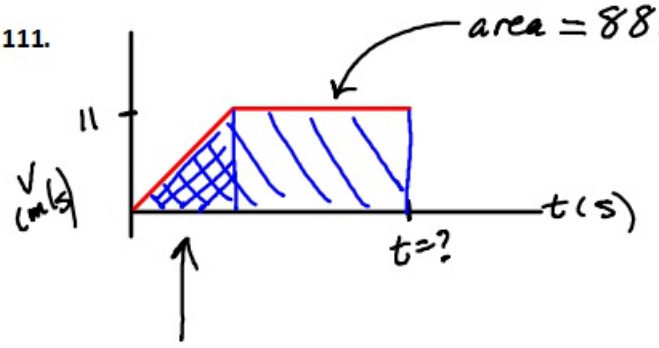
111.



area = 12 m

$\Delta x = \frac{1}{2}(v_0 + v_f)t$

$12 = \frac{1}{2}(0 + 11)t$

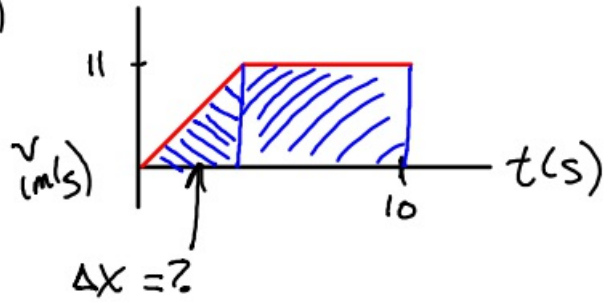
$t = 2.18$

$88 = \frac{1}{2}(11 + 11)t$

$t = 8\text{ s}$

race takes 10.18 s

b)



Δx = area under entire graph = 100 m

$100 = \frac{1}{2}(T)(11) + (10 - T)(11)$

$100 = 5.5T - 11T + 110$

$T = 1.818\text{ s}$

$\Delta x_{start} = ?$ $\quad v_0 = 0$ $\quad v_f = 11\text{ m/s}$ $\quad t = 1.818\text{ s}$

$\Delta x = \frac{1}{2}(v_0 + v_f)t$

$= \frac{1}{2}(0 + 11)(1.818)$

$\Delta x_{start} = 10\text{ m}$

90. $X(5) = ?$

0 to 2 $\quad V_0 = 0 \quad X_0 = 0 \quad \Delta t = 2$

$V_f = 4\,m/s \quad X_f = ?$

$$X_f - X_0 = \tfrac{1}{2}(V_0 + V_f)t = \tfrac{1}{2}(0+4)2$$

$$X_2 = 4m$$

2 to 4s $\quad X_0 = 4m \quad V_0 = 4\,m/s \quad a = 0 \quad \Delta t = 2s$

$$X_f - X_0 = V_0 t + \tfrac{1}{2} a t^2$$

$$X_4 - 4 = 4(2) + 0 \qquad X_4 = 12m$$

4s to 5s $\quad X_4 = 12m \quad V_0 = 4\,m/s \quad V_f = 2\,m/s$

$\Delta t = 1s$

$$X_5 - X_4 = \tfrac{1}{2}(V_0 + V_f)t$$

$$X_5 - 12 = \tfrac{1}{2}(4+2)(1)$$

$$X_5 = 15m$$