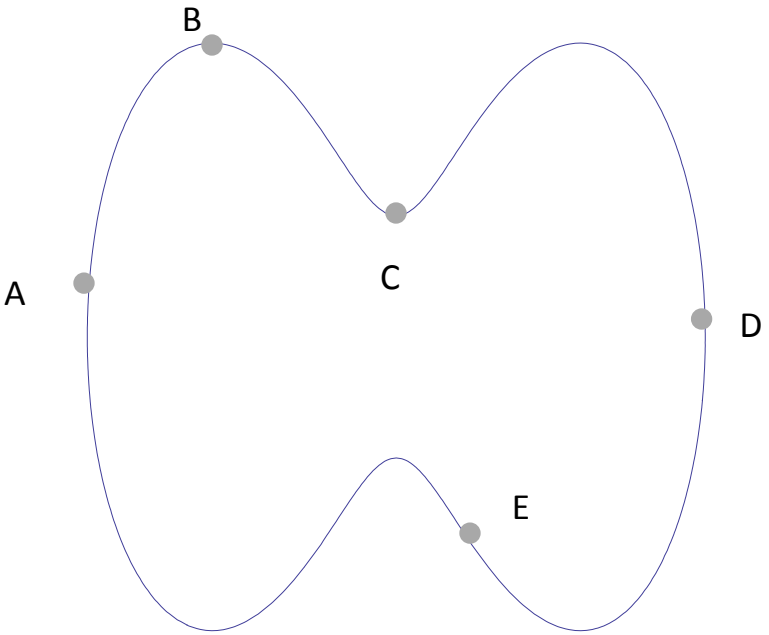
Non-uniform 2D motion examples

Example 1

A car starts from rest a point A and is speeding up at a constant rate around a track shown below. Draw the acceleration vectors of the car at the locations A, B, C, D and E.



Example 2

A ball of mass m moves on a frictionless track shaped like a loop of radius r in a vertical plane.

a) Draw the acceleration vectors of the ball at several locations around the loop (12 o'clock, 3 o'clock, 6 o'clock, 9 o'clock, and 10 o'clock).
b) Draw the FBDs of the ball at the locations listed in a)
c) Give the expressions of the normal and tangential components of the acceleration vector (a_t and a_n) in terms of the velocity v of the ball and the radius r of the loop.
d) What should be the minimum speed of the ball at the bottom of the track so that the ball remains on the track when doing a full revolution?