Work Rate Problems
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YouTube Video Link to this Post is Here

Following is covered in the video

¤ **Rate, Time and Work Concept**
¤ **Work done in Parts**
¤ **Work done when people work together**
¤ **Filling and Emptying a Tank (Inlet-Outlet Pipe Problems)**
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Rate, Time and Work Concept

• Problems in Rate and and Work are based of one simple formula

Rate * Time = Work Done

• If work done is same throughout the problem, then work done can be taken as 1.

• Example: It takes Ram 5 days to paint a house. It takes Shyam 10 days to paint the same house.
Since both of them are doing the same work so the work done can be taken as 1

Work done in parts or multiples

• If work done is in parts such as 20 houses painted and 25 houses painted then take the work done as 20 and 25 respectively.

• Example: Rohan takes 10 mins to read 20 pages. Mohan takes 15 mins to read 30 pages.
Work done in case of Rohan can be taken as 20 pages and in case of Mohan can be taken as 30 pages

Work done when People Work Together

• If two people are working together then their combined rate, $R = R_1 + R_2$ where,
R_1 is the rate of 1st person working alone
R_2 is the rate of 2nd person working alone

• If there are 10 people working together and each of them has a rate R_1 then combined rate of 10 people, $R = 10R_1$

• Example: It takes 7 machines (working together) 7 days to print 7 books.
If we take rate of one machine as R then rate of 7 machines = 7R

Filling and Emptying a Tank (Inlet-Outlet Pipe Problems)

Filling a Tank

• Inlet Pipe will do a positive work to fill the tank
• Outlet Pipe will do negative work to empty the tank
• So, Outlet pipe will increase the work to be done by Inlet Pipe
• Total Work Done to Fill the Tank = Work done by Inlet Pipe - Work done by Outlet Pipe = Capacity of the Tank

Emptying a Tank

• Inlet Pipe will do a negative work to fill the tank
• Outlet Pipe will do a positive work to empty the tank
• So, Inlet Pipe will increase the work to be done by the Outlet Pipe
• Total Work Done to Empty the Tank = Work done by Outlet Pipe - Work done by Inlet Pipe = Capacity of the Tank

Solved Problems

Q1. It takes 7 machines (working together) 7 days to print 7 books. How much time will it take 10 such machines to print 10 books?

Sol: Let rate of one machine = R
=> Rate of 7 machines = 7R
=> 7R * 7 = 7
=> R = 1/7

=> Rate of 10 machines = 10R = 10 * 1/7 = 10/7
=> 10/7 * Time = 10
=> Time = 7 days
So, **Answer will be 7**

Q2. It takes Ram 5 days to paint a house. It takes Shyam 10 days to paint the same house. How much time will it take for both to work together and paint the house?

Sol: Let rate of Ram be R and rate of Shyam be S and Work done = 1
=> Rate of Ram * 5 = 1
=> R * 5 = 1
=> R = 1/5

=> Rate of Shyam * 10 = 1
=> S * 10 = 1
=> S = 1/10

Both working together => Combined Rate = R + S = 1/5 + 1/10 = 3/10
=> 3/10 * Time = 1
=> Time = 10/3 days

So, **Answer will be 10/3 days**

Q3. Rohan takes 10 mins to read 20 pages. Mohan takes 15 mins to read 30 pages. Then how many pages can both of them read together in 30 mins?

Sol: Let rate of Rohan be R and rate of Mohan be M.
=> R * 10 = 20
=> R = 2

=> M * 15 = 30
=> M = 2

Both working together => Combined Rate = R + M = 2 + 2 = 4
=> 4 * 30 = 120 pages

So, **Answer will be 120 pages**

Q4. If 15 men working together can finish the work in 20 days. 10 women working together can finish the same work in the same number of days as 15 men. How many days will it take 1 man and 1 woman working together to complete the same work?

Sol: Let rate of each man be M and rate of each woman be M and Let the Work done = 1
=> Rate of 15 men = 15M
=> 15M * 20 = 1
=> M = 1/300

=> 10W * 20 = 1
=> W = 1/200

Both working together => Combined Rate = M + W = 1/300 + 1/200 = 5/600 = 1/120
=> 1/120 * Time = 1
=> Time = 120 days

So, **Answer will be 120 days**

Q5. An inlet pipe can fill an empty tank in 4 hours. An outlet pipe can empty a full tank in 10 hours. If both the pipes are open together then how much time will it take to fill an empty tank completely?

Sol: Let rate of Inlet pipe be I and Rate of Outlet pipe be O and work done be 1
=> I * 4 = 1
=> I = 1/4

=> O * 10 = 1
=> O = 1/10

Both working together => Combined Rate = I - O= 1/4 - 1/10 = 3/20
=> 3/20 * Time = 1
=> Time = 20/3 hours

So, **Answer will be 20/3 hours**

Hope it helps!
Good Luck!