

Mathematics Questions by Topic

Motion and Force

Answer 4

Source: K21SM2Q15

Question 4

A particle of mass 2 kg, is moving so that its velocity vector at a time t , given by

$$\dot{\underline{r}}(t) = 4\sin^2(t)\underline{i} + 4\cos^2(t)\underline{j}, \text{ for } t \geq 0, \text{ given that } \underline{r}\left(\frac{\pi}{4}\right) = \frac{\pi}{2}(\underline{i} + \underline{j})$$

The change in momentum over $\frac{\pi}{6} \leq t \leq \frac{\pi}{4}$, is given by

- A. $-2\underline{i} + 2\underline{j}$.
- B. $2\underline{i} - 2\underline{j}$.
- C. $\underline{i} - \underline{j}$
- D. $-\underline{i} + \underline{j}$
- E. $2\sqrt{2}$

ANSWER B

$$\dot{\underline{r}}\left(\frac{\pi}{6}\right) = 4\sin^2\left(\frac{\pi}{6}\right)\underline{i} + 4\cos^2\left(\frac{\pi}{6}\right)\underline{j} = \underline{i} + 3\underline{j}$$

$$\dot{\underline{r}}\left(\frac{\pi}{4}\right) = 4\sin^2\left(\frac{\pi}{4}\right)\underline{i} + 4\cos^2\left(\frac{\pi}{4}\right)\underline{j} = 2\underline{i} + 2\underline{j}$$

$$\underline{p} = m\left(\dot{\underline{r}}\left(\frac{\pi}{4}\right) - \dot{\underline{r}}\left(\frac{\pi}{6}\right)\right) = 2\left((2\underline{i} + 2\underline{j}) - (\underline{i} + 3\underline{j})\right)$$

$$\underline{p} = 2\underline{i} - 2\underline{j}$$