Let find max possible velocity from the first two informations. For this, let at $t=0$, particle be at $x=10m$ & let part reach $x=22m$ just at the end of $t=3s$. Then,

$$v_{max} = \frac{22-10}{3} = 4m/s.$$

However, we have to check whether this satisfies 3rd condition or not. According to

this situation, at $t = 12$s, particle will be at $10m + (12 \times 4) = 58m$, which is between 55m & 60m, So in any case, V can't exceed 4m/s.

Now, lets find minimum V. Let at $t = 0$, particle be at $x = 12m$. Also let particle reach $x = 22m$ at $t = 4s$.

Then, $V_{min} = \frac{22 - 10}{4} = 3m/s$

Lets check 3rd cond,

Location at $t = 12s$

will be $12 + (3) \times 12$

$= 48m$, which is not satisfying. So, we adjust either initial position or arrival time for 1st car.

$$(10 + x) + (12)v = 55.$$

$$10 + x = 55 - 12v$$

$$x = 45 - 12v$$

$0 < x < 2.$ $\quad 45 - 12v > 0$

$v < \frac{45}{12},$ $\quad 45 - 12v < 2$

$12v > 43$

$v > \frac{43}{12}$. Now lets adjust time for first case.

$$12 + (3 + \Delta t)\, v = 55.$$

$$(3 + \Delta t)\, v = 43$$

$$(\Delta t) = \frac{43}{v} - 3.$$

$$\frac{43}{v} - 3 > 0$$

$$\frac{43}{v} > 3 \qquad v < \frac{43}{3}.$$

$$\frac{43}{v} - 3 < 1 \qquad \frac{43}{v} < 4$$

$v > \frac{43}{4}$ → This is much more than $\frac{43}{12}$.

So, least possible value of 'v' must be $\frac{43}{12}$.

For this, the initial location of particle must be $x = 12$.

$$t_{max} = \frac{88 - 12}{\frac{43}{12}} \simeq 21.2 \text{ sec}.$$

$$t_{min} = \frac{88-10}{4} = \frac{78}{4}$$

$$\simeq \boxed{19.5 \text{ sec}}$$

Now lets see if we can search for further min velocity by adjusting initial position & arriving time interval for first two cases, because we have taken two boundary conditions. Then,

$$(10+x) + (12)v = 55$$

AND

$(10+x) + (3+\Delta t)v = 22$.

So,

$55 - 12v + 3v + v\Delta t = 22$

$9v - v(\Delta t) = 33$

$\Delta t = \frac{9v - 33}{v} = 9 - \frac{33}{v}$

$\Delta t > 0, \quad 9 - \frac{33}{v} > 0 \quad \frac{33}{v} < 9$

$v > \frac{11}{3}$ → This is even lesser velocity.

So, our previous t_{max} was wrong.

On back calculation, we see when $v_{min} = \frac{11}{3}$ m/s. $x = 1$ m. So, initial position = 11 m. Then,

$$t_{max} = \frac{88 - 11}{11/3} = 21 \text{ s.}$$

Then, the final actual range is

19.5 sec → 21 s

Pathfinder answer is CORRECT.