

Answer on Question #52771, 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 passes the same point is _____
?

Solution:

The train is accelerating, so we can use the formula's for accelerated motion in one line:

$$v^2 - u^2 = 2aL$$

u = head of train

$3u$ = tail of train [$v=3u$]

so

$$(3u)^2 - u^2 = 2aL$$

$$9u^2 - u^2 = 2aL$$

$$8u^2 = 2aL$$

$$a = \frac{4u^2}{L}$$

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: $u\sqrt{5}$