

Worksheet 5

1. Consider the curve:

$$\vec{r}(t) = (t \sin t + \cos t) \vec{i} + (-t \cos t + \sin t) \vec{j}; \quad -\sqrt{2} \leq t \leq 2.$$

- Find the velocity  $\vec{v}(t)$ .
- Find the unit tangent vector  $\vec{T}(t)$ .
- Find the length of the curve.

2. Consider the curve:

$$\vec{r}(t) = 3 \cos t \vec{i} + 3 \sin t \vec{j} + t \vec{k}.$$

- Find the velocity  $\vec{v}(t)$ .
- Find the unit tangent vector  $\vec{T}(t)$ .
- Find the arc length parameter  $s$ ; take  $t_0 = 0$  as your base point.

3. Given that:

$$\frac{d\vec{r}}{dt} = 6\sqrt{t+1} \vec{i} + 4e^{-t} \vec{j} + \frac{1}{t+1} \vec{k},$$
$$\vec{r}(0) = \vec{k},$$

find  $\vec{r}(t)$ .

4. Find parametric equations for the line tangent to the curve:

$$\vec{r}(t) = \left(\ln \frac{t}{6}\right) \vec{i} + \left(\frac{t-6}{t+7}\right) \vec{j} + \left(t \ln \frac{t}{6}\right) \vec{k}$$

at the value  $t = 6$  of the parameter.