Time and Work - Shortcuts and Tricks

Trick

Basically there are two techniques to solve the Time and Work problems:-

Time and Work

Fraction Efficiency

1.Fraction Method

Eg: A can do a job in 10 days it menas that A can do job 1/10 per day.

You need to understand one simple concept - If A can do a job in 10 day then in one day A can do 1/10th of job.

So with the help of this we can solve the problem by fraction method.

Example1. A can do a job in 6 days and B can do the same job in 8 days. In how much time they can do the job together.

Solution - 1/6 + 1/8 = 7/24.

2. Efficiency Method

Eg: A can do a job in 10 days so we can also write this dividing 100 by 10 days=100/10=10%

i.e the efficiency of A of doing work per day is 10%.

Best trick used in exams is by finding the efficiency of workers in percent. If A can do a job in 2 days then he can do 50% in a day.

Shortcut

Number of days required to complete the work	Work that can be done per day	Efficiency in Percent
n	1/n	100/n
1	1/1	100%
2	1/2	50%
3	1/3	33.33%
4	1/4	25%
5	1/5	20%
6	1/6	16.66%
7	1/7	14.28%
8	1/8	12.5%
9	1/9	11.11%
10	1/10	10%
11	1/11	9.09%

Now Solving few examples regarding this short technique.

Q1. - A take 2 days to complete a job and B takes 4 days to complete the same job. In how much time they will complete the job together ?

Solution - A's efficiency = 50%, B's efficiency = 25%. If they work together they can do 75% of the job in a day. To complete the job they need 1.33 days or 4/3 days.

Q2.- A tank can be filled in 20 minutes. There is a leakage which can empty it in 60 minutes. In how many minutes tank can be filled?

Solution -
Method 1

⇒ Efficiency of filling pipe = 20 minutes = 1/3 hour = 300%

⇒ Efficiency of leakage = 60 minutes = 100%

We need to deduct efficiency of leakage so final efficiency is 200%. We are taking 100% = 1 Hour as base so answer is 30 minutes.

Method 2

⇒ Efficiency of filling pipe = 100/20 = 5%

⇒ Efficiency of leakage pipe = 100/60 = 1.66%

⇒ Net filling efficiency = 3.33%

So tank can be filled in = 100/3.33% = 30 minutes

Q3.A and B together can complete a task in 20 days. B and C together can complete the same task in 30 days. A and C together can complete the same task in 30 days. What is the respective ratio of the number of days taken by A when completing the same task alone to the number of days taken by C when completing the same task alone?

Solution -

⇒ Efficiency of A and B = 1/20 per day = 5% per day ------------(i)

⇒ Efficiency of B and C = 1/30 per day = 3.33% per day----------(ii)

⇒ Efficiency of C and A = 1/30 per day = 3.33% per day----------(iii)

Taking equation 2 and 3 together

⇒ B + C = 3.33% and C + A = 3.33%

⇒ C and 3.33% will be removed. Hence A = B

⇒ Efficiency of A = B = 5%/2 = 2.5% = 1/40

⇒ Efficiency of C = 3.33% - 2.5% = 0.833% = 1/120

⇒ A can do the job in 40 days and C can do the job in 120 days he they work

alone.

⇒ Ratio of number of days in which A and C can complete the job 1:3.

Time And Distance Concepts

Concepts

1) There is a relationship between speed, distance and time:

Speed = Distance / Time

Distance = Speed* Time

2) Average Speed = 2xy / x+y

where x km/hr is a speed for certain distance and y km/hr is a speed at for same distance covered.

Note: Remember that average speed is not just an average of two speeds i.e. x+y/2. It is equal to 2xy / x+y

3) The Speed of a moving object is the Distance travelled by it in unit Time. Thus

Speed = Distance/ Time

Total Time taken to cover some distance = Distance / Speed

Distance travelled = Speed × Time

Speed is either measured in Kilometer/ hour or meter/ second

To convert meter/second in Kilometer/hour,

S m/sec = 18/5 × S Km/hr

To convert Kilometer/ hour in meter/second,

S Km/hr = 5/18 × S m/s

Speed and time are inversely proportional (when distance is constant)

Speed ∝ 1/ Time (When Distance is constant)

If the ratio of the speeds of P and Q is p : q, then the ratio of the times taken by them to cover the

same distance is 1/p:1/q or q : p

AVERAGE SPEED:

If a car covers Certain distance with a speed of x Km/hr and another equal distance with a speed of y

Km/h, then average speed for the whole journey is the harmonic mean of two speeds i.e.

Average Speed =2xy / x+y km/h = 2xy/(x + y) km/h

CONCEPT OF RELATIVE SPEED:

Case1: Two OBJECTS are moving in same directions at speed V1 & V2 respectively. The relative speed is defined as

$V_R = |V_1 - V_2|$

Case2: Two OBJECTS are moving in opposite directions at speed V1 & V2 respectively. The relative speed is defined as

$V_R = V_1 + V_2$

CONCEPT OF TRAINS

The basic concept for train related problem is Speed = Distance / time. but we should kept in mind these discussed points below.

(i) When the train is crossing a moving object, the speed has to be taken as the RELATIVE SPEED of the train with respect to the object.

(ii) The distance to be covered when train crosses an object will be equal to:

Length of the train + Length of the object

NOTE- When train is crosses a stationary object (with length) like platform, bridge and then its Length is added to the length of train to get required length.

When train is crosses a man, pole, tree etc.. then their length is neglect with respect to train, Here only length of train is considered.

Condition:

When Train crosses single object: (Let the speed of train is S_T & length of train L_T)

1. Train Crosses a stationary object (No Length)

Time taken by train to cross the object = Length of Train / Speed of Train = L_T / S_T

2. Train Crosses a stationary object of Length L

Time taken by train to cross the object =

(Length of Train + Length of Stationary object)/ Speed of Train = Lt + L/ St

3. Train crosses a moving object (No Length)

a) When train and Object move in the SAME direction with speed of x m/s and y m/s,

Time taken by train to cross the object =

Length of Train/(x - y)

b) When train and Object move in the OPPOSITE direction with speed of x m/s and y m/s,

Time taken by train to cross the object =

Length of Train/(x+y)

4. Train crosses a moving object of length L

a) When 2 trains move in the SAME direction with speed of x m/s and y m/s,

Time taken to cross each other =

(Length of Train one + Length of Train two)/ (x - y)

b) When 2 trains move in the OPPOSITE direction with speed of x m/s and y m/s,

Time taken to cross each other =

(Length of Train one + Length of Train two)/ (x + y)

5. When two train crossing each other in both directions:

Let length of one train = L1; Length of Second train = L2 They are crossing each other in opposite

direction in T1 sec and same direction in T2 sec respectively, Then, Speed of faster train = (L1 + L2) /2 [1/T1 + 1/T2]

Speed of slower train = (L1+ L2) / 2 [1/T1 – 1/T2]

6. If two trains (or bodies) start at the same time from points A and B towards each other and after

crossing they take a and b sec in reaching B and A respectively, then:

(A's speed) : (B's speed) = √b : √a

CONCEPT OF BOAT & STREAMS

Downstream/Upstream: In water, the direction of object is along the stream is called downstream.

and, the direction of object is against the stream is called upstream. If the speed of a boat in still

water is u km/hr and the speed of the stream is v km/hr, then:

1. Let the speed of the boat in still water is a Km/h and speed of stream is b Km/h

SPEED OF BOAT DOWNSTREAM = (A + B) KM/H

SPEED OF BOAT UPSTREAM = (A - B) KM/H

2. LET THE SPEED DOWNSTREAM IS X KM/H AND SPEED UPSTREAM IS Y KM/H

SPEED IN STILL WATER = 1*(X + Y) /2 KM/H

RATE OF STREAM = 1* (X - Y)/2 KM/H

4) AS WE KNOW, SPEED = DISTANCE/ TIME. NOW, IF IN QUESTIONS DISTANCE IS CONSTANT THEN SPEED WILL BE INVERSELY PROPORTIONAL TO TIME I.E. IF SPEED INCREASES ,TIME TAKEN WILL DECREASE AND VICE VERSA.

. **Q1**: A man covers a distance of 600m in 2min 30sec. What will be the speed in km/hr?

Solution: Speed =Distance / Time

⇒ Distance covered = 600m, Time taken = 2min 30sec = 150sec

Therefore, Speed= 600 / 150 = 4 m/sec

⇒ 4m/sec = (4*18/5) km/hr = 14.4 km/ hr.

Q2: A boy travelling from his home to school at 25 km/hr and came back at 4 km/hr. If whole journey took 5 hours 48 min. Find the distance of home and school.

Solution: In this question, distance for both speed is constant.

⇒ Average speed = (2xy/ x+y) km/hr, where x and y are speeds

⇒ Average speed = (2*25*4)/ 25+4 =200/29 km/hr

Time = 5hours 48min= 29/5 hours
Now, Distance travelled = Average speed * Time

⇒ Distance Travelled = (200/29)*(29/5) = 40 km

Therefore distance of school from home = 40/2 = 20km

Average Tricks and Practice Questions

Average =Total of data/No.of data
And Total of data= Average* No.of data

Sample examples

Q1.The average age of 20 girls of a class is equal to 14 yrs. When the age of the class teacher is included the average becomes 15 yrs. Find the age of the class teacher.

Solution: Total ages of 20 girls = 14 × 20 = 280 yrs.

Total ages when class teacher is included = 15 × 21 = 315 yrs.

∴ Age of class teacher = 315 - 280 = 35 yrs.

Direct formula:

Age of new entrant = New average + No. of old members × increase in average

= 15 + 20 (15 – 14) = 35 yrs.

Q2.The average weight of 4 men is increased by 3 kg when one of them who weighs 120 kg is replaced by another man. What is the weight of the new man?

Solution: Quicker approach: If the average is increased by 3 kg, then the sum of weighs increases by 3 × 4 = 12 kg.

And this increase in weight is due to the extra weight included due to the inclusion of new person.

∴ Weight of new person = 120 + 12 = 132 kg.

Direct formula:

Weight of new person = weight of removed person + No. of persons × increase in average = 120 + 12 × 3 = 132 kg.

Q3.T he average of 11 results is 50. If the average of first six results is 49 and that of last six is 52, find the sixth result.

Solution: The total of 11 results = 11 × 50 = 550

The total of first 6 results = 6 × 49 = 294

The total of last 6 results = 6 × 52 = 312

The 6th result is common to both;

Therefore, Sixth result = 294 + 312 – 550 = 56

Direct formula:

6^{th} result=50+6{(52-50)+(49-50)}=50+6(2-1)=56

Q4. A batsman in his 17th innings makes a score of 85, and thereby increases his average by 3. What is his average after 17 innings?

Solution: Let the average after 16^{th} innings be x, then 16x + 85 = 17 (x +3) = Total score after 17^{th} innings.

∴ X = 85 – 51 = 34

∴ Average after 17^{th} innings = x + 3 = 34 + 3 = 37

Direct formula:

Average after 16 innings = 85 – 3 × 17 = 34

Average after 17 innings = 85 – 3 (17 – 1) = 37