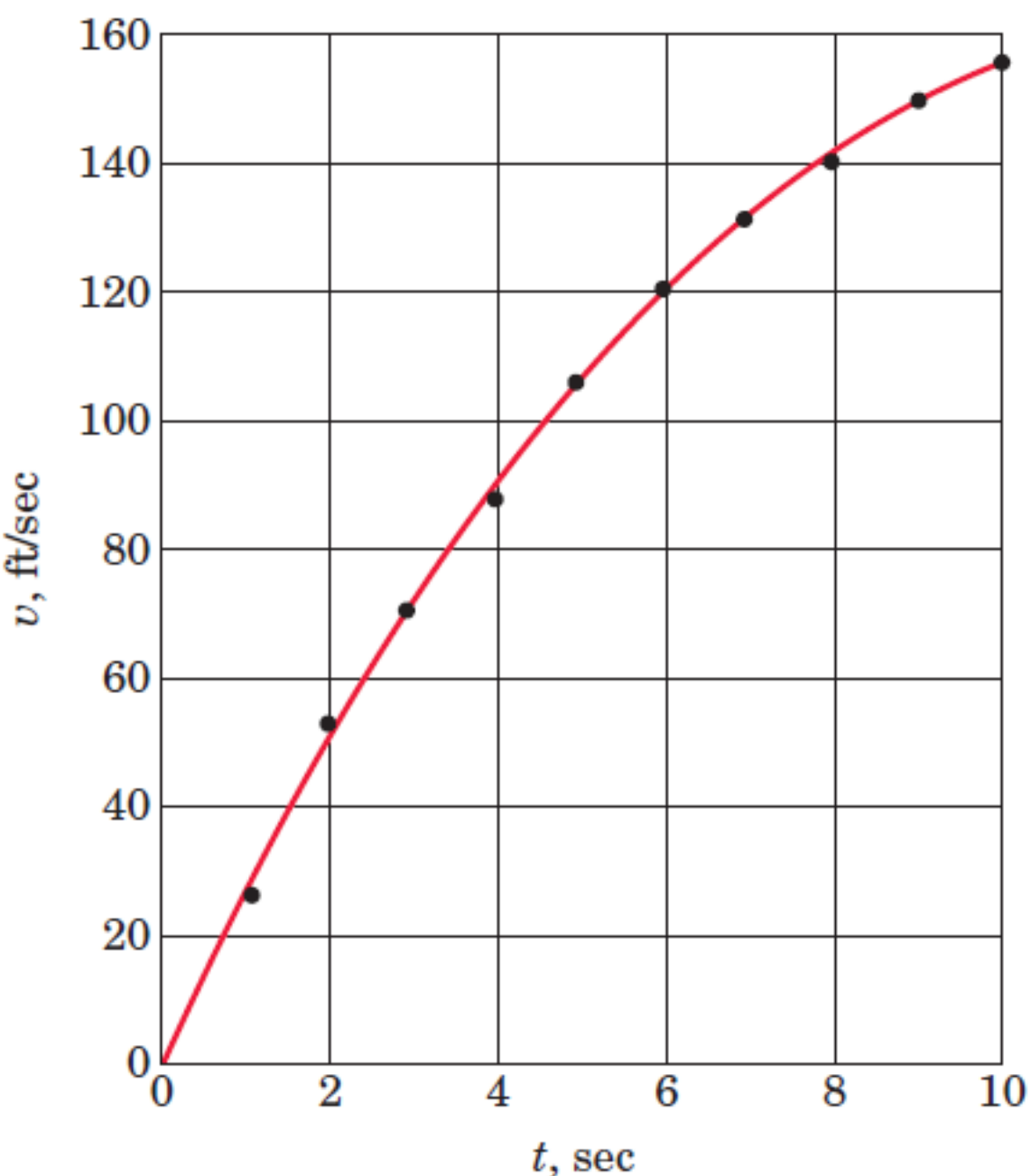


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Problem

An electric car is subjected to acceleration tests along a straight and level test track. The resulting v - t data are closely modeled over the first 10 seconds by the function $v = 24t - t^2 + 5\sqrt{t}$, where t is the time in seconds and v is the velocity in feet per second. Determine the displacement s as a function of time over the interval $0 \leq t \leq 10$ sec and specify its value at time $t = 10$ sec.



Problem 2/30

Step-by-step solution

Step 1 of 2

The velocity of car is given by,

$$v = 24t - t^2 + 5\sqrt{t}, \text{ which is valid in the range } 0 \leq t \leq 10.$$

Use the relation $v = \frac{ds}{dt}$.

$$\int ds = \int v dt$$

$$s = \int (24t - t^2 + 5\sqrt{t}) dt$$

$$s = 12t^2 - \frac{t^3}{3} + \frac{10}{3}t\sqrt{t} + c$$

At the start of car, when $t = 0$ sec, the displacement is zero. Hence constant of integration becomes $c = 0$.

$$s = 12t^2 - \frac{t^3}{3} + \frac{10}{3}t\sqrt{t} \text{ ft(1)}$$

Above equation gives displacement s as a function of time over interval $0 \leq t \leq 10$ sec.

[Comment](#)

Step 2 of 2

At $t = 10$ sec,

Substitute $t = 10$ in equation (1) to get,

$$s = 12 \times 10^2 - \frac{10^3}{3} + \frac{10}{3} \times 10\sqrt{10}$$

$$s = 972.08 \text{ ft}$$

This is displacement value of car when $t = 10$ sec.

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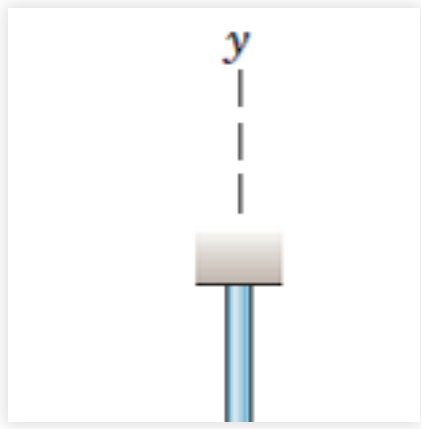
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Recommended solutions for you in Chapter 2

Chapter 2, Problem 217P

Collars A and B slide along the fixed right-angle rods and are connected by a cord of length L . Determine the acceleration a_x ...

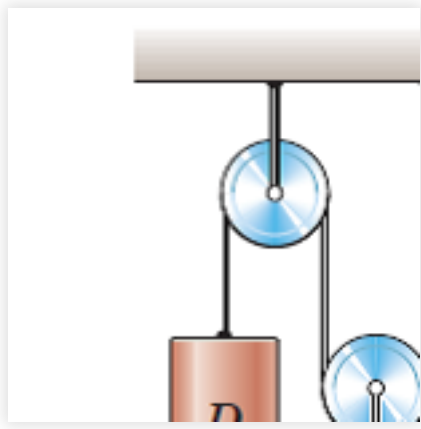
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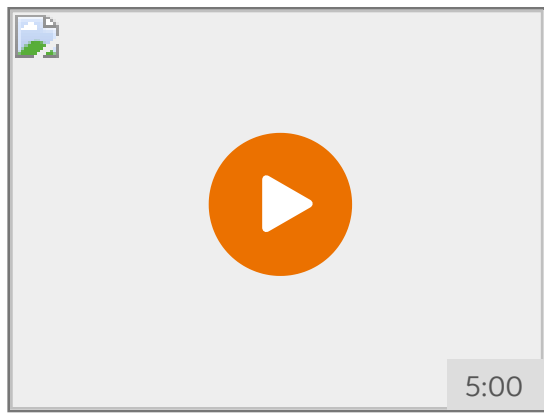
Chapter 2, Problem 216P

Determine the relationship which governs the velocities of the four cylinders. Express all velocities as positive down. How...

[See solution](#)



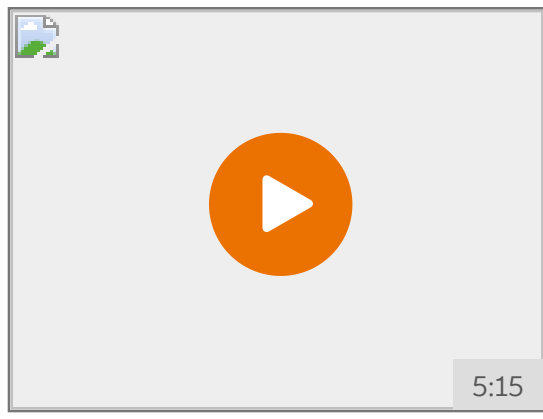
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Examples related to Chapter 2

Example 1

The position coordinate of a particle which is confined to move along a straight line is given by $s = 2t^3 - 24t + 6$, where s is measured in meters from a convenient origin and t is in seconds. Determine (a) the time required for the particle to reach a velocity of 72 m/s from its initial condition at $t = 0$, (b) the acceleration of the particle when $v = 30 \text{ m/s}$, and (c) the net displacement of the particle during the interval from $t = 1 \text{ s}$ to $t = 4 \text{ s}$.



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Example 2

Example 3

Example 4

Example 5

Post a question

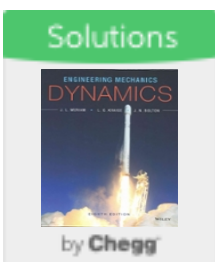
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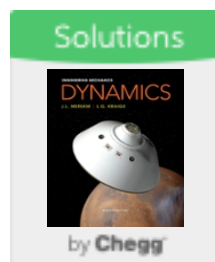
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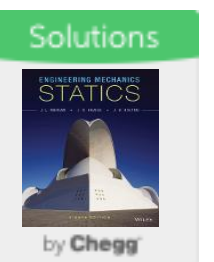
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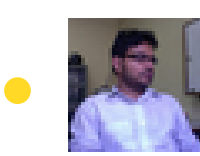
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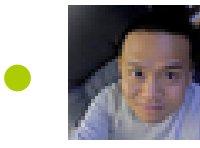
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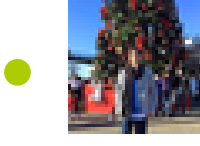
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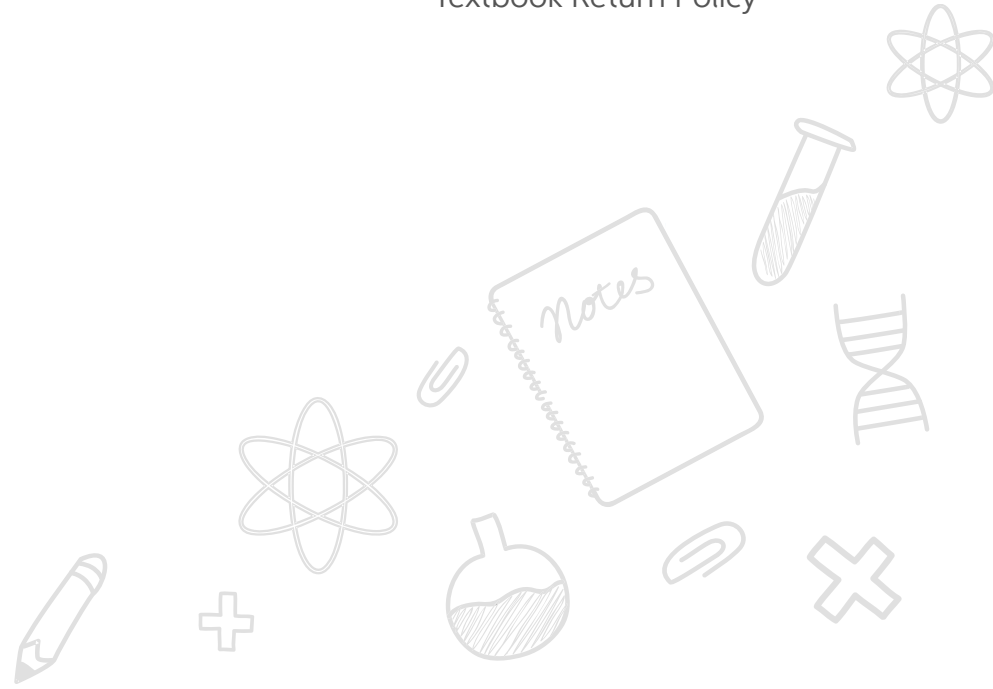
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