

MA205 - Integral Calculus
Lesson 33: Vector Functions I

1. Evaluate the following definite and indefinite integrals by hand.

(a) $\int_1^2 (-\sin(t)\mathbf{i} + 9t^2\mathbf{j} + 3\mathbf{k}) dt$

(b) $\int_0^4 \langle 10e^t, -\cos(t), \sqrt{t} \rangle dt$

(c) $\int \left(t^{1/3}\mathbf{i} + \frac{3}{2}t^9\mathbf{j} + \frac{3}{t}\mathbf{k} \right) dt$

(d) $\int \langle -t^{-4}, 2.75, 0.5e^t \rangle dt$

2. Suppose $\mathbf{r}'(t) = 2\mathbf{i} + 14t\mathbf{j} + 7\sqrt{t}\mathbf{k}$ and $\mathbf{r}(0) = \mathbf{j} - \mathbf{k}$. Find $\mathbf{r}(t)$.

3. If $\mathbf{r}'(t) = \langle 2 \sin(t), -\cos(t), 3 \rangle$ and $\mathbf{r}(\pi) = \langle 5, 0, \pi \rangle$, find $\mathbf{r}(t)$.

4. Suppose the velocity of a particle at any time t is given by $\mathbf{v}(t) = (t^2 - 1)\mathbf{i} + 10t^3\mathbf{j} - 5t\mathbf{k}$.

(a) Find the vector function that describes the acceleration of the particle at any time t .

(b) If the initial position of the particle is represented by $2\mathbf{i} - \mathbf{j} + 17\mathbf{k}$, find the vector function that describes the position of the particle at any time t .