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Question: 17. A billiard ball is hit and travels in a straight line. If s cm is th...

17. A billiard ball is hit and travels in a straight line. If s cm is the distance of the ball from its initial position at t sec, then $s = 100t^2 + 100t$. If the ball hits a cushion that is 39 cm from its initial position, at what velocity does it hit the cushion?

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Expert Answer ⓘ



Sahil Kumar Marka answered this
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Sol Given

$$s(t) = 100t^2 + 100t$$

$s = 39 \text{ cm.}$

$$\Rightarrow 39 = 100t^2 + 100t$$

$$\Rightarrow 100t^2 + 100t - 39 = 0$$

$$\Rightarrow t = \frac{-100 \pm \sqrt{(100)^2 - 4(-39)(100)}}{2(100)}$$

$$= \frac{-100 \pm \sqrt{10000 + 15600}}{200}$$

$$= \frac{-100 \pm 160}{200} \quad \left[t \text{ cannot be negative} \right]$$

$$= \frac{-100 + 160}{200}$$

$$t = \frac{60}{200} = \frac{3}{10}$$

Now,

$$\text{velocity } v(t) = \frac{d}{dt} (100t^2 + 100t)$$

$$= 200t + 100$$

at $t = \frac{3}{10}$

$$\text{Velocity} = 200 \left(\frac{3}{10} \right) + 100$$

$$= 160 \text{ cm/s}$$

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Q: 2) A thin 4-ft-wide, right-angle gate with negligible mass is free to pivot about a frictionless hinge at point O. The horizontal portion of the gate covers a 1-ft-diameter drainpipe which contains air at atmospheric pressure. Determine the minimum water depth h at which the gate will pivot to allow water to flow through the pipe. Ans: $h = 1.88 \text{ ft}$