No calculators will be allowed and no partial credit will be given.

1. Find the derivative of the vector function \( \vec{r}(t) = \langle \cos(t), \frac{6}{t}, t^3 \rangle \)

2. Find the derivative of the vector function \( \vec{r}(t) = \langle \frac{5t^2}{2}, e^{4t}, t^4 + \frac{3}{t^2} \rangle \)

3. A space curve \( C \) is described by the vector function \( \vec{r}(t) = \langle t^2, \frac{t^3}{3}, t \rangle \). Find \( \hat{T}(1) \), the unit tangent vector to \( C \) at the point corresponding to \( t = 1 \).

4. A space curve \( C \) is described by the vector function \( \vec{r}(t) = \langle 4 \ln(t), 3\sqrt{t}, t^2 \rangle \). Find \( \hat{T}(1) \), the unit tangent vector to \( C \) at the point corresponding to \( t = 1 \).

5. A space curve \( C \) is described by the vector function \( \vec{r}(t) = \langle 2 \cos(t), 3 \sin(t), 3t \rangle \). Find \( \hat{T}(\frac{\pi}{3}) \), the unit tangent vector to \( C \) at the point corresponding to \( t = \frac{\pi}{3} \).

6. Express the indefinite integral \( \int \langle 3 \cos(t) - \frac{3}{t^3}, \sqrt{t} \rangle \, dt \) as a vector of elementary functions. Use the constant vector \( \langle C_1, C_2, C_3 \rangle \) to denote arbitrary constants of integration.

7. Express the indefinite integral \( \int (t^3 + t^2, e^{3t}, 2e^t) \, dt \) as a vector of elementary functions. Use the constant vector \( \langle C_1, C_2, C_3 \rangle \) to denote arbitrary constants of integration.

8. Find \( \vec{r}(t) \) given \( \vec{r}'(t) = \langle \cos(t), e^t, 3e^t \rangle \) and \( \vec{r}(0) = \langle -1, 0, 4 \rangle \)

9. Find \( \vec{r}(t) \) given \( \vec{r}'(t) = \langle \frac{2t}{t^2 + 1}, t^3 + 2t, 9 \rangle \) and \( \vec{r}(0) = \langle -2, 4, 0 \rangle \)

10. Find \( \vec{r}(t) \) given \( \vec{r}'(t) = \langle \cos(t), \sin(t), 0 \rangle \) and \( \vec{r}(\frac{3\pi}{2}) = \langle 0, -1, 1 \rangle \)
1. \((-\sin(t), \frac{-6}{t^2}, 3t^2)\)

2. \((5t, 4e^{4t}, 4t^4 - \frac{6}{t^3})\)

3. \((\frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}})\)

4. \((\frac{8}{\sqrt{89}}, \frac{3}{\sqrt{89}}, \frac{4}{\sqrt{89}})\)

5. \((-\frac{2\sqrt{3}}{\sqrt{57}}, \frac{3}{\sqrt{57}}, \frac{6}{\sqrt{57}})\)

6. \((3\sin(t), -\frac{3}{2t^2}, \frac{2t^2}{3}) + (C_1, C_2, C_3)\)

7. \((\frac{t^4}{4} + \frac{2t^2}{5}, \frac{e^{3t}}{3}, 2e^t) + (C_1, C_2, C_3)\)

8. \((\sin(t) - 1, e^t - 1, 3e^t + 1)\)

9. \((\ln(t^2 + 1) - 2, \frac{t^4}{4} + t^2 + 4, 9t)\)

10. \((\sin(t) + 1, -\cos(t) - 1, 1)\)