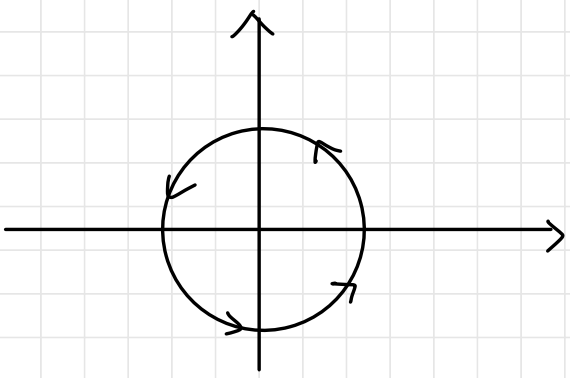
1.

$r(\theta) = 2\cos\theta\, i + 2\sin\theta\, j$

$x(\theta) = 2\cos\theta$

$y(\theta) = 2\sin\theta$

$x^2 + y^2 = 4$



2. $\lim_{t\to 0} \left[t^2 i + 3t j + \frac{1-\cos t}{t} k\right] = 0$

$\therefore \lim_{t\to 0} \frac{1-\cos t}{t} = 0$

3.

$f'(t) = (\cos t, -\sin t)$

$g'(t) = (1, e^t)$

1. $(f+g)'(0) = f'(0)+g'(0)$

$= (1,0)+(1,0) = (2,1)$

2. $(f\cdot g)'(0) = f'(0)\cdot g(0) + f(0)\,g'(0)$

$= (1,0)(0,1) + (0,1)\cdot(1,1) = 1$

3. $(f\times g)'(t) = f'(t)\times g(t) + f(t)\times g'(t)$

$$= \begin{vmatrix} i & j & k \\ \cos t & -\sin t & 0 \\ t & e^t & 0 \end{vmatrix} + \begin{vmatrix} i & j & k \\ \sin t & \cos t & 0 \\ 1 & e^t & 0 \end{vmatrix}$$

$= (e^t\cos t + t\sin t)\vec{k} + (e^t\sin t - \cos t)\vec{k}$

$(f\times g)'(0) = 0$

4.

$$\int (e^{-t}\hat{i} + j + t\sin t\, k)\, dt$$

$$= -e^{-t}\hat{i} + tj + (-t\cos t + \sin t)k + C$$

$\because \int t\sin t\, dt = -t\cos t + \sin t + C.$