Answer on Question #54925, Physics / Mechanics | Kinematics | Dynamics

The two ends of a train moving with constant acceleration pass a certain point with velocities u and 3u. The velocity with which the middle point of the train pared passes the same point is

(1)2u (2)3/2u

(3)√5u

(4)√10u

Solution:

The train is accelerating, so we can use the formula's for accelerated motion in one line: $v^2 - u^2 = 2aL$

where L is length of train u= head of train velocity 3u= tail of train [v=3u] velocity Thus,

$$(3u)^{2} - u^{2} = 2aL$$
$$9u^{2} - u^{2} = 2aL$$
$$8u^{2} = 2aL$$
$$a = \frac{4u^{2}}{L}$$

Now at middle of train

$$L' = \frac{L}{2}$$
$$v'^2 - u^2 = 2aL'$$
$$v'^2 = u^2 + \frac{2aL}{2}$$

put the value of a

$$v'^{2} = u^{2} + 2 * \frac{4u^{2}}{L} * \frac{L}{2}$$
$$v'^{2} = 5u^{2}$$
$$v' = u\sqrt{5}$$

Answer: (3)√5u