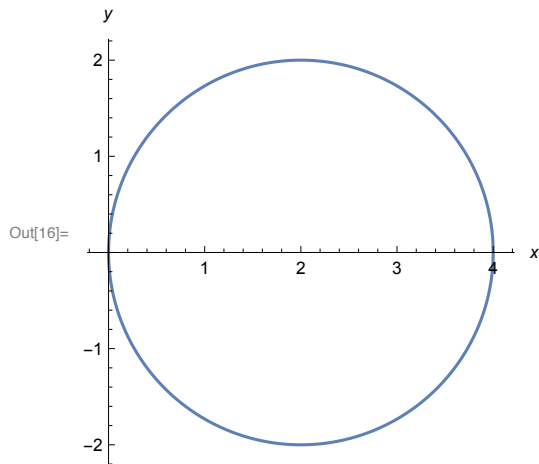


Quit[]

In[9]:=

```
(* plots a elliptical path in xy plane *)
xc = 2;
yc = 0;
a = 2;
b = 2;
x[s_] = xc - a * Cos[2 * Pi * s];
y[s_] = yc + b * Sin[2 * Pi * s];
Print["Elliptical Path"]
ParametricPlot[{x[s], y[s]}, {s, 0, 1}, AxesLabel -> {x, y}]
```

Elliptical Path



In[33]:= Quit[]

In[1]:= (* excersize 2, time derivatives *)

```
q = {x[t], y[t], z[t]};
x[t] = Cos[2 * Pi * s[t]];
y[t] = Sin[2 * Pi * s[t]];
z[t] = 2 * s[t];
s[t] = t / 4 + 1 / 8 * t^2;
Print["First order derivative of x,y,z"]
dqdt = D[q, t]
Print["Second order derivative of x, y, z"]
ddqddt = D[dqdt, t]
```

First order derivative of x,y,z

Out[7]=
$$\left\{ -2 \pi \left(\frac{1}{4} + \frac{t}{4} \right) \sin \left[2 \pi \left(\frac{t}{4} + \frac{t^2}{8} \right) \right], 2 \pi \left(\frac{1}{4} + \frac{t}{4} \right) \cos \left[2 \pi \left(\frac{t}{4} + \frac{t^2}{8} \right) \right], 2 \left(\frac{1}{4} + \frac{t}{4} \right) \right\}$$

Second order derivative of x, y, z

Out[9]=
$$\left\{ -4 \pi^2 \left(\frac{1}{4} + \frac{t}{4} \right)^2 \cos \left[2 \pi \left(\frac{t}{4} + \frac{t^2}{8} \right) \right] - \frac{1}{2} \pi \sin \left[2 \pi \left(\frac{t}{4} + \frac{t^2}{8} \right) \right], \right. \\ \left. \frac{1}{2} \pi \cos \left[2 \pi \left(\frac{t}{4} + \frac{t^2}{8} \right) \right] - 4 \pi^2 \left(\frac{1}{4} + \frac{t}{4} \right)^2 \sin \left[2 \pi \left(\frac{t}{4} + \frac{t^2}{8} \right) \right], \frac{1}{2} \right\}$$

Quit[]

```
In[30]:= (* Solves for the quintic polynomial coefficients *)
s3[t_] = a0 + a1*t + a2*t^2 + a3*t^3;
s5[t_] = a0 + a1*t + a2*t^2 + a3*t^3 + a4*t^4 + a5*t^5;
c3 = {s3[0] == 0, s3'[0] == 0, s3[T] == 1, s3'[T] == 0};
c5 = {s5[0] == 0, s5'[0] == 0, s5[T] == 1, s5'[T] == 0, s5''[0] == 0, s5''[T] == 0};
Print["Quintic polynomials"]
p5 = Solve[c5[[1]] && c5[[2]] && c5[[3]] && c5[[4]] && c5[[5]] && c5[[6]],
  {a0, a1, a2, a3, a4, a5}]
Print["Cubic Polynomial"]
p3 = Solve[c3[[1]] && c3[[2]] && c3[[3]] && c3[[4]], {a0, a1, a2, a3}]
```

Quintic polynomials

Out[35]= $\left\{ \left\{ a_0 \rightarrow 0, a_1 \rightarrow 0, a_2 \rightarrow 0, a_3 \rightarrow \frac{10}{T^3}, a_4 \rightarrow -\frac{15}{T^4}, a_5 \rightarrow \frac{6}{T^5} \right\} \right\}$

Cubic Polynomial

Out[37]= $\left\{ \left\{ a_0 \rightarrow 0, a_1 \rightarrow 0, a_2 \rightarrow \frac{3}{T^2}, a_3 \rightarrow -\frac{2}{T^3} \right\} \right\}$