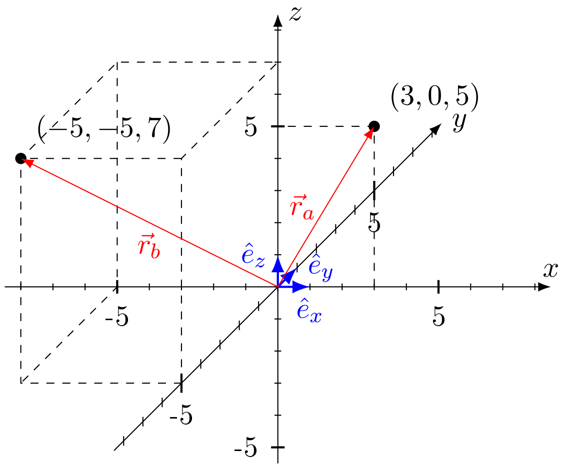
Vectorial kinematics

If you are able to solve these problems on your own, then you can assume that you have the minimum knowledge about these topics.
The problems marked with (*) have additional difficulties. Don't hesitate about seeking help from teachers and your classmates if you are not able to complete them.
For each of the following exercises, create a Jupyter notebook with your name in the title, including one or several cells of code intertwined with cells showing text indicating the exercise that is being solved.

1. **Addition of positions**



   (a) Save in a variable called `a_r` a vector that indicates the position $\vec{r}_a = 3\hat{e}_x + 0\hat{e}_y + 5\hat{e}_z$.

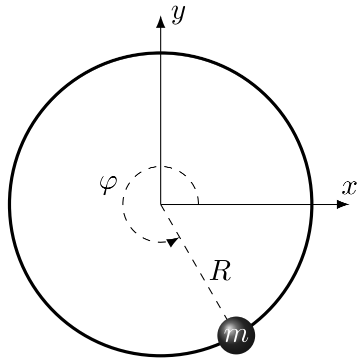
   (b) Save $\vec{r}_b = -5\hat{e}_x + (-5)\hat{e}_y + 7\hat{e}_z$ in `b_r`.

   (c) Subtract the corresponding variables to find $\Delta\vec{r}_{a\to b} = \vec{r}_b - \vec{r}_a$ and save the result in `ab_deltaR`.

   (d) Save in `c_r` the result from $\vec{r}_a + \Delta\vec{r}_{a\to b}$.

   (e) To verify that you did a good work, it's sufficient to display `c_r` and check that $\vec{r}_c = \vec{r}_b$.

2. (*) **Position as a function of a variable**
   A particle of mass m is attached to a ring of radius R, and therefore its radius measured from the center of the ring is constant. Then it's enough to know the angle φ to describe its position.



   (a) Write it using Cartesian coordinates in terms of R and φ. Recall that R is a constant, it's just a symbol for `SymPy`, and φ is a variable that depends on time, or dynamic symbol, as it is called in this library. You will need to use trigonometric functions, investigate how these are implemented using this library.

   (b) Calculate the velocity of this particle using `SymPy`.
   Answer:
   $-R\sin(\varphi)\dot{\varphi}\mathbf{\hat{e}_x} + R\cos(\varphi)\dot{\varphi}\mathbf{\hat{e}_y}$