12.1 example (vectors)

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Calculus BC – Vectors

Given a particle's position vector $\langle 3t^2 + 1, \sin 2t \rangle$, find:

a) the particle's position at t = 0

$\langle 1, 0 \rangle$

b) the particle's position at $t = \pi/4$

$\langle 3 \cdot \frac{\pi^2}{16} + 1, 1 \rangle$

c) its velocity vector

$\langle 6t, 2\cos 2t \rangle$

d) its velocity vector when $t = \pi/4$

$\langle \frac{3\pi}{2}, 0 \rangle$

Given a particle's position vector $\langle 3t^2 + 1, \sin 2t \rangle$, find:

e) the particle's speed when $t = \pi/4$ $\quad \frac{3\pi}{2}$ $\quad = \sqrt{\left(\frac{3\pi}{2}\right)^2 + 0^2}$

f) the distance the particle travels between $t = 0$ and $t = \pi/4$

$v = \langle 6t, 2\cos 2t \rangle$

$$\int_0^{\pi/4} \sqrt{36t^2 + 4\cos^2 2t}\, dt = 2.466$$

g) the particle's displacement over the interval $[0, \pi/4]$ $\quad \langle 1, 0 \rangle \rightarrow \left\langle \frac{3\pi^2}{16} + 1, 1 \right\rangle$

$$\sqrt{\left(\frac{3\pi^2}{16} + 1 - 1\right)^2 + 1^2} = 2.103$$

Given a particle's position vector $\langle 3t^2 + 1, \sin 2t \rangle$, find: $v = \langle 6t, 2\cos 2t \rangle$

h) its acceleration vector $\langle 6, -4\sin 2t \rangle$

i) its acceleration vector when t = 1 $\langle 6, -4\sin 2 \rangle$

j) the magnitude of the acceleration vector when t = 1 $\sqrt{36 + 16\sin^2 2}$

6.5.4: 13, 15, 23

worksheet