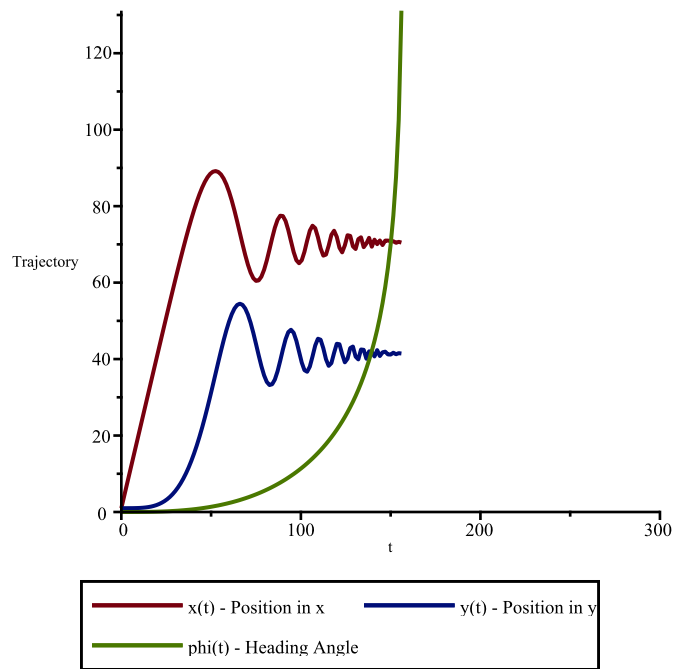


```

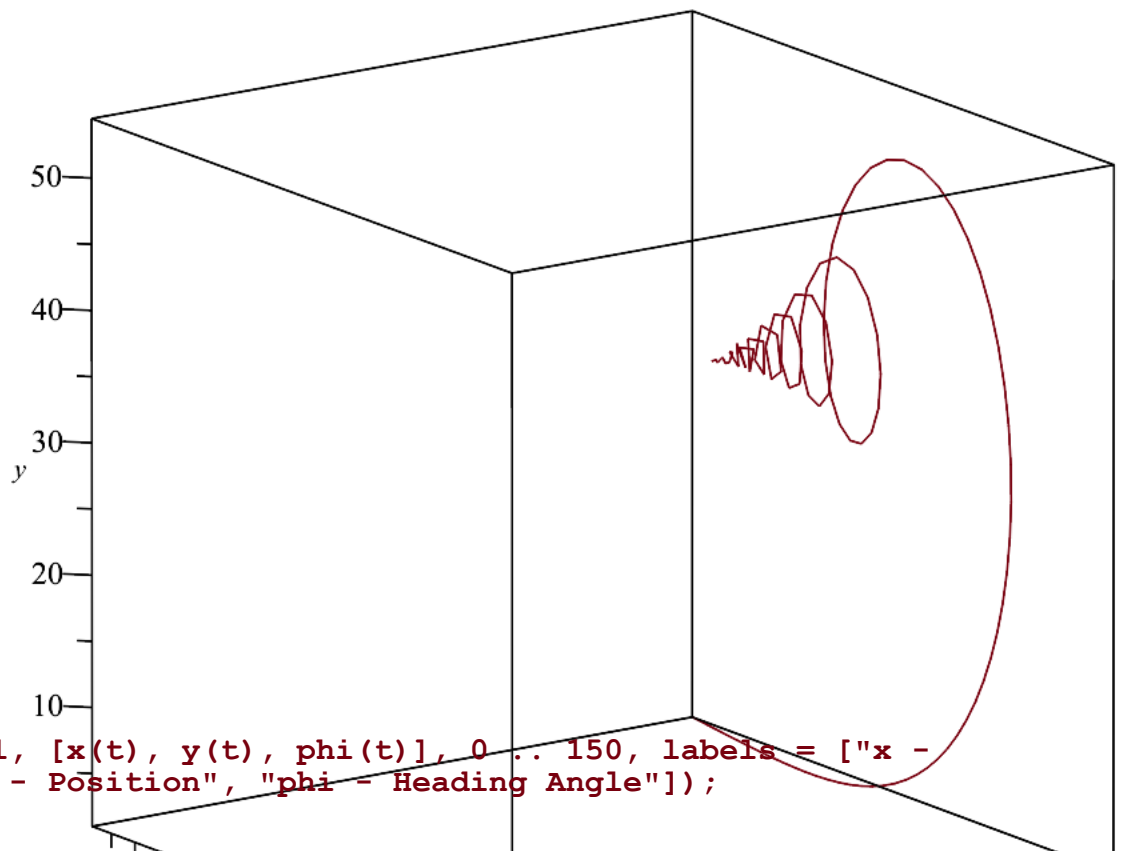
> restart:
> with(DEtools): # load the whole package, not just a single
  command - we need odeadvisor and singularities (dsolve is a top-
  level command, i.e. outside any package
> des := {diff(phi(t),t) = tan(0.01*t*sin(0.01*t))/l, diff(x(t),t)
  = V*cos(phi(t)), diff(y(t),t) = V*sin(phi(t))};
  des :=  $\left\{ \frac{d}{dt} \phi(t) = \frac{\tan(0.01 t \sin(0.01 t))}{l}, \frac{d}{dt} x(t) = V \cos(\phi(t)), \frac{d}{dt} y(t) = V \sin(\phi(t)) \right\}$  (1)
> odeadvisor~(des); # all three ODEs can (in principle) be solved
  by integrating (_quadrature)
  {[_quadrature]} (2)
> singularities~(des); # this command applies to the ODEs, not
  their solutions
  {regular = Ø, irregular = Ø} (3)
> t__0 := 0: # time point where ICs are given
> ics := {phi(t__0)=0, x(t__0)=1, y(t__0)=1}: # initial conditions,
  values arbitrarily chosen here
> ivp := des union ics;
  ivp :=  $\left\{ \frac{d}{dt} \phi(t) = \frac{\tan(0.01 t \sin(0.01 t))}{l}, \frac{d}{dt} x(t) = V \cos(\phi(t)), \frac{d}{dt} y(t) = V \sin(\phi(t)), \phi(0) \right.$  (4)
   $\left. = 0, x(0) = 1, y(0) = 1 \right\}$ 
> desSol := dsolve(ivp, numeric, parameters=[V,l]);
  desSol := proc(x_rkf45) ... end proc (5)
> # for the following calls, please see ?dsolve,numeric,interactive
> desSol('initial'); # query the ICs
  [t=0., phi(t)=0., x(t)=1., y(t)=1.] (6)
> desSol(parameters=[2,3]); # values arbitrarily chosen here
  [V=2., l=3.] (7)
> desSol(0.1);
  [t=0.1, phi(t) = 1.11092700631257 x 10-8, x(t) = 1.19999999999564, y(t) = 1.00000000055528] (8)
> desSol(0.9);
  [t=0.9, phi(t) = 8.09991071499280 x 10-6, x(t) = 2.79999999993680, y(t) = 1.00000364501732] (9)
> with(plots):
> # odeplot (from package plots) is for numerical solution of ODEs
  only - not for symbolic solutions
> odeplot(desSol, [[t, x(t)], [t, y(t)], [t, phi(t)]], 0 .. 300,
  labels = ["t", "Trajectory"], legend = ["x(t) - Position in x",
  "y(t) - Position in y", "phi(t) - Heading Angle"]);
Warning, cannot evaluate the solution further right of 157.07963,
probably a singularity

```



```
> odeplot(desSol, [t, x(t), y(t)], 0 .. 300);
```

[Warning, cannot evaluate the solution further right of 157.07963, probably a singularity](#)



```
> odeplot(desSol, [x(t), y(t), phi(t)], 0 .. 150, labels = ["x - Position", "y - Position", "phi - Heading Angle"]);
```

