

Mathematics Questions by Topic

Motion and Force

Answer 21

Source: K14SM2Q21

Question 21

A particle of mass 10 kg travels in a straight line with velocity $v \text{ ms}^{-1}$ when its displacement is x metres, where $v = 2 \log_e(\sqrt{x^2 + 1} + x)$ for $x \geq 0$. The maximum force in newtons acting on the particle is closest to

- A. 1.5
- B. 2.7
- C. 20
- D. 24
- E. 26.5

ANSWER E

$$v = 2 \log_e(\sqrt{x^2 + 1} + x)$$

$$\frac{dv}{dx} = \frac{2}{\sqrt{x^2 + 1}}$$

$$a(x) = v \frac{dv}{dx} = \frac{4 \log_e(\sqrt{x^2 + 1} + x)}{\sqrt{x^2 + 1}}$$

$a(x)$ has a maximum when $x = 1.51$

$$F_{\max} = ma = 10 \times a(1.51) = 26.5$$

