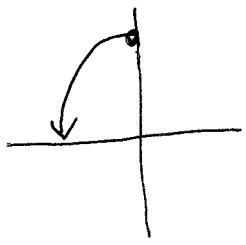
(1)



$x = 2\cos(t)$
$y = 2\sin(t)$ $\quad \frac{\pi}{2} \le t \le \pi$

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(2) $1+t=0 \Rightarrow t=-1$. Thus, $x = 1-1=0$, $y = 1+1=2$, $z = 1-2=-1$

$\therefore (0,2,-1)$

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(3) $$\ell = \int_{t=0}^{1} \|r'(t)\| dt = \int_0^1 \sqrt{(3\sin(t))^2 + (3\cos(t))^2 + (4)^2} =$$

$$\int_0^1 \sqrt{9(\cos^2(t)+\sin^2(t)) + 16}\, dt = \int_0^1 \sqrt{9+16}\, dt$$

$$= \int_0^1 \sqrt{25}\, dt = \boxed{5}.$$

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(4) $\nabla f = \begin{pmatrix} 2x \\ 2y \end{pmatrix}$