(4) $B_1 \rightarrow$ Ashish catches the waiting bus

$B_2 \rightarrow$ Ashish catches the next taxi, which arrives between 0 and 5 minutes

$B_3 \rightarrow$ Ashish catches the bus at 5 minutes.

$X \rightarrow$ Ashish's waiting time.

So, $E(X) = E(X/B_1)\,P(B_1) + E(X/B_2)P(B_2) + E(X/B_3)\,P(B_3)$.

$= (0)(2/3) + (5/2)(1/6) + (5)(1/6)$

$= 15/12$.

And CDF is,

$P(X \le x) = F_X(x) = \frac{2}{3} + \left(\frac{1}{30}\right)(x).,\quad 0 \le x \le 10\ ;\ 0$, otherwise.

(15) We want to compute the CDF of the ambulance's travel time T, $P(T \le t) = P(|X-Y| \le vt)$

where, $X \rightarrow$ Location of Ambulance.

$Y \rightarrow$ Location of Accident.

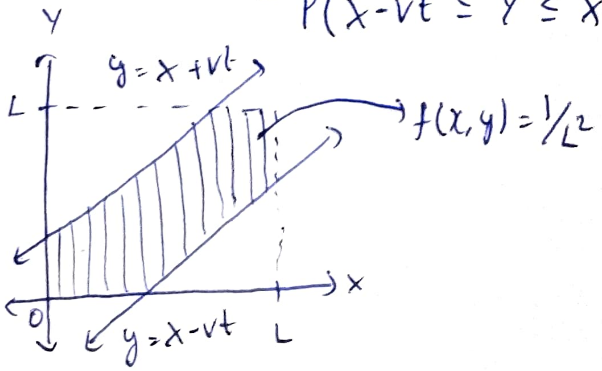
As X and Y are independent,

$$f_{X,Y}(x,y) = \begin{cases} 1/L^2, & \text{if } 0 \le x, y \le L \\ 0, & \text{otherwise} \end{cases}$$

Now, $P(T \le t) = P(|X-Y| \le vt)$

$= P(-vt \le Y - X \le vt)$.

$= P(X - vt \le Y \le X + vt)$.



$P(X - vt \le Y \le X + vt)$ corresponds to the integral of the joint density of X and Y over the shaded region.

$\therefore$, because the joint density is uniform over the entire region,

$$F_T(t) = (1/L^2) \times (\text{Shaded area}) = \begin{cases} 0 & , \text{if } t < 0 \\ \frac{2vt}{L} - \frac{(vt)^2}{L^2} & , \text{if } 0 < t < L/v \\ 1 & , \text{if } t \ge L/v \end{cases}$$

So,
$$f_T(t) = \begin{cases} \frac{2v}{L} - \frac{2v^2 t}{L^2} & , \text{if } 0 \le t \le L/v \\ 0 & , \text{otherwise} \end{cases}$$