The two ends of a train moving with constant acceleration pass a certain point with velocities $u$ and $3 u$. The velocity with which the middle point of the train pared passes the same point is
(1) $2 u$
(2) $3 / 2 u$
(3) V 5 u
(4) V 10 u

## Solution:

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

$$
v^{2}-u^{2}=2 a L
$$

where $L$ is length of train
$u=$ head of train velocity
$3 u=$ tail of train [ $\mathrm{v}=3 \mathrm{u}]$ velocity
Thus,

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

Now at middle of train

$$
\begin{gathered}
L^{\prime}=\frac{L}{2} \\
v^{\prime 2}-u^{2}=2 a L^{\prime} \\
v^{\prime 2}=u^{2}+\frac{2 a L}{2}
\end{gathered}
$$

put the value of a

$$
\begin{gathered}
v^{\prime 2}=u^{2}+2 * \frac{4 u^{2}}{L} * \frac{L}{2} \\
v^{\prime 2}=5 u^{2} \\
v^{\prime}=u \sqrt{5}
\end{gathered}
$$

Answer: (3)V5u

