

## Notes for lecture 5

1. Date: May 12<sup>th</sup>.
2. Reading: the lecture material is based on Sections 2.6 of Chapter 2 of the main textbook (refer to Chapter2.6.pdf file).
3. The lecture communicates the following issues
  - a. Polar coordinates.
    - i The position of a particle is now measured not with respect to a path along which the particle is traveling (see previous lecture), but with respect to a fixed coordinates systems (frame of reference). However, it is measured not by  $x$  and  $y$  coordinates, but by curvilinear coordinates  $r$  and  $\theta$ .
    - ii Velocity and acceleration vectors are represented not with respect to some fixed coordinate system but with respect to some moving (changing) coordinate system ( $\mathbf{e}_r, \mathbf{e}_\theta$ ). That is the most important point of the class.
4. Ch2D.swf file in the Resources (same as before) is provided
  - a. When playing the file please do not push Main Menu button; when returning please use Chapter Menu button.
  - b. The content of Ch2D.swf file relevant to this lecture (yellow button corresponding to Coordinate Systems-> Two-dimensional->Polar)
5. To learn more about polar coordinates, you can refer to Wikipedia  
[https://en.wikipedia.org/wiki/Polar\\_coordinate\\_system#:~:text=In%20mathematics%2C%20the%20polar%20coordinate,angle%20from%20a%20reference%20direction](https://en.wikipedia.org/wiki/Polar_coordinate_system#:~:text=In%20mathematics%2C%20the%20polar%20coordinate,angle%20from%20a%20reference%20direction)  
and (Khan Academy resources)  
<https://www.khanacademy.org/math/multivariable-calculus/integrating-multivariable-functions/double-integrals-a/v/polar-coordinates-1?form=MY01SV&OCID=MY01SV>
6. In solving practical problems,
  - a. The basic knowledge differentiation and integration of functions of single variable (at the level of pre-calculus) is required. When computing integrals that may look difficult to you, you may use Wolfram Alpha, see  
<https://www.wolframalpha.com/examples/mathematics/calculus-and-analysis/>
  - b. When solving equations numerically, you can also use Wolfram Alpha, use  
<https://www.wolframalpha.com/examples/mathematics/algebra/equation-solving/>
  - c. When plotting graphs, you can also use Wolfram Alpha  
<https://www.wolframalpha.com/examples/mathematics/plotting-and-graphics/>
  - d. Also, for plotting in polar coordinates you can refer to  
<https://www.desmos.com/calculator/ms3eghkkgz> and  
<https://www.geogebra.org/m/a2CUgqam> and  
<https://www.geogebra.org/m/jhKUc6Hm>
7. The deadline for submitting assignment (see Assignment5.pdf) is May 19.