PIPES AND CISTERNS

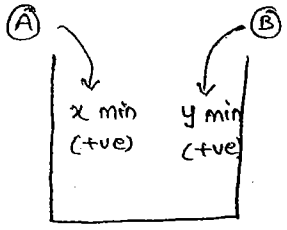
pipes :- → taps → capacity → $\frac{m^3}{\text{sec (or) min (or) hour}}$

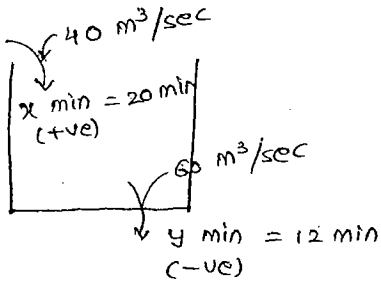
cistern : → volume (m^3)

pipes — inlet pipe → into the tank (+ve)

pipes — outlet pipe → From the tank (−ve)

Leakages → (−ve)





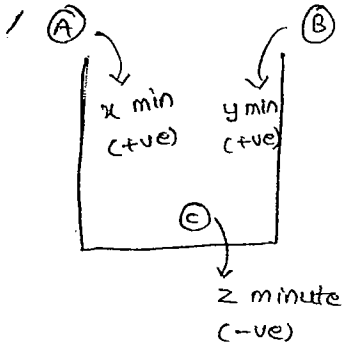
⇒ so it is empty

$\frac{xy}{x+y}$ min < x minutes, y minutes

$\frac{xy}{x-y}$ min > x minute, y minute

Functioning → F ∝ $\frac{1}{t}$ ∝ capacity

t → time



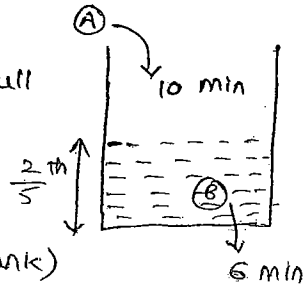
$$1 \text{ minute} = \frac{1}{x} + \frac{1}{y} - \frac{1}{z}$$

P. 9 NO:- 73

1. $\frac{xy}{x-y} = \frac{10 \times 6}{10-6} = 15$ min to empty of full tank

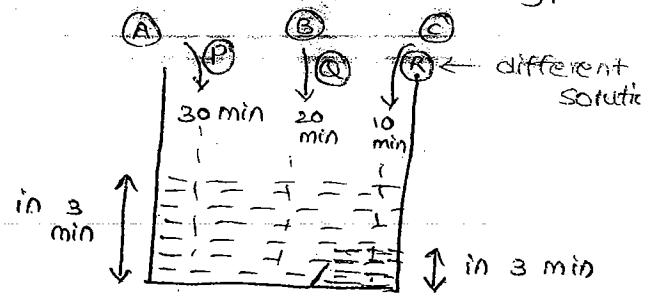
⇒ $\frac{2}{5} \times 15$

⇒ 6 m to empty the ($\frac{2}{5}$ th of tank)



Note :- 10 min to full, 6 min to empty. so if the tank is

2. After 3 min = $\frac{R}{\text{Total}}$



1 min (A+B+C) = $\frac{1}{30} + \frac{1}{20} + \frac{1}{10}$

$= \frac{11}{60}$ th

3 min (A+B+C) = $\frac{11}{60} \times 3$

$= \frac{11}{20}$ th

1 min, R $\longrightarrow \frac{1}{10}$

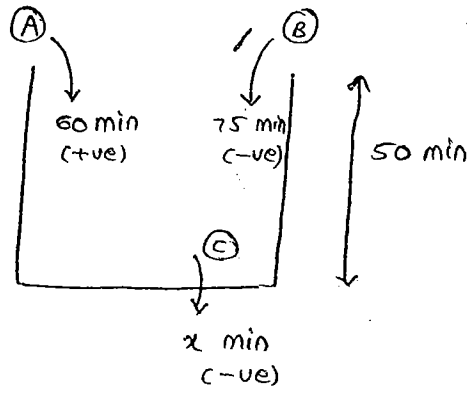
3 min, R $\longrightarrow \frac{3}{10}$

$\therefore$ After 3 min = $\frac{R}{T} = \frac{\frac{3}{10}}{\frac{11}{20}}$

$= \frac{3}{10} \times \frac{20}{11} = \frac{6}{11}$

3. 1 min (A+B−C) = $\frac{1}{60} + \frac{1}{75} - \frac{1}{x} = \frac{1}{50}$

$x = 100$ min

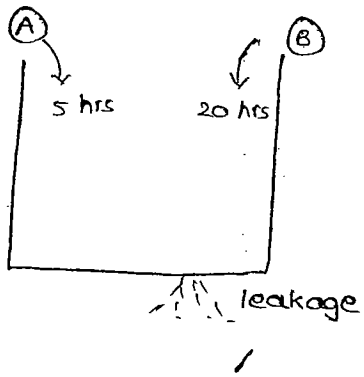


4. $\frac{xy}{x+y} = \frac{5 \times 20}{25} = 4$ hours

due to leakage = $4 + \frac{1}{2} = \frac{9}{2}$ hrs

1 hour $\longrightarrow \frac{1}{5} + \frac{1}{20} - \frac{1}{x} = \frac{2}{9}$

$x = 36$ hours



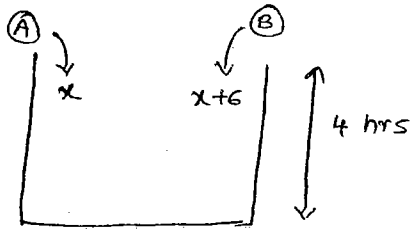
Level - 2

1. 1 hour $\longrightarrow \frac{1}{x} + \frac{1}{x+6} = \frac{1}{4}$

$\frac{x+6+x}{x^2+6x} = \frac{1}{4}$

$x = 6, -4$

$\therefore$ 6 hours to fill A alone



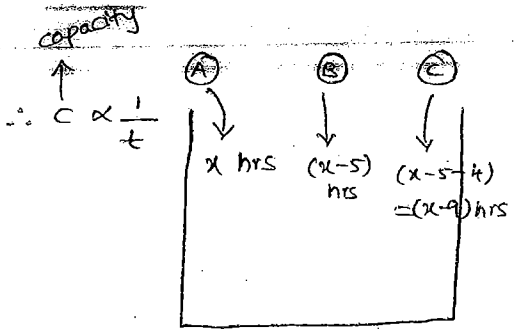
2. 1 hour $= \frac{1}{x} + \frac{1}{x-5} + \frac{1}{x-9}$

$$\frac{x-5+x}{x^2-5x} = \frac{1}{x-9}$$

$$x^2 - 18x + 45 = 0$$

$$x = +15, \quad +3$$

$\therefore$ 15 hours



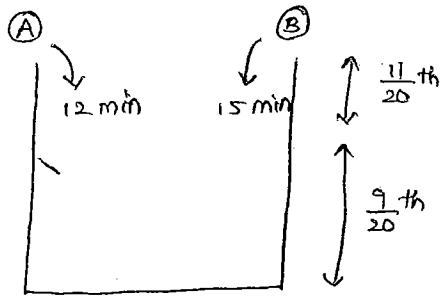
3. 1 min (A+B) $= \frac{1}{12} + \frac{1}{15} = \frac{3}{20}$ th

3 min (A+B) $= \frac{3}{20} \times 3$

$= \frac{9}{20}$ th

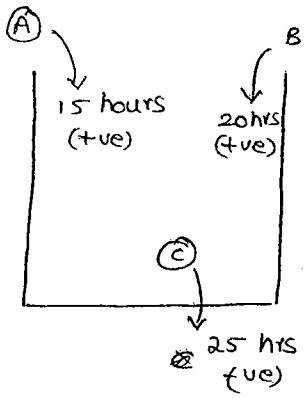
$B = \frac{11}{20} \times 15$

B = 8 min 15 sec



4. 1 hr (A+B-C) $= \frac{1}{15} + \frac{1}{20} - \frac{1}{25}$

$=$

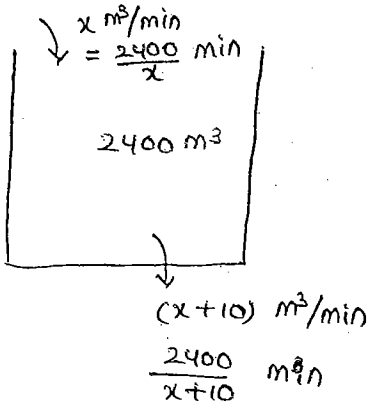


5. capacity $\propto \frac{1}{\text{time}}$

$$\frac{2400}{x} - \frac{2400}{(x+10)} = 8$$

$$x^2 + 10x - 3000 = 0$$

$x = -60, \quad 50 \ m^3/min$



$\frac{2400}{x+10} = \frac{2400}{50+10} = 40$ min

$\frac{2400}{x} = \frac{2400}{50} = 48$ min

} difference is 8 min, which is satisfied

$\therefore x = 50 \ m^3/min$

6.

1 min (A+B−C) $= \frac{1}{20} + \frac{1}{24} - \frac{1}{x} \Rightarrow$

$\frac{1}{15} = \frac{1}{20} + \frac{1}{24} - \frac{1}{x}$

$x = 40$ min

capacity $= 3 \times 40 = 120$ gallons