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Aptitude Made Simple

Work and Time

Various competitive examinations ask questions regularly based on Work and Time. Work and Time is one of the highest rated topic by Paper setter for any competitive exam and it is lowest rated/most challenging topic from students point of view.

Why Work and Time???

Consider simple work of taking 20 printouts from your computer.

You may require 10 minutes to do this work. However, if same work to be done by your parents they may require 20 minutes to do it. If you ask same work to grandparents they may need 30 minutes to do same.

Consider simple work of writing letter manually on paper and post it to your friend.

Here you can observe that your grandparents can do this work in 10 minutes [as they are used to with writing and posting letters]. However, as you are not very familiar or used to write letter manually and post it by visiting post office you may need 30 minutes to do same work.

Here you can observe that every-one is different in terms of efficiency and time required to do work. It also depends on area of expertise to that specific work for that person.

This is something really important in real time world while allocating people for work, doing estimates of any project etc. Therefore it is very important for us to solve Work and Time problems and apply them in our day to day work.

Simple Method to solve Work and Time:

We will be using simple LCM method to solve Work and Time problems. This is different from conventional method which we generally study in our academics.

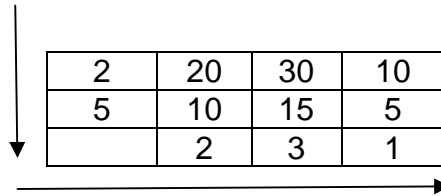
If we calculate LCM of numbers, we are almost 70% completion of problem.

Let us look at simple LCM examples first before looking at actual problems:

Example 1: Calculate LCM of 20, 30, 10

Method 1: Divisional Method

This is conventional method and we will keep dividing numbers till we get either 1 or all prime numbers.



2	20	30	10
5	10	15	5
	2	3	1

$$\text{LCM} = 2 * 5 * 2 * 3 * 1 = \mathbf{60}$$

Method 2: Orally by table method.

Find greatest number from list for which LCM is to be identified.

Now look at table of this number and keep checking whether that number is divisible by other numbers in list.

Here largest number is 30. So we will write tables of 30 and table of 20, 10 as well.

We will write 30 table till we get the number which is completely divisible by 10 and 20

20	30	10
40	60	20
60		30
		40
		50
		60

As you can see 30 is divisible by 10 but not by 20.

However 60 is divisible by 10 and 20 both.

So 60 is LCM [you can do this calculation orally in fraction of seconds if tables are learned 1 to 30].

Example 2: Calculate LCM of 25, 50

Method 1: Divisional Method

This is conventional method and we will keep dividing numbers till we get either 1 or all prime numbers.

5	25	50
5	5	10
	1	2

$$\text{LCM} = 5 * 5 * 2 * 1 * 2 = \mathbf{50}$$

Method 2: Orally by table method.

Find greatest number from list for which LCM is to be identified.

Now look at table of this number and keep checking whether that number is divisible by other numbers in list.

Here largest number is 50. So we will write tables of 50 and table of 25 as well.

We will write 50 table till we get the number which is completely divisible by 25.

25	50
50	

As you can see 50 is divisible by 25

So **50 is LCM**

Types of Problems:

Type	Given	To Find
Type 1	A do in x days B do in y days	Together A & B will do in how much time
Type 2	A+B do in x days A do in y days	B alone will do in how much time
Type 3	A do in x days B do in y days If they work alternate days	How much time will be required to complete work
Type 4	A do in x days A leaves job on 3 rd day and B worked alone	How much work pending / How much work is done.

Type1:

Problem 1:

A does a work in 10 days and B does work in 15 days. In how many days they together can complete work?

Solution :

Let us assume Work -> Eating mangoes.

A takes 10 days to eat certain number of mangoes.

B takes 15 days to eat certain number of mangoes.

Calculate LCM of 10,15 -> LCM of 10 and 15 is 30.

Person	Total Mango	Number of days	1 day speed
A	30	10	$30/10 = 3$ Mango
B	30	15	$30/15 = 2$ Mango

So A eats 3 Mango in 1 day and B eats 2 Mango in 1 day.

In order to do complete work [30 Mangos]:

1 day Speed of A + B = $3 + 2 = 5$

Time required to complete work = $30/5 = 6$ Days

Answer is 6 Days

Problem 2:

A does a work in 10 hours. B does same work in 30 hours. C completes same work in 60 hours. How much time required to complete work if A, B and C worked together?

Solution :

Let us assume Work -> Eating mangoes.

A takes 10 hours to eat certain number of mangoes.

B takes 30 hours to eat certain number of mangoes.

C takes 60 hours to eat certain number of mangoes.

Calculate LCM of 10, 30, 60 -> LCM of 10, 30, 60 is 60.

Person	Total Mango	Number of hours	1 Hour speed
A	60	10	$60/10 = 6$ Mango
B	60	30	$60/30 = 2$ Mango
C	60	60	$60/60 = 1$ Mango
A+B+C	60	60/9	$6+2+1 = 9$ Mango

A+B+C will require $60/9$ hours to complete work.

$$60/9 = 6\frac{6}{9}$$

Answer is $6\frac{6}{9}$ Hours

Type2:**Problem 1:**

The man can do a work in 5 days. With help of his son he can do that work in 3 days.
How much time his son will take alone to complete work.

Solution :

Calculate LCM of 5, 3 -> LCM of 5, 3 is 15.

Person	Total Mango	Number of days	1 day speed
Man	15	5	$15/5 = 3$ Mango
Man+Son	15	3	$15/3 = 5$ Mango
Son	15	?	$5-3 = 2$ Mango

The speed of Man alone = 3 Mango in 1 day

The speed of Man +Son = 5 Mango in 1 day.

Speed of Son alone = (Speed of Man +Son) – (Speed of Man alone)
 $= 5 - 3 = 2$ Mango

Number of days son alone will require = Total mango / 1 Day speed
 $= 15/2 = 7.5$ days

Answer is 7.5 days

Problem 2:

A & B together completes a work in 6 days. B alone can do same work in 24 days. How much A will take alone to complete work.

Solution :

Calculate LCM of 6, 24 -> LCM of 6, 24 is 24.

Person	Total Mango	Number of days	1 day speed
A+B	24	6	$24/6 = 4$ Mango
B	24	24	$24/24 = 1$ Mango
A	24	?	$4-1 = 3$ Mango

The speed of A + B = 5 Mango in 1 day.

The speed of B alone = 1 Mango in 1 day

Speed of A alone = (Speed of A + B) – (Speed of B alone)

$$= 4 - 1 = 3 \text{ Mango}$$

Number of days A alone will require = Total mango / 1 Day speed

$$= 24/3 = 8 \text{ days}$$

Answer is 8 days

Type3:**Problem 1:**

A completes work in 9 days and B completes same work in 12 days. If they work on alternate days, how much time they will require to finish work.

Solution :

Calculate LCM of 9, 12 -> LCM of 9, 12 is 36.

Person	Total Mango	Number of days	1 day speed
A	36	9	$36/9 = 4$ Mango
B	36	12	$36/12 = 3$ Mango

A speed is 4 Mango per day

B speed is 3 Mango per day.

As A and B are working on Alternate days:

Total Mango to finish : 36

Day	Mango eaten	Pending Mango(36-eaten)
1 [A will work]	4	32
2 [B will work]	$4+3 = 7$	29
3 [A will work]	$7+4 = 11$	25
4 [B will work]	$11+3 = 14$	22

Looking at this we can understand that in 2 days 7 Mango eaten.

As we need to complete 36 Mango.

36 is not completely divisible by 7 so we need to find number less than and nearest to 36 and should be completely divisible by 7.

To complete 35:

2 days - 7 Mango

?days - 35 Mango

Cross multiply to get answer

$$2 * 35 = 7 * ?$$

$$? = 70/7 = 10$$

35 Mango completed in 10 days and 1 still pending [as $36 - 35 = 1$]

On 11th day 1 mango pending and A will be working.

So A will require $\frac{1}{4}$ time eat same [as in 1 day he eats 4].

$$\text{Total days required} = 10 + \frac{1}{4}$$

Answer is $10\frac{1}{4}$ Days

Problem 2:

A completes work in 20 days and B completes same work in 30 days. If they work on alternate days, how much time they will require to finish work.

Solution :

Calculate LCM of 20,30 -> LCM of 20, 30 is 60.

Person	Total Mango	Number of days	1 day speed
A	60	20	$60/20 = 3$ Mango
B	60	30	$60/30 = 2$ Mango

A speed is 3 Mango per day

B speed is 2 Mango per day.

As A and B are working on Alternate days:

Total Mango to finish 60.

Day	Mango eaten	Pending Mango(36-eaten)
1 [A will work]	3	57
2 [B will work]	$3+2 = 5$	55

Looking at this we can understand that in 2 days 5 Mango eaten.

As we need to complete 60 Mango.

To complete 60:

2 days - 5 Mango

? days - 60 Mango

Cross multiply to get answer.

$$2 * 60 = 5 * ?$$

? = $120/5 = 24$ days will be required.

Answer is 24 days

Type4:**Problem 1:**

A completes work in 15 days and B completes same work in 10 days. They started working together but after 2 days work, B left the job and A continued alone to complete work. In how much day pending work will be completed?

Solution :

Calculate LCM of 15, 10 → LCM of 15, 10 is 30.

Person	Total Mango	Number of days	1 day speed
A	30	15	$30/15 = 2$ Mango
B	30	10	$30/10 = 3$ Mango

A speed is 2 Mango per day

B speed is 3 Mango per day.

A+B speed for 1 day is 5 Mango.

A +B worked together for 2 days.

Number of mangoes eaten in this time = $2 * 5 = 10$

Pending work [mango] = Total Mango – Completed work [mango]

Pending = $30 - 10 = 20$

A as alone, To complete pending work : 20 mango

1 day - 2 Mango

? days - 20 Mango

Cross multiply to get answer.

$1 * 20 = 2 * ?$

$? = 20/2 = 10$ days

To complete pending work by A alone 10 days will be required.

Answer is 10 days

Problem 2:

A completes work in 18 days and B completes same work in 15 days. They started working together but after 5 days work, B left the job and A continued alone to complete work. How much work pending and in how much days pending work will be completed?

Solution :

Calculate LCM of 18, 15 \rightarrow LCM of 18, 15 is 90.

Person	Total Mango	Number of days	1 day speed
A	90	18	$90/18 = 5$ Mango
B	90	15	$90/15 = 6$ Mango

A speed is 5 Mango per day

B speed is 6 Mango per day.

A+B speed for 1 day is 11 Mango.

A +B worked together for 5 days.

Number of mangoes eaten in this time = $11 * 5 = 55$

Pending work [mango] = Total Mango – Completed work [mango]

Pending = $90 - 55 = 35$ Mango

Pending Work in terms of total work = $35/90 = 7/18$

A as alone, To complete pending work : 35 mango

1 day - 5 Mango

? days - 35 Mango

Cross multiply to get answer.

$1 * 35 = 5 * ?$

$? = 35/5 = 7$ days

Answer is Pending work $7/18$ and 7 days will be required to complete pending work