

Answer on Question #66222-Mechanics - Relativity

In an arcade video game a spot is programmed to move across the screen to $x = 9.00t - 0.750t^3$, where x is the distance in cm and t is the time in seconds. when the spot reaches a screen edge, at either $x=0$ or $x=15.0\text{cm}$. t is reset to 0 and spot start moving again according to $x(t)$

- at what time after starting is the spot instantaneously at rest.
- where does it occur
- what is its acceleration when it occurs
- in what direction is it moving just prior to coming to rest.
dii) just after
- when does it first reach an edge of the screen after $t=0$.

Solution

- The instantaneous speed of a plot

$$v(t) = (x(t))' = (9.00t - 0.75t^3)' = 9.00 - 2.25t^2.$$

At rest

$$v(t) = 9.00 - 2.25t^2 = 0, \rightarrow t = \sqrt{\frac{9}{2.24}} = 2 \text{ s.}$$

- Position of a plot at $t = 2 \text{ s}$ is

$$x(t) = 9.00t - 0.75t^3 = 9.00 \times 2 - 0.75 \times 2^3 = 12 \text{ cm.}$$

- The acceleration

$$a(t) = (x(t))'' = (9.00t - 0.75t^3)'' = -4.5t.$$
$$a(2) = -4.5 \times 2 = -9 \frac{\text{cm}}{\text{s}^2}.$$

- The plot is moving at positive direction of axis x .

dii) The plot is moving at opposite direction of axis x .

- At the edge of the screen $x(t) = 0 \text{ cm}$. So

$$x(t) = 9.00t - 0.75t^3 = 0, \rightarrow 0.75t^3 - 9.00t = 0, \rightarrow t = \sqrt{\frac{9.00}{0.75}} = \sqrt{12} = 3.46 \text{ s.}$$

Answers: a) 2s, b) 12cm, c) -9 cm/s², d) at positive direction, dii) at opposite direction, e) 3.46 s.

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