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. $\dfrac{-2\sin(2x)}{\cos^3(2x)}$

B. $\dfrac{4(\sin(2x)+x\cos(2x))}{(\cos(2x)-2x\sin(2x))^3}$

C. $\dfrac{4(\sin(2x)+x\cos(2x))}{(\cos(2x)-2x\sin(2x))^2}$

D. $\dfrac{1}{\cos(2x)-2x\sin(2x)}$

E. $-4(x\cos(2x)+2\sin(2x))$

ANSWER B

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

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

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

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

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