Q- Two towns $A \& B$ are connected by a regular bus service with a bus leaving in either direction every T min. A man cycling with a speed of $20 \mathrm{Km} / \mathrm{hr}$ in the direction A to B notices that a bus goes past him every 18 min in the direction of his motion, and every 6 min in the opposite direction. What is the period T of the bus service and with what speed, (assumed constant) do the buses ply on the road.

Let the speed of each bus is $V \mathrm{~km} / \mathrm{hr}$.
The distance between any two buses moving in the same direction remains constant and equal to velocity of each bus*time $=\mathrm{V} * \mathrm{~T}$

Velocity of the buses moving in same direction relative to the man will be $\mathrm{V}-\mathrm{V}_{\mathrm{m}}$ and thus the distance between the buses is covered in time $t_{1}$ given by

$$
\begin{equation*}
\left(V-V_{m}\right) * t_{1}=V * T \tag{1}
\end{equation*}
$$

Similarly the distance between any two buses moving in the direction opposite to the man remains constant and equal to velocity of each bus*time $=\mathrm{V}^{*} \mathrm{~T}$

Velocity of the buses moving in the opposite direction relative to the man will be $\mathrm{V}+\mathrm{V}_{\mathrm{m}}$ and thus the distance between the buses is covered in time $t_{2}$ given by

$$
\begin{equation*}
\left(V+V_{m}\right) * t_{2}=V * T \tag{2}
\end{equation*}
$$

Equating the two equations we get

$$
\frac{\left(V+V_{m}\right)}{\left(V-V_{m}\right)}=\frac{t_{1}}{t_{2}}
$$

Substituting the values we get

$$
\frac{V+20}{V-20}=\frac{18}{6}
$$

Gives $V=40 \mathrm{~km} / \mathrm{hr}$
And from equation (1) we get

$$
(40-20) *(18 / 60)=40 * T
$$

Gives $T=9 / 60 \mathrm{hr}=9 \mathrm{~min}$

