Answers ①

① $|a| = \sqrt{2^2+0^2+1^2} = \sqrt{5}$

$|b| = \sqrt{4^2+(-2)^2+0^2} = \sqrt{20}$

$a \cdot b = (2)(4) + (0)(-2) + (1)(0) = 8$

$\cos\theta = \frac{a \cdot b}{|a||b|} = \frac{8}{\sqrt{5}\cdot\sqrt{20}} = \frac{4}{5}$

$\theta = \cos^{-1}(4/5) \approx \boxed{37°}$

② $r'(t) = -2\sin(2t),\ 4,\ 2\cos(2t)$

$|r'(t)| = \sqrt{(-2\sin(2t))^2 + 4^2 + (2\cos(2t))^2}$

$|r'(0)| = \sqrt{4+4^2} = \sqrt{20}$

$T(t) = \frac{r'(t)}{|r'(t)|} = \left\langle \frac{-2\sin(2t)}{\sqrt{20}}, \frac{4}{\sqrt{20}}, \frac{2\cos 2t}{\sqrt{20}} \right\rangle$

$T'(t) = \left\langle \frac{\sqrt{20}(-4\cos(2t)) - 0}{20}, 0, \frac{\sqrt{20}(-4\sin(2t))}{20} \right\rangle$

simplified ↓

$T'(t) = \left\langle \frac{-\sqrt{20}\cos(2t)}{5}, 0, \frac{-\sqrt{20}\sin(2t)}{5} \right\rangle$

$|T'(t)| = \sqrt{\left(\frac{-\sqrt{20}\cos(2t)}{5}\right)^2 + 0^2 \left(\frac{-\sqrt{20}\sin(2t)}{5}\right)^2}$

$|T'(t)| = \sqrt{20/25}$

$\frac{|T'(t)|}{|r'(t)|} = \boxed{\frac{\sqrt{\frac{20}{25}}}{\sqrt{20}}}$