

Mathematics Questions by Topic

Motion and Force

Answer 6

Source: K20SM2Q19

Question 6

A body is moving in a straight line. When its displacement is x metres from the origin at time t seconds, $t = x \cos(2x)$. The acceleration in ms^{-2} is given by

- A. $\frac{-2 \sin(2x)}{\cos^3(2x)}$
- B. $\frac{4(\sin(2x) + x \cos(2x))}{(\cos(2x) - 2x \sin(2x))^3}$
- C. $\frac{4(\sin(2x) + x \cos(2x))}{(\cos(2x) - 2x \sin(2x))^2}$
- D. $\frac{1}{\cos(2x) - 2x \sin(2x)}$
- E. $-4(x \cos(2x) + 2 \sin(2x))$

ANSWER B

$$t = x \cos(2x) \Rightarrow \frac{dt}{dx} = \cos(2x) - 2x \sin(2x)$$

$$v = \frac{dx}{dt} = \frac{1}{\cos(2x) - 2x \sin(2x)} = (\cos(2x) - 2x \sin(2x))^{-1}$$

$$\Rightarrow \frac{dv}{dx} = \frac{-(-2 \sin(2x) - 2 \sin(2x) - 4x \cos(2x))}{(\cos(2x) - 2x \sin(2x))^2}$$

$$\frac{dv}{dx} = \frac{4(\sin(2x) + x \cos(2x))}{(\cos(2x) - 2x \sin(2x))^2}$$

$$a = v \frac{dv}{dx} = \frac{4(\sin(2x) + x \cos(2x))}{(\cos(2x) - 2x \sin(2x))^3}$$

Define $t(x) = x \cdot \cos(2 \cdot x)$ ▶ Done

Define $v(x) = \frac{1}{\frac{d}{dx}(t(x))}$ ▶ Done

Define $a(x) = v(x) \cdot \frac{d}{dx}(v(x))$ ▶ Done

$a(x) = \frac{4 \cdot (x \cdot \cos(2 \cdot x) + \sin(2 \cdot x))}{(\cos(2 \cdot x) - 2 \cdot x \cdot \sin(2 \cdot x))^3}$