

Calc 3: Assignment #8

① Sketch or describe the following curves:

a) $r(t) = \langle \cos(t), \sin(t) \rangle$

b) $r(t) = \langle t, \sin(t) \rangle$

c) $r(t) = \langle t, \cos(t), \sin(t) \rangle$

d) $r(t) = \langle t^2, 3t, -t \rangle$

② Find the following limits:

a) $\lim_{t \rightarrow 0} \left\langle \frac{e^t - 1}{t}, \frac{\sqrt{t+1} - 1}{t}, \frac{3}{t+t} \right\rangle$

b) $\lim_{t \rightarrow \infty} \left\langle \arctan(t), e^{-2t}, \frac{\ln(t)}{t} \right\rangle$

③ Find the derivatives of:

a) $\vec{r}(t) = \langle t \sin(t), \tan(t), t \cos(2t) \rangle$

b) $\vec{r}(t) = e^{t^2} \mathbf{i} - j + \ln(t+3t) \mathbf{k}$

④ Find $\int_1^2 t^2 \mathbf{i} + t\sqrt{t-1} \mathbf{j} + t \sin(\sqrt{t}) \mathbf{k} \, dt$

⑤ Two particles travel along the space curves

$$r_1(t) = \langle t, t^2, t^3 \rangle, \quad r_2(t) = \langle t+2t, t+6t, t+4t \rangle$$

Do they collide? Do their paths intersect?

⑥ Use Maple's `spacecurve` command to plot:

$$a) \langle (t + \cos(16t)) \cos(t), (t + \cos(16t)) \sin(t), t + \cos(16t) \rangle$$

$$b) \langle \cos(t) \sin(2t), \sin(t) \sin(2t), \cos(2t) \rangle$$

$$c) \langle t, t \sin(t), t \cos(t) \rangle$$

⑦* Use Maple's `CrossProduct` and `DotProduct`

commands to prove that $a \cdot (b \times c) = (a \times b) \cdot c$

Valentine's Special: Use Maple's `plot` command

to draw the 2D parametric curve given by

$$\vec{r}(t) = \langle \cos(t) \sin(t) \ln(|t|), |t|^{0.3} \sqrt{\cos(t)} \rangle \text{ for } -1 \leq t \leq 1.$$

Hint: `plot([sin(t) * cos(t) * log(|t|), |t|^0.3 * sqrt(cos(t)), t=-1..1])`

Also try to plot the 2D curve:

$$\vec{r}(t) = \langle 3.9 \sin^3(t), 3 \cos(t) - 1.2 \cos(2t) - 0.6 \cos(3t) - 0.2 \cos(4t) \rangle$$

for $0 \leq t \leq 2\pi$ Which one do you like better?