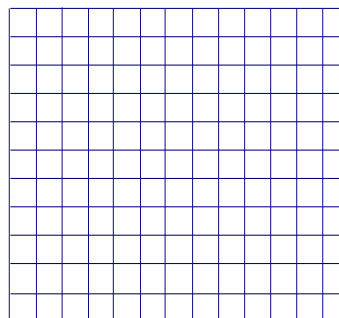**DIRECTIONS** To receive full credit, you must provide complete legible solutions to the following problems in the space provided. No Attached papers. Transfer all your answers to the space provided.

1.   Consider the given vector equation. $r(t) = 3sin(t)\mathbf{i} - 2cos(t)\mathbf{j}, \ t = 3\pi/4$

a.   Find **r** '(t).   Ans_____
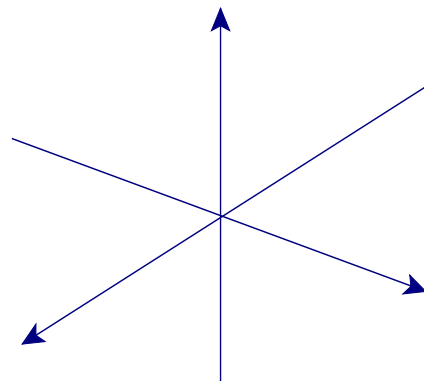
b.   Sketch the plane curve together with the
          position vector **r**(t) and the tangent vector
          r '(t) for the given value of t.

2.   Consider the given vector equation $r(t) = 2\text{sint}\,\mathbf{i} + 2\text{cost}\,\mathbf{j} + t\mathbf{k}, \ \ t = \pi$

a.   Find **r** '(t).   Ans_____

b.   Sketch the plane curve together with the
          position vector **r**(t) and the tangent vector
          r '(t) for the given value of t.

3.   Find parametric equations for the tangent line to the helix with parametric equations
          $x = 5cos(t), y = 3sin(t), z = t$ at the point $(0, 3, \pi/2)$.

                                                       Ans_____

4. If $\mathbf{r}(t) = 4t\mathbf{i} + 6t^2\mathbf{j} + 6t^3\mathbf{k}$, find Ans_____

a. $\mathbf{T}(1)$ Ans_____

b. $\mathbf{r}'(t) \times \mathbf{r}''(t)$ Ans_____

4. Evaluate the integral. Ans_____

$$\int_0^1 \left(\frac{5}{1+t^2}\mathbf{j} + \frac{3t^2}{1+t^3}\mathbf{k} \right) dt$$

5. Find $\mathbf{r}(t)$ if $\mathbf{r}'(t) = t^5\mathbf{i} + e^t\mathbf{j} + 2te^{2t}\mathbf{k}$ and $\mathbf{r}(0) = \mathbf{i} + \mathbf{j} + \mathbf{k}$.

Ans_____

6. If $\mathbf{u}(t) = \langle \sin 6t, \cos 4t, t \rangle$ and $\mathbf{v}(t) = \langle t, \cos 4t, \sin 6t \rangle$

a. $\dfrac{d}{dt}(\mathbf{u}(t) \cdot \mathbf{v}(t))$ Ans_____

b. $\dfrac{d}{dt}(\mathbf{u}(t) \times \mathbf{v}(t))$ Ans_____