

Arc Length

Find the length of the indicated portion of the curve.

1. $\vec{x}(t) = \begin{pmatrix} 1 \\ 3 \\ 0 \end{pmatrix} + t \begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix}, \quad 0 \leq t \leq 10.$

2. $\vec{x}(t) = (t)\vec{i} + (\frac{2}{3}t^{3/2})\vec{k}, \quad 0 \leq t \leq 8.$

3. $\vec{x}(t) = (6 \sin 2t)\vec{i} + (6 \cos 2t)\vec{j} + (5t)\vec{k}, \quad 0 \leq t \leq \pi$

4. $\vec{x}(t) = (t \sin t + \cos t)\vec{i} + (t \cos t - \sin t)\vec{j}$, $\sqrt{2} \leq t \leq 2$.

5. $\vec{x}(t) = (\sqrt{2}t)\vec{i} + (\sqrt{2}t)\vec{j} + (1 - t^2)\vec{k}$ from $(0, 0, 1)$ to $(\sqrt{2}, \sqrt{2}, 0)$.

6. A curve

$$\vec{x}(t) = \begin{pmatrix} \cos t \\ \sin t \\ \ln \cos t \end{pmatrix}$$

. Find the length of the curve from $t = 0$ to $\pi/4$.

Solutions:

1. $10\sqrt{6}$

2. $\frac{52}{3}$

3. 13π

4. 1

5. $\sqrt{2} + \ln(1 + \sqrt{2})$

6. $\frac{1}{2} \ln(3 + 2\sqrt{2})$