

speeding up

→ v & a have the same sign.

slowing down

→ v & a have diff. signs.

4. A particle moves along the y-axis so that its position at any time t , for $0 \leq t \leq 5$, is given by $y(t) = t^4 - 18t^2$.

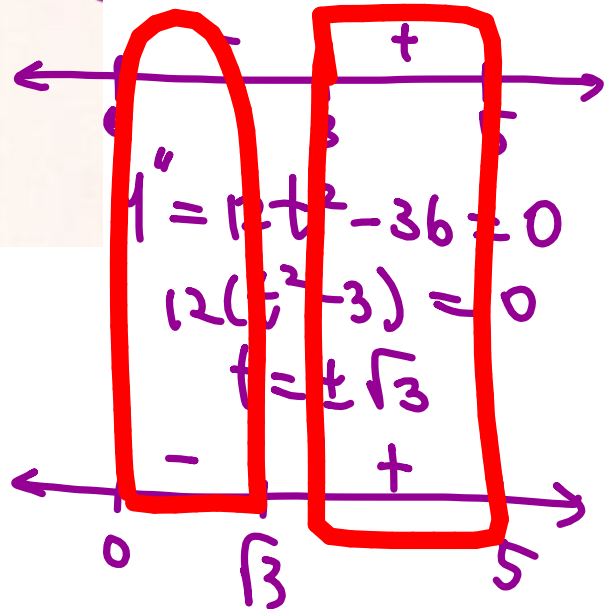
In which interval(s) is the particle speeding up?

- (A) $0 < t < \sqrt{3}$
 (B) $0 < t < \sqrt{3}$ and $3 < t < 5$
 (C) $3 < t < 5$
 (D) $\sqrt{3} < t < 3$ and $3 < t < 5$
 (E) $\sqrt{3} < t < 3$

$$y' = 4t^3 - 36t = 0$$

$$4t(t^2 - 9) = 0$$

$$(t = 0, \pm 3)$$



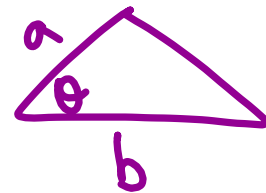
29. Two sides of a triangle are 4 m and 5 m in length and the angle between them is increasing at a rate of 0.06 rad/s. Find the rate at which the area of the triangle is increasing when the angle between the sides of fixed length is $\pi/3$.

$$A = \frac{1}{2} ab \sin \theta$$

$$A = \frac{1}{2} (4)(5) \sin \theta$$

$$\frac{dA}{dt} = 10 \cos \theta \frac{d\theta}{dt}$$

$$= 10 \cos\left(\frac{\pi}{3}\right) (.06) = .3 \frac{\text{m}^2}{\text{s}}$$



$$A = \frac{1}{2} ab \sin \theta$$

related rates.

How

[Redacted]

[Redacted]

[Redacted]

[Redacted]

[Redacted]

[Redacted]

at rest $\rightarrow v=0$

$$x' = v = 0$$

$$f(t) = \cos\left(\frac{\pi t}{4}\right)$$

$$f' = v = -\frac{\pi}{4} \sin\left(\frac{\pi t}{4}\right) = 0$$

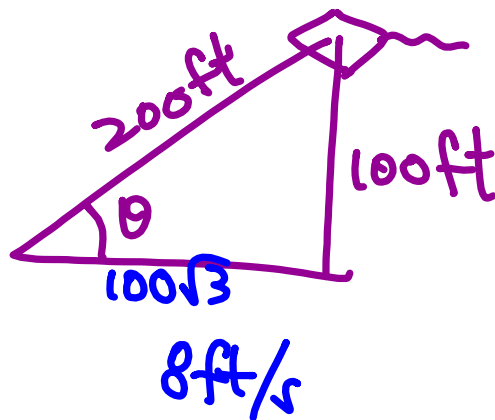
$$\frac{\pi t}{4} = 0, \pi, 2\pi, 3\pi, \dots$$

$$t = 0, 4, 8, 12$$

$$\text{if } 0 \leq t < 10, t = \{0, 4, 8\}$$

28. A kite 100 ft above the ground moves horizontally at a speed of 8 ft/s. At what rate is the angle between the string and the horizontal decreasing when 200 ft of string has been let out?

$$\frac{d\theta}{dt}$$



$$\tan \theta = \frac{100}{x} = 100x^{-1}$$

$$\sec^2 \theta \frac{d\theta}{dt} = -\frac{100}{x^2} \frac{dx}{dt}$$

$$\left(\frac{2}{\sqrt{3}}\right)^2 \frac{d\theta}{dt} = -\frac{100}{(100\sqrt{3})^2} (8)$$

$$\left(\frac{4}{3}\right) \frac{d\theta}{dt} = \frac{-1}{100 \cdot 3} \cdot 8$$

$$\frac{d\theta}{dt} = \frac{-8^2}{100 \cdot 3} \cdot \frac{3}{4} = -.02 \text{ rad/s.}$$