

Space Curves with MATLAB

We will sketch the curve represented by the vector-valued function

$$\mathbf{r}(t) = \cos t \mathbf{i} + \sin t \mathbf{j} + t \mathbf{k}, \quad 0 \leq t \leq 10\pi.$$

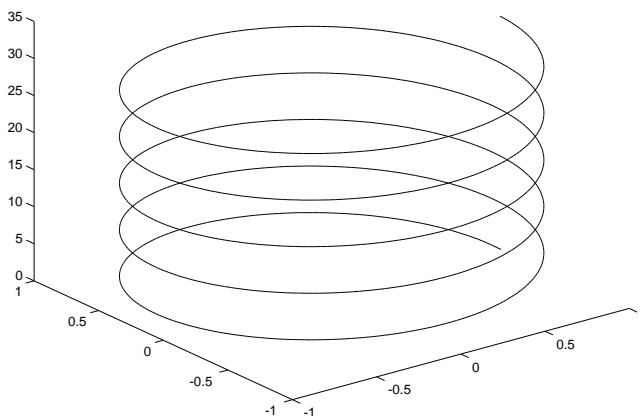
The parametric equations for this curve are

$$x = \cos t, \quad y = \sin t, \quad z = t.$$

We can use MATLAB to plot this curve using the following commands.

```
>> t=linspace(0,10*pi,1000);  
>> plot3(cos(t),sin(t),t);
```

We obtain the following plot of an Helix curve.



The tangent line at point $P\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}, \frac{7\pi}{6}\right)$ on the curve has the following parametric equations. (Check it.)

$$x = -\frac{\sqrt{3}}{2} + \frac{t}{2}, \quad y = -\frac{1}{2} - \frac{\sqrt{3}}{2}t, \quad z = \frac{7\pi}{6} + t.$$

We can include this tangent line (for $-1 \leq t \leq 1$) and point P in our plot with the following commands.

```
>> hold on  
>> plot3(-sqrt(3)/2,-1/2,7*pi/6,'*')  
>> t=linspace(-1,1);  
>> plot3(-sqrt(3)/2+t/2, -1/2-sqrt(3)/2*t, 7*pi/6+t)
```

We obtain the plot of the Helix curve, the tangent line, and a star (*) at point P .

