150 workers were engaged to finish a job 'W' in 'x' number of days. However, 4 workers dropped out on the 2nd day, 4 more workers dropped out on the 3rd day and so on. Practically, it took 8 more days to finish the work. Find the number of days in which the work was actually completed.

Solution

150 workers take x days to complete W work

$\therefore$ 1 Worker alone in x days can complete $\frac{W}{150}$ work

$\therefore$ 1 Worker alone in 1 day can complete $\frac{W}{150x}$ work

Practically, it takes x+8 days to complete the work,

$$150\times\frac{W}{150x}+146\times\frac{W}{150x}+142\times\frac{W}{150x}+............(x+8)\text{days}=\text{W}$$

$$\therefore \frac{1}{150x}[150+146+142+.........(x+8)\text{terms}]=1$$

$$\therefore \frac{1}{150x}\frac{x+8}{2}\left[2\times150+(x+8-1)(-4)\right]=1$$

$$\therefore (x+8)(300-4x-28)=300x$$

$$\therefore (x+8)(272-4x)=300x$$

$$\therefore (x+8)(68-x)=75x$$

$$\therefore 68x-x^2+544-8x=75x$$

$$\therefore -x^2-15x+544=0 \text{ Or } x^2+15x-544=0$$

$$\therefore x=17,-32$$

Rejecting the -ve value, $x=17$

So, the work was planned to be over in 17 days.

However, practically it took 17+8=25 days for its completion.