VQAR - 11

PIPES & CISTERNS

PROBLEMS:

1) If a pipe can fill a tank in 2h & another pipe can fill the same tank in 6h then what part of a tank will be filled by both the pipes in 1h, if they are opened simultaneously?

Sol → In 1h, part filled by 1st pipe = $\frac{1}{m} = \frac{1}{2}$

→ In 1h, part filled by 2nd pipe = $\frac{1}{n} = \frac{1}{6}$

∴ In 1h, filled by both the pipes together

$$= \left[\frac{1}{m} + \frac{1}{n} \right]$$

$$= \left[\frac{1}{2} + \frac{1}{6} \right]$$

$$= \frac{3+1}{6} = \frac{4}{6} = \frac{2}{3} \text{ part.}$$

2) If a Pipe can fill a tank in 5h & an another Pipe can empty the tank in 10h, then Part fill by both pipes in 1h, if both pipes are open Simultaneously.

Sol. -> In 1h, Part filled by 1st pipe = $\frac{1}{m} = \frac{1}{5}$

In 1h, Part emptied by 2nd pipe = $\frac{1}{n} = \frac{1}{10}$

$\therefore$ In 1h, Part filled by both pipes when open Simultaneously:

NOTE: [-ve sign is used, as 2nd pipe empties the tank

$= \frac{1}{m} - \frac{1}{n} \Rightarrow \frac{1}{5} - \frac{1}{10}$

$= \frac{2-1}{10} = \frac{1}{10}$ Part.

⇒ Fast Track Techniques:

(i) If both pipes either fills or empties the tank, then the time taken to fill or empty the tank when both pipes are opened is

$$t = \frac{mn}{m+n}$$

(ii) If first pipe fills the tank & second pipe empties the tank, then the time taken to fill the tank when both pipes are opened is

$$t = \frac{mn}{m-n} \quad ; m > n$$

(iii) (or)

$$t = \frac{mn}{m-n} \quad ; n > m$$

3) A pipe can fill a tank in 5h, while another pipe can empty it in 6h, If both the pipes are opened simultaneously, how much time will be taken to fill the tank?

Sol: By using Fast Track Technique.

Here, $m = 5h$ & $n = 6h$

time taken to fill the tank $= \frac{m \times n}{n - m}$

$= \frac{5 \times 6}{6 - 5} = \frac{30}{1} = 30h$ //

4) Two pipes A & B can fill a tank in 18h & 12h, respectively. If both the pipes are opened simultaneously. How much time will be taken to fill the tank:

Sol: By using fast track method.

Time taken by both pipes to fill $= \frac{mn}{m+n}$

→ Where, m & n are time taken to fill the tank by individual pipes.

→ Here, $m = 18$, $n = 12$

Time taken to fill the tank $= \frac{m \times n}{m+n} = \frac{18 \times 12}{18+12}$

$\Rightarrow \frac{18 \times 12}{30} = \frac{3 \times 12}{5} = \frac{36}{5} = 7\frac{1}{5}\ h$ //

5) Pipe A can fill a tank in 20h while pipe B alone can fill it in 10h & pipe C can empty the full tank in 30h. If all the pipes are opened together, how much time will be needed to make the tank full?

Sol: ⇒ Part filled by pipe A alone in 1h : $\frac{1}{20}$

Part ~~emptied~~ filled by pipe B alone in 1h : $\frac{1}{10}$

Part emptied by pipe C alone in 1h : $\frac{1}{30}$

Net Part filled by (A+B+C) in 1h : $\left(\frac{1}{20}\right)+\left(\frac{1}{10}\right)-\left[\frac{1}{30}\right]$

$$\Rightarrow \left[\frac{3+6-2}{60}\right]$$

$$= \frac{7}{60} h$$

∴ Required time to fill the tank : $\frac{60}{7}$ h //

⇒ Fast Track Method.

Here m = 20, n = 10, P = 30

∴ Required time to fill the tank : $\frac{mnP}{nP+mP-mn}$

$$\Rightarrow \frac{20 \times 10 \times 30}{10\times 30 + 20\times 30 - 20\times 10}$$

$$\Rightarrow \frac{6000}{300+600-200} = \frac{6000}{700}$$

$$\Rightarrow \frac{60}{7} //$$