TIME AND WORK

IIMPORTANT FACTS AND FORMULAE

1. If A can do a piece of work in n days, then A's 1 day's work = (1/n).

2. If A's 1 day's work = (1/n),then A can finish the work in n days.

3. A is thrice as good a workman as B, then:
   Ratio of work done by A and B = 3 : 1.
   Ratio of times taken by A and B to finish a work = 1 : 3.

SOLVED EXAMPLES

Ex. 1. Worker A takes 8 hours to do a job. Worker B takes 10 hours to do the same Job.How long should it take both A and B, working together but independently, to do the same job? (IGNOU, 2003)

Sol. A's 1 hour's work = 1/8

B's 1 hour's work = 1/10

(A + B)'s 1 hour's work = (1/8) +(1/10)=9/40

Both A and B will finish the work in 40/9 days.

Ex. 2. A and B together can complete a piece of work in 4 days. If A alone can complete the same work in 12 days, in how many days can B alone complete that work? (Bank P.O. 2003)

Sol. (A + B)'s 1 day's work = (1/4). A's 1 day's work = (1/12).

B's 1 day's work =((1/4)-(1/12))=(1/6)

Hence, B alone can complete the work in 6 days.

Ex. 3. A can do a piece of work in 7 days of 9 hours each and B can do it in 6 days

of 7 bours each. How long will they take to do it, working together 8 hours a day?

Sol. A can complete the work in (7 x 9) = 63 hours.
B can complete the work in (6 x 7) = 42 hours.

A's 1 hour's work = (1/63) and B's 1 hour's work =(1/42)

(A + B)'s 1 hour's work =(1/63)+(1/42)=(5/126)

Both will finish the work in (126/5) hrs.
Number of days.of (42/5) hrs each =(126 x 5)/(5 x 42)=3 days

Ex. 4. A and B can do a piece of work in 18 days; Band C can do it in 24 days A and C can do it in 36 days. In how many days will A, Band C finish it together and separately?

Sol. (A + B)'s 1 day's work = (1/18) (B + C)'s 1 day's work = (1/24)
and (A + C)'s 1 day's work = (1/36)

Adding, we get: 2 (A + B + C)'s 1 day's work =(1/18 + 1/24 + 1/36)

=9/72 =1/8

(A +B + C)'s 1 day's work =1/16

Thus, A, Band C together can finish the work in 16 days.
Now, A's 1 day's work = [(A + B + C)'s 1 day's work] - [(B + C)'s 1 day work:
=(1/16 – 1/24)= 1/48

A alone can finish the work in 48 days.

Similarly, B's 1 day's work =(1/16 – 1/36)=5/144

B alone can finish the work in 144/5=28 4/5 days

And C's 1 day work =(1/16-1/18)=1/144

Hence C alone can finish the work in 144 days.

Ex. 6. A is twice as good a workman as B and together they finish a piece in 18 days. In how many days will A alone finish the work?
Sol. (A's 1 day's work):)(B's 1 days work) = 2 : 1.

(A + B)'s 1 day's work = 1/18

Divide 1/18 in the ratio 2 : 1.

∴ A's 1 day's work =(1/18*2/3)=1/27

Hence, A alone can finish the work in 27 days.

Ex. 6. A can do a certain job in 12 days. B is 60% more efficient than A. How many days does B alone take to do the same job?

Sol. Ratio of times taken by A and B = 160 : 100 = 8 : 5.

Suppose B alone takes x days to do the job.

Then, 8 : 5 :: 12 : x = 8x = 5 x 12 =x = 7 1/2 days.

Ex. 7. A can do a piece of work in 80 days. He works at it for 10 days B alone finishes the remaining work in 42 days. In how much time will A and B working together, finish the work?

Sol. Work done by A in 10 days =(1/80*10)=1/8

Remaining work = (1- 1/8) =7/ 8

Now,7/ 8 work is done by B in 42 days.

Whole work will be done by B in (42 x 8/7) = 48 days.

A's 1 day's work = 1/80 and B's 1 day's work = 1/48

(A+B)'s 1 day's work = (1/80+1/48)=8/240=1/30

Hence, both will finish the work in 30 days.

Ex. 8.A and B undertake to do a piece of work for Rs. 600.A alone can do it in 6 days while B alone can do it in 8 days. With the help of C, they finish it in 3 days. !find the share of each.

Sol :C's 1 day's work = 1/3-(1/6+1/8)=24

A : B : C = Ratio of their 1 day's work = 1/6:1/8:1/24= 4 : 3 : 1.

A's share = Rs. (600 *4/8) = Rs.300, B's share = Rs. (600 *3/8) = Rs. 225.

C's share = Rs. [600 - (300 + 225») = Rs. 75.

Ex. 9. A and B working separately can do a piece of work in 9 and 12 days respectively, If they work for a day alternately, A beginning, in how many days, the work will be completed?

(A + B)'s 2 days' work =(1/9+1/12)=7/36

Work done in 5 pairs of days =(5*7/36)=35/36

Remaining work =(1-35/36)=1/36

On 11th day, it is A's turn. 1/9 work is done by him in 1 day.

1/36 work is done by him in(9*1/36)=1/4 day

Total time taken = (10 + 1/4) days = 10 1/4days.

Ex 10 .45 men can complete a work in 16 days. Six days after they started working, 30 more men joined them. How many days will they now take to complete the remaining work?

(45 x 16) men can complete the work in 1 day.

1 man's 1 day's work = 1/720

45 men's 6 days' work =(1/16*6)=3/8

Remaining work =(1-3/8)=5/8

75 men's 1 day's work = 75/720=5/48

Now, $\frac{5}{48}$ work is done by them in 1 day.

$\frac{5}{8}$work is done by them in $(\frac{48}{5} \times \frac{5}{8})$=6 days.

Ex:11. 2 men and 3 boys can do a piece of work in 10 days while 3 men and 2 boys can do the same work in 8 days.In how many days can 2 men and 1 boy do the work?

Soln: Let 1 man's 1 day's work = x and 1 boy's 1 day's work = y.

Then, $2x+3y = \frac{1}{10}$ and $3x+2y = \frac{1}{8}$

Solving,we get: $x = \frac{7}{200}$ and $y = \frac{1}{100}$

(2 men + 1 boy)'s 1 day's work $= (2 \times \frac{7}{200} + 1 \times \frac{1}{100}) = \frac{16}{200} = \frac{2}{25}$

So, 2 men and 1 boy together can finish the work in $\frac{25}{2} = 12\frac{1}{2}$ days

TIME AND DISTANCE

IMPORTANT FACTS AND FORMULAE

1. Speed = $\left(\frac{\text{Distance}}{\text{Time}}\right)$, Time= $\left(\frac{\text{Distance}}{\text{Speed}}\right)$, Distance = (Speed * Time)

2. x km / hr = $x * \frac{5}{18}$

3. x m/sec = (x * 18/5) km /hr

4. If the ratio of the speeds of A and B is a:b , then the ratio of the times taken by them to cover the same distance is $\frac{1}{a}:\frac{1}{b}$

or b:a.

5. Suppose a man covers a certain distance at x km/ hr and an equal distance at y km / hr .Then , the average speed during the whole journey is $\frac{2xy}{x+y}$ km/ hr.

SOLVED EXAMPLES

Ex. 1.How many minutes does Aditya take to cover a distance of 400 m, if he runs at a speed of 20 km/hr?

Sol. Aditya's speed = 20 km/hr = $\{20 * \frac{5}{18}\}$ m/sec = $\frac{50}{9}$ m/sec

$\therefore$ Time taken to cover 400 m= $\{ 400 * \frac{9}{50} \}$ sec =72 sec = 1 $\frac{12}{60}$ min 1 $\frac{1}{5}$ min.

Ex. 2.A cyclist covers a distnce of 750 m in 2 min 30 sec. What is the speed in km/hr of the cyclist?

Sol. Speed = $\{ \frac{750}{150} \}$ m/sec =5 m/sec = $\{ 5 * \frac{18}{5} \}$ km/hr =18km/hr

Ex. 3.A dog takes 4 leaps for every 5 leaps of a hare but 3 leaps of a dog are equal to 4 leaps of the hare. Compare their speeds.

Sol. Let the distance covered in 1 leap of the dog be x and that covered in 1 leap of the hare by y. Then , $3x = 4y \Rightarrow x = \frac{4}{3} y \Rightarrow 4x = \frac{16}{3} y$.

$\therefore$ Ratio of speeds of dog and hare = Ratio of distances covered by them in the same time

$= 4x : 5y = \frac{16}{3} y : 5y = \frac{16}{3} : 5 = 16:15$

Ex. 4.While covering a distance of 24 km, a man noticed that after walking for 1 hour and 40 minutes, the distance covered by him was $\frac{5}{}$ of the remaining distance. What was his

speed in metres per second?

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Sol. Let the speed be x km/hr.

Then, distance covered in 1 hr. 40 min. i.e., $1\frac{2}{3}$ hrs $= \frac{5x}{3}$ km

Remaining distance $= \{24 - \frac{5x}{3}\}$ km.

$\therefore \frac{5x}{3} = \frac{5}{7}\{24 - \frac{5x}{3}\} \Leftrightarrow \frac{5x}{3} = \frac{5}{7}\{\frac{72-5x}{3}\} \Leftrightarrow 7x = 72 - 5x$

$\Leftrightarrow 12x = 72 \Leftrightarrow x = 6$

Hence speed = 6 km/hr $= \{6 * \frac{5}{18}\}$ m/sec $= \frac{5}{3}$ m/sec $= 1\frac{2}{3}$

Ex. 5.Peter can cover a certain distance in 1 hr. 24 min. by covering two-third of the distance at 4 kmph and the rest at 5 kmph. Find the total distance.

Sol. Let the total distance be x km . Then,

$\frac{2x}{3} + \frac{1x}{3} = \frac{7}{4} \Leftrightarrow \frac{x}{5} + \frac{x}{5} = \frac{7}{6} \Leftrightarrow 7x = 42 \Leftrightarrow x = 6$

Ex. 6.A man traveled from the village to the post-office at the rate of 25 kmph and walked back at the rate of 4 kmph. If the whole journey took 5 hours 48 minutes, find the distance of the post-office from the village.

Sol. Average speed $= \{\frac{2xy}{x+y}\}$ km/hr $= \{\frac{2*25*4}{25+4}\}$ km/hr $= \frac{200}{29}$ km/hr

Distance traveled in 5 hours 48 minutes i.e., $5\frac{4}{5}$ hrs. $= \{\frac{200}{29} * \frac{29}{5}\}$ km $= 40$ km

Distance of the post-office from the village $= \{\frac{40}{2}\} = 20$ km

Ex. 7.An aeroplane files along the four sides of a square at the speeds of 200,400,600 and 800km/hr.Find the average speed of the plane around the field.

Sol. :

Let each side of the square be x km and let the average speed of the plane around the field by y km per hour then ,

$x/200+x/400+x/600+x/800=4x/y \Leftrightarrow 25x/2500 \Leftrightarrow 4x/y \Leftrightarrow y=(2400*4/25)=384$

hence average speed =384 km/hr

Ex. 8. Walking at $\frac{5}{7}$ of its usual speed, a train is 10 minutes too late. Find its usual time to cover the journey.

Sol. : New speed =5/6 of the usual speed

New time taken=6/5 of the usual time

So,(6/5 of the usual time)-(usual time)=10 minutes.

=>1/5 of the usual time=10 minutes.

⇨ usual time=10 minutes

Ex. 9.If a man walks at the rate of 5 kmph, he misses a train by 7 minutes. However, if he walks at the rate of 6 kmph, he reaches the station 5 minutes before the arrival of the train. Find the distance covered by him to reach the station.

Sol. Let the required distance be x km

Difference in the time taken at two speeds=1 min =1/2 hr

Hence x/5- x/6=1/5<=>6x-5x=6

⇔x=6

Hence, the required distance is 6 km

Ex. 10.A and B are two stations 390 km apart. A train starts from A at 10 a.m. and travels towards B at 65 kmph. Another train starts from B at 11 a.m. and travels towards A at 35 kmph. At what time do they meet?

Sol. Suppose they meet x hours after 10 a.m. Then,

(Distance moved by first in x hrs) + [Distance moved by second in (x-1) hrs]=390.

$65x + 35(x-1) = 390 \Rightarrow 100x = 425 \Rightarrow x = 17/4$

So, they meet 4 hrs.15 min. after 10 a.m i.e., at 2.15 p.m.

Ex. 11. A goods train leaves a station at a certain time and at a fixed speed. After ^hours, an express train leaves the same station and moves in the same direction at a uniform speed of 90 kmph. This train catches up the goods train in 4 hours. Find the speed of the goods train.

Sol. Let the speed of the goods train be x kmph.

Distance covered by goods train in 10 hours= Distance covered by express train in 4 hours

10x = 4 x 90 or x =36.

So, speed of goods train = 36kmph.

Ex. 12. A thief is spotted by a policeman from a distance of 100 metres. When the policeman starts the chase, the thief also starts running. If the speed of the thief be 8km/hr and that of the policeman 10 km/hr, how far the thief will have run before he is overtaken?

Sol. Relative speed of the policeman = (10-8) km/hr =2 km/hr.

Time taken by police man to cover 100m $\left(\frac{100}{1000} \times \frac{1\text{hr}}{2}\right) = \frac{1}{20}$ hr.

In $\frac{1}{20}$ hrs, the thief covers a distance of $8 \times \frac{1}{20}$ km $= \frac{2}{5}$ km = 400 m

Ex.13. I walk a certain distance and ride back taking a total time of 37 minutes. I could walk both ways in 55 minutes. How long would it take me to ride both ways?

Sol. Let the distance be x km. Then,

(Time taken to walk x km) + (time taken to ride x km) =37 min.

(Time taken to walk 2x km) + (time taken to ride 2x km)= 74 min.

But, the time taken to walk 2x km = 55 min.

Time taken to ride 2x km = (74-55)min =19 min.