1. (30 points) Given $r(t) = \langle t^2, \cos(t^2), \sin^2 t \rangle$, find $r'(t)$.

Solution:

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

2. (30 points) Given $r'(t) = \langle -\sin t, 3, 4\cos 2t \rangle$, find $T(0)$, the unit tangent vector at $t = 0$. You must fully simplify your answer.

Solution:

$$T(0) = \frac{r'(0)}{|r'(0)|} = \frac{(0,3,4)}{5}$$