}, \frac{\Delta y}{\Delta t}\right)$, where Δx means change in x and Δt means change in t)