

QUANTITATIVE ABILITY - TIME AND WORK CONCEPTS

Man - Work - Hour Formula:

More men can do more work. More work means more time required to do work.

More men can do more work in less time.

M men can do a piece of work in T hours, then Total effort or work = MT man hours.

Rate of work * Time = Work Done.

If A can do a piece of work in D days, then A's 1 day's work = $1/D$.

Part of work done by A for t days = t/D .

If A's 1 day's work = $1/D$, then A can finish the work in D days.

$MDH/W = \text{Constant}$

Where,

M = Number of men

D = Number of days

H = Number of hours per day

W = Amount of work

If M_1 men can do W_1 work in D_1 days working H_1 hours per day and M_2 men can do W_2 work in D_2 days working H_2 hours per day, then

$$(M_1 \times D_1 \times H_1)/W_1 = (M_2 \times D_2 \times H_2)/W_2$$

- If A is x times as good a workman as B, then:

Ratio of work done by A and B = $x:1$

Ratio of time taken by A and B to finish a work = $1:x$ i.e; A will take $\frac{1}{x}$ of the time taken by B to do the same work.

Shortcuts for frequently asked time and work problems

- A and B can do a piece of work in 'a' days and 'b' days respectively, then working together:
They will complete the work in $(ab)/(a + b)$ days
In one day, they will finish $(a + b)/ab$ part of work.
- If A can do a piece of work in 'a' days, B can do in 'b' days and C can do in 'c' days then, A, B and C together can finish the same work in $(abc)/(ab + bc + ca)$ days.
- If A can do a work in x days and A and B together can do the same work in y days then, Number of days required to complete the work if B works alone = $(xy)/(x - y)$ days.
- If A and B together can do a piece of work in x days, B and C together can do it in y days and C and A together can do it in z days, then number of days required to do the same work:
If A, B, and C working together = $(2xyz)/(xy + yz + zx)$
If A working alone = $(2xyz)/(xy + yz - zx)$
If B working alone = $(2xyz)/(-xy + yz + zx)$
If C working alone = $(2xyz)/(xy - yz + zx)$
- If A and B can together complete a job in x days.
If A alone does the work and takes 'a' days more than A and B working together.
If B alone does the work and takes b days more than A and B working together.
Then, $x = \sqrt{ab}$ days
- If m_1 men or b_1 boys can complete a work in D days, then m_2 men and b_2 boys can complete the same work in $(D \times m_1 \times b_1)/(m_2 \times b_1 + m_1 \times b_2)$ days.

- If m men or w women or b boys can do work in D days, then 1 man, 1 woman and 1 boy together can together do the same work in $(D \times m \times w \times b)/(mw + wb + bm)$ days.
- If the number of men to do a job is changed in the ratio $a : b$, then the time required to do the work will be changed in the inverse ratio. i.e; $b : a$
- If people work for same number of days, ratio in which the total money earned has to be shared is the ratio of work done per day by each one of them.
- A, B and C can do a piece of work in x , y and z days respectively. The ratio in which the amount earned should be shared is $(1/x) : (1/y) : (1/z) = yz : zx : xy$
- If people work for different number of days, ratio in which the total money earned has to be shared is the ratio of work done by each one of them.

Special cases of time and work problems

- ❖ Given a number of people work together/alone for different time periods to complete a work, for eg: A and B work together for few days, then C joins them, after few days B leaves the job. To solve such problems, following procedure can be adopted.
 - Let the entire job be completed in D days.
 - Let sum of parts of the work completed by each person = 1
 - Find out part of work done by each person with respect to D . This can be easily found out if you calculate how many days each person worked with respect to D .
 - Substitute values found out in Step 3 in Step 2 and solve the equation to get unknowns.
- ❖ A certain no of men can do the work in D days. If there were m more men, the work can be done in d days less. How many men were there initially?

Let the initial number of men be M
 Number of man days to complete work = $M \times D$
 If there are $(M + m)$ men, days taken = $D - d$
 So, man days = $(M + m)(D - d)$
 i.e; $M \times D = (M + m)(D - d)$
 $M[D - (D - d)] = m(D - d)$
 $M = m(D - d)/d$
- ❖ A certain no of men can do the work in D days. If there were m less men, the work can be done in d days more. How many men were initially?

Let the initial number of men be M
 Number of man days to complete work = $M \times D$
 If there are $(M - m)$ men, days taken = $(D + d)$
 So, man days = $(M - m)(D + d)$
 i.e; $MD = (M - m)(D + d)$
 $M(D + d - D) = m(D + d)$
 $M = m(D + d)/d$
- ❖ Given A takes a days to do work. B takes b days to do the same work. Now A and B started the work together and n days before the completion of work A leaves the job. Find the total number of days taken to complete work?

Let D be the total number of days to complete work.
 A and B work together for $(D - n)$ days.
 So, $(D - n)(\frac{1}{a} + \frac{1}{b}) + n(\frac{1}{b}) = 1$

$$D\left(\frac{1}{a} + \frac{1}{b}\right) - \frac{n}{a} - \frac{n}{b} - \frac{n}{b} = 1$$

$$D\left(\frac{1}{a} + \frac{1}{b}\right) = \frac{n+a}{a}$$

$$D = \frac{b(n+a)}{a+b} \text{ days.}$$

Frequently asked questions in quantitative aptitude test on time and work

After going through the questions given below, it will be good for you if you can take our practice placement test. At the end of the test, you can have a look at solutions provided for each question with answers.

1. Given A takes x days to do work. B takes y days to do the same work. If A and B work together, how many days will it take to complete the work?
2. If A and B together can do a piece of work in x days, B and C together can do it in y days and C and A together can do it in z days, find how many days it takes for each of them to complete the work if they worked individually. How many days will it take to complete the work if they worked together?
3. Give A is n times efficient than B. Also A takes n days less than B to complete the work. How many days will it take to complete the work if they worked together?
4. Given A takes x days to do work. B takes y days to do the same work. Now A & B together begins a work. After few days one of them leaves. Also, given the other takes n more days to complete the work
 - (a) Find total number of days to complete the work.
 - (b) How many days did they work together?
5. Given A takes x days to do work. B takes y days to do the same work. A started the work and B joined him after n days.
 - (a) How long did it take to complete the work?
 - (b) How many days did they work together? Or How long did B work?
6. Case 5 with 3 people joining work one after the other.
7. Given A takes x days to do work. B takes y days to do the same work. If A and B works on alternate days i.e. A alone works on first day, B alone works on next day and this cycle continues, in how many days will the work be finished
8. Given A alone can complete a job in x days and also B is b% efficient than A. How many days will it take to complete work if B works alone?
9. Problems where combinations of workers [men, women, girls and boys] take some days to do a work. These problems are solved using man days concept.
 - (a) You have to calculate for another combination of them to complete the work.
 - (b) How long will one set of people take to complete the entire work?
10. A certain combination starts the job and after few days leaves the work. Find the number of people from the category who are required to finish the remaining work.
11. Problems related to wages from work. How much each person earns from the work done.

TIME AND WORK – WORKSHEET (BASIC)

Directions for questions 1 to 5:

3 toys maker Mahesh, Suresh and Ramesh take a contract of making toys. Mahesh alone can make the entire toys in 12 days while Suresh alone can make the entire toys in 15 days and Ramesh can destroy the entire toys in 20 days.

Q 1: How much time will Mahesh and Suresh take to make all toys if Mahesh and Suresh work together?

- (a) $20/3$ days (b) 13.5 days (c) $13\frac{1}{4}$ days (d) 8.25 days

Q 2: How much time will they take to make the entire toys if all 3 work together?

- (a) 3 days (b) 13.5 days (c) $13\frac{1}{4}$ days (d) 10 days

Q 3: How much time will Mahesh and Suresh take to make the entire toys and if they work on alternate days with Mahesh starting on the first day?

- (a) 13 days (b) 13.5 days (c) $13\frac{1}{4}$ days (d) 8.25 days

Q 4: In the previous question, when will the work be complete if all 3 work on alternate days, with Mahesh working on first day, Suresh on second day, Ramesh on third day, and this process repeats till work is complete?

- (a) 30 days (b) $30\frac{3}{5}$ days (c) $28\frac{1}{4}$ days (d) Never

Q 5: How much time Mahesh and Suresh will they take to make the entire toys if they start working together, but Suresh leaves 2 days before the scheduled completion of the work?

- (a) 6.9 days (b) $8\frac{1}{5}$ days (c) 8.5 days (d) $8\frac{4}{15}$ days

Q 6: Two taps can fill a tank in 24 min and 36 min respectively. A 3rd outlet pipe can empty the tank in 30min. If all of them are opened simultaneously, what will be the time required to fill the tank?

- (a) 75 min (b) 20 min (c) 12 min (d) $\frac{360}{13}$ min

Q 7: Bhim and Arjun working by themselves can build a wall respectively in 8 days and 18 days more than what they would take when working together. In how many days can Bhim alone build the wall?

- (a) 20 (b) 24 (c) 30 (d) 12

Q 8: Three taps are connected to a water tank. First and second taps fill it up in A seconds and B seconds respectively, when they are opened separately. The third tap empties the full tank in C seconds. If all are opened simultaneously, what is the condition required on A, B and C to ensure that the tank will actually fill up?

- (a) $A + B > C$ (b) $A - B < C$ (c) $AB < BC + CA$ (d) $A + B > \frac{C}{2}$

Q 9: A tank can be filled by one tap in 10 minutes and by another in 30 minutes. Both the taps are kept open for 5 minutes and then the first one is shut off. In how many minutes more is the tank completely filled?

- (a) 5 (b) 7.5 (c) 10 (d) 12

Q 10: A factory has 3 stamping machines for stamping, which can finish a lot in 4, 5 and 6 hours respectively. Due to some power problems in the city on Thursdays, only 2 of these machines can work simultaneously at any given point in time. What is the largest part of the job that can be finished in one hour on a Thursday?

- (a) $20/9$ (b) $11/15$ (c) $9/20$ (d) $5/6$

Q 11: A can do $(1/3)$ of a work in 5 days and B can do $(2/5)$ of the work in 10 days. In how many days both A and B together can do the work?

- (a) $7\frac{3}{4}$ (b) $8\frac{4}{5}$ (c) $9\frac{3}{8}$ (d) 10

Q 12: in 5 days, 64 pumps can fill a 100 liters tank working 12 hours a day. In how many days will 80 pumps, working 8 hours a day, fill another tank of capacity 300 liters?

- (a) 36 days (b) 27 days (c) 18 days (d) 13.5 days

Q 13: 7 wrestlers fight for 8 hours and lose a total of 20 pounds, how many more wrestlers fighting would it take to lose a total of 20 pounds in only 4 hours, if the new wrestlers lost weight only half as fast as the original 7?

- (a) 7 (b) 21 (c) 27 (d) 14

Q 14: 15 men take 21 days of 8 hours each to do a piece of work. How many days of 6 hours each would 21 women take if 3 women do as much work as 2 men?

- (a) 20 (b) 21 (c) 25 (d) 30

Q 15: 12 mugs of water fill a bucket when the capacity of each mug is 13.5 liters. How many mugs will be needed to fill the same bucket, if the capacity of each mug is 9 liters?

- (a) 12 (b) 14 (c) 16 (d) 18

Q 16: 8 women can dig a pit in 20 hours. If a woman works half as much again as a boy, then 4 women and 9 boys can dig a similar pit in:

- (a) 10 hours (b) 12 hours (c) 15 hours (d) 16 hours

Q 17: 8 boys and 12 girls complete a certain piece of work in 9 days. If each boy takes twice the time taken by a girl to finish the work, in how many days will 12 girls finish the same work ?

- (a) 8 (b) 15 (c) 9 (d) 12

Q 18: 10 men can finish a piece of work in 10 days, where as it take 12 women to finish it in 10 days. If 15 men and 6 women undertake to complete the work, how many days will they take to complete it?

- (a) 2 (b) 4 (c) 5 (d) 11

Q 19: If 3 farmers or 4 tractors can plough a field in 43 days, then the number of days that 7 farmers and 5 tractors take to plough it is:

- (a) 12 (b) 18 (c) 24 (d) 30

Q 20: 12 men or 18 women can reap a field in 14 days. The number of days that 8 men and 16 women will take to reap it is:

- (a) 5 (b) 7 (c) 8 (d) 9

Q 21: A alone can finish a work in 10 days and B alone can do it in 15 days. If they work together and finish, then out of a total wages of Rs.75. A will get:

- (a) Rs.30 (b) Rs.37.50 (c) Rs.45 (d) Rs.50

Q 22: A can do a certain job in 12 days. B is 60% more efficient than A. The number of days it takes for B to do the same piece of work is:

- (a) 6 (b) $6\frac{1}{4}$ (c) $7\frac{1}{2}$ (d) 8

Q 23: A is thrice as good a work man as B and takes 10 days less to do a piece of work than B takes. B can do the work in:

- (a) 12 days (b) 15 days (c) 20 days (d) 30 days

Q 24: A, B and C together earn Rs.150 per day while A and C together earn Rs.94 and B and C together earn Rs.76. The daily earning of C is:

- (a) Rs.75 (b) Rs.56 (c) Rs.34 (d) Rs.20

Q 25: A can complete a job in 9 days B in 10 days and C in 15 days. B and C start the work and are forced to leave after 2 days. The time taken to complete the remaining work is:

- (a) 6 days (b) 9 days (c) 10 days (d) 13 days

Q 26: A completes a work in 4 days whereas B completes the work in 6 days. C works $1\frac{1}{2}$ times as fast as A. How many days it will take for the three together to complete the work?

- (a) $\frac{7}{12}$ (b) $1\frac{5}{12}$ (c) $1\frac{5}{7}$ (d) None of these

Q 27: Twelve men can complete a work in 8 days. Three days after they started the work, 3 more men joined them. In how many days will all of them together complete the remaining work?

- (a) 2 (b) 4 (c) 5 (d) 6

Q 28: A, B and C contract a work for Rs.550. Together A and B are to do $\frac{7}{11}$ of the work. The share of C should be:

- (a) Rs.183 $\frac{1}{3}$ (b) Rs.200 (c) Rs.300 (d) Rs.400

Q 29: If 5 men or 9 women can finish a piece of work in 19 days, 3 men and 6 women will do the same work in:

- (a) 10 days (b) 12 days (c) 13 days (d) 15 days

Q 30: Two men undertake to do a piece of work for Rs.400. One alone can do it in 6 days, the other in 8 days. With the help of a boy, they finish it in 3 days. The boy's share is

- (a) Rs.40 (b) Rs.50 (c) Rs.60 (d) Rs.80

Solutions – Worksheet (Basic)

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|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. A | 2. D | 3. C | 4. C | 5. D | 6. D | 7. A | 8. C | 9. C | 10. C |
| 11. C | 12. C | 13. D | 14. D | 15. D | 16. D | 17. D | 18. C | 19. A | 20. D |
| 21. C | 22. C | 23. B | 24. D | 25. A | 26. D | 27. B | 28. B | 29. D | 30. B |