



WB – CS

Provincial Civil Services

Prelims & Mains

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General Studies

Volume 8

Maths and Reasoning



WB - CS

G.S. PAPER

MATHS & REASONING

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Time & Work

Introduction:-

Work is defined as something which has an effect or custom; often the one desired or expected. The basic concept of Time and work is based on the concept of Proportionality

⇒ If there is lot of work, then time taken to complete that work will be more. Hence both time and work are directly proportional to each other.

$$\text{Time taken} \propto \text{Work}$$

∴ Condition applied if same person is working

Formulae of Capacity:-

$$\text{Capacity} = \frac{\text{Work}}{\text{Time}}$$

⇒ If there are lot of persons, then time taken to complete to work will be less, Hence no. of persons is inversely proportional to time taken to complete a work.

$$\text{Time} \propto \frac{1}{\text{No. of Person}}$$

Note:- Generally we assume that work is having the value 1.

Solved Examples

Q.1 A can complete a work in 10 days and B can complete the same work in 15 days. If they work together, in how many days work will be completed?

Sol:

A Can Complete a Work in = 10 days

$$\text{Capacity} = \frac{\text{Work}}{\text{Time}} \quad [\because \text{By formula}]$$

Let us assume work be 1

$$\boxed{\text{Efficiency} = \frac{1}{10}} \Rightarrow \text{Capacity of A doing work in 1 day}$$

B Can Complete Work in = 15 days

$$\boxed{\text{Efficiency} = \frac{1}{15}} \Rightarrow \text{Capacity of B doing work in 1 day}$$

$$\text{Total Capacity of A \& B to do work in One day} = \frac{1}{10} + \frac{1}{15}$$

$$[\text{Capacity of A} + \text{Capacity of B}]$$

$$= \frac{1}{10} + \frac{1}{15}$$

$$\Rightarrow \frac{3+2}{30} \Rightarrow \frac{5}{30} = \frac{1}{6}$$

As we know,

$$\text{Capacity} = \frac{\text{Work}}{\text{Time}}$$

$$\frac{1}{6} = \frac{1}{\text{Time}} \Rightarrow \text{Time} = 6 \text{ days} \Rightarrow \boxed{\text{Required Documents}}$$

Shortcut: The name of the shortcut method will be LCM

	A	B	A+B
Days	10	15	5
Efficiency	3	2	
Total work	30		
Days =	$\frac{\text{Total work}}{\text{Efficiency}}$		

Helping hand

(a) LCM of 10, 15 is 30 (total work is 30)

(b) Eff. of A = $30/10 = 3$

Eff. of B = $30/15 = 2$

(c) Eff. of A & B together is $5(3+2)$.

Q. 2 A can do a piece of work in 8 hours and B can do the same work in 12 hours. in how much time both can finish the whole working together?

sol:

	A	B	A+B
Days-	8	12	
Efficiency-	3	2	5
Total Work-	24		Number of days = $\frac{24}{5} = 4\frac{4}{5}$ days

Q. 3 A and B together can complete a work in 20 days and A alone can finish that work in 30 days. in how many days B can complete the work.

sol:

	A+B	A	B
Days-	20	30	
Efficiency-	3	2	1
Total Work-	60		B complete the work = $\frac{60}{1} = 60$ days

Q. 4 A, B and C can do a work in 10, 12 & 15 days respectively. in how many days all of them together will finish the work.

sol:

	A	B	C	A+B+C
Days	10	12	15	(4)
Efficiency-	6	5	4	15
Total Work-	60		$\frac{60}{15} = 4$ days.	

Q. 5 A and B together can complete a work in 24 days, B and C in 30 days, A and C in 40 days. Find the time taken by A alone to complete the work.

sol:

	A+B	B+C	C+A	(A+B+C)	A
Days-	24	30	40		60 days $\rightarrow \frac{120}{2}$
Efficiency-	5	4	3	6	2
Total Work,	120				

$$\text{Efficiency of } (A+B) + (B+C) + (C+A) = 2C(A+B+C)$$

Q. 6 A takes 4 days more to complete a work than the time taken by (A+B) to do the same work and B takes 9 days more than time taken by (A+B) to do same work. in how many days A+B complete the work.

sol:

Let us assume (A+B) Complete in = n days

$$\text{Capacity} = \frac{\text{work}}{\text{Time}}$$

Let us assume work to be unity Capacity = $\frac{1}{n}$

So, A Can do work in = $(n+4)$ days

B Can do work in = $(n+9)$ days

$$(\text{Capacity})_A = \frac{1}{n+4}$$

$$(\text{Capacity})_B = \frac{1}{n+9}$$

$$\Rightarrow \frac{1}{n} = \frac{1}{n+4} + \frac{1}{n+9}$$

$$\Rightarrow \frac{1}{n} = \frac{2n+13}{n^2+13n+36}$$

$$\Rightarrow n^2 + 13n + 36 = 2n^2 + 13n$$

$$n^2 = 36$$

$$\boxed{n = 6 \text{ days}}$$

SHORTCUT $\Rightarrow$

$$TA + B^2 = TA_{\text{extra}} \times TB_{\text{extra}}$$

$TA + B$ = Time taken by (A+B) to Complete work

TA_{extra} = Extra time by A

TB_{extra} = Extra time by B

$$TA + B^2 = 4 \times 9 = 36$$

$$\boxed{TA + B = 6 \text{ days.}}$$

Q. 7 A can complete a work in 10 days and B can complete the same work in 15 days. if B starts the work and A joins him after 5 days, then in how many days will the work be completed?

sol:

	A	B
Days	10	15
Efficiency	3	2

Total work = 30

$$5 \text{ day work of B} = 2 \times 5$$

$$= 10$$

$$\text{Work of remaining} = 20$$

$$\text{Time taken by A \& B together to Complete} = \frac{20}{5} = 4 \text{ days}$$

Remaining work

$$\text{Work Complete in} = 5 + 4 = 9 \text{ days.}$$

Q. 8 working together, A and B can complete the work in 12 days. They work together for 9 days, after which B leaves. If A finishes the remaining work in 5 days, then find the no. of days that B alone will take to complete the work.

sol:

(A+B) Can do work = 12 days

Capacity = $\frac{\text{work}}{\text{Time}}$ [$\therefore$ Formula]

Let us assume work to be 1

$$\boxed{\text{Capacity} = \frac{1}{12}}$$

$$9 \times W_A + B + 5 \times W_A = 1 \text{ [Given]}$$

$$3 \times \frac{1}{12} + 5 \times W_A = 1$$

$$5W_A = 1 - \frac{3}{4} \Rightarrow \boxed{W_A = \frac{1}{20}}$$

$$\frac{1}{20} + W_B = \frac{1}{12}, W_B = \frac{1}{12} - \frac{1}{20} = \frac{5-3}{60} = \frac{2}{60} = \frac{1}{30}$$

Capacity of
 W_{A+B} = Work done by (A+B) in
 1 day
 W_A = Work done by A in
 day

No. of days B alone can do a work = 30 days

Q. 9 A is thrice as good as workman as B and therefore is able to finish a job in 60 days less than B. working together in how many days they can do it?

sol:

Let Capacity of B = M

Capacity of A = $3M$

Time Taken by B to Complete Work = $\frac{1}{M}$

Time taken by A to Complete Work = $\frac{1}{3M}$

$$\frac{1}{M} - \frac{1}{3M} = 60 \text{ [}\therefore \text{ given]}$$

$$\frac{2}{3M} = 60$$

$$\boxed{M = \frac{1}{90}} \text{ --- (1)}$$

Capacity of (A+B) to Complete a work = $M + 3M = 4M$

Time taken by (A+B) to Complete a work = $\frac{1}{4M}$

Putting (1) in M .

$$\text{Time} = \frac{1 \times 90}{4 \times 1} = 22.5 \text{ days}$$

concept of Alternate days

Q. 10 A and B can complete a work in 20 days and 30 days respectively. if they work on alternate days. Find the no. of days in which the work will be completed if work is started by A.

sol:

	A	B
Days	20	30
Efficiency	3	2
Total work	60	

A Start the Work

A	B	A	B	A	B	...
3	2	3	2	3	2	...

In 2 days (A+B) Compl. = 5 work

Days taken by (A+B) to Complete

$$60 \text{ work} = \frac{60}{5/2} = 24 \text{ days.}$$

Q. 11 A and B can complete a work in 10 days and 20 days respectively. if they work on alternate days. Find the least number of days in which work will be completed.

sol:

	A	B
Days	10	20
Efficiency	2	1
Total work	20	

IF A start the work.

A	B	A	B	A	B	...
2	1	2	1	2	1	...

Work Complete in 2 days = 3

= 18

Total work 20

total days = 6+1 = 7 days -

2 work is remaining, A's turn = 1 toot 1 day

IF B starts, B A B A B A

1 2 1 2 1 2

Work Complete, B's turn = 3

Work Complete in 6 days = 3x6 = 18,

2 work remaining, B's turn.

B took 2 days.

Total days = 6+2

= 8 days.

Q. 12 if 3 men or 6 women can do a piece of work in 16 days, in how many days can 12 men and 8 women do the same piece of work?

sol:

$$3m = 6w$$

$$\frac{m}{w} \rightarrow \frac{6}{3} \quad [\text{Efficiency of 1 men} = 6]$$

$$\text{Total work} = 3 \times 6 = 6 \times 3 \times 16 = 288$$

Time taken by 8 men & 8 women

$$= \frac{288}{12 \times 6 + 8 \times 3} = \frac{288}{12(6+2)} = 3 \text{ days.}$$

Q. 13 24 men working 9 hrs a day can complete a piece of work in 35 days. 30 men working 8 hrs a day complete thrice the original work in how many days?

sol:

$$\frac{M_1 D_1 H_1}{W_1} = \frac{M_2 D_2 H_2}{W_2}$$

$$\frac{24 \times 9 \times 35^1}{1} = \frac{30 \times D_2 \times 8^2}{3 \times 1} \quad [\text{Since work is thrice}]$$

$$D_2 = \frac{27}{2}$$

Q. 14 If 100 cats can kill 100 rats in 100 days. in how many days 10 cats can kill 10 rats?

sol: Since per page hrs are not given, hence we remove it.

$$\frac{M_1 D_1 H_1}{W_1} = \frac{M_2 D_2 H_2}{W_2} \quad [\because \text{Efficiency is Constant}]$$

$$\frac{100 \times 100}{100} = \frac{10 \times D_2}{10} = D_2 = 100$$

Q. 15 For how many days will 60 kg of food be sufficient for a family of 8 members if each member consume 1.5 kg of food per day?

sol: Since hours per day is not given and efficiency is Constant

$$\frac{M_1 D_1}{W_1} = \frac{M_2 D_2}{W_2}$$

$$\frac{8 \times D_1}{60} = \frac{1 \times 1}{1.5}$$

$$D_1 = 5 \text{ days}$$

Q. 16 14 workers make 17 boxes in 6 days. How many workers are required to make 289 boxes in 42 days?

sol: Since per day hour is not given

$$\frac{M_1 D_1}{W_1} = \frac{M_2 D_2}{W_2} \quad [\because \text{Efficiency is Constant}]$$

$$\frac{14 \times 6^2}{17} = \frac{M_2 \times 42}{289 \times 17}$$

$$M_2 = 34 \text{ Workers}$$

Reasoning

ALPHABET

Alphabet :-

There are 26 letters in an English Alphabet,
A to Z.

Left →													← Right												
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

(when counted from Z to A)

Place
Value
Reverse
order

First half → (A to M)	1	2	3	4	5	6	7	8	9	10	11	12	13
	A	B	C	D	E	F	G	H	I	J	K	L	M → 13
Second half → (N to Z)	26	25	24	23	22	21	20	19	18	17	16	15	14
	Z	Y	X	W	V	U	T	S	R	Q	P	O	N → 13

E	J	O	T	Y
5	10	15	20	25

Remember 'EJOTY'

C	F	I	L	O	R	U	X
3	6	9	12	15	18	21	24

'CFILORUX'

Nowels →	A	E	I	O	U
	1	5	9	15	21

when at the left of the left letter or right of the right letter is asked, we'll find the difference of their sequence (for same side).

ex ample : Which is the 7th letter from the left of the 10th letter from left in english alphabet?

Solⁿ: Left left
 10 - 7 = 3rd letter

3rd letter = C

when at the left of the right letter or right of the left letter is asked, we'll find the sum of their sequences (for two different side's sequence)

example : which will be the 8th letter at the right from 12th letter from left.

Solⁿ: Left + Right
 12 + 8 = 20th letter = T

T will be the 20th letter from left in the english alphabet.

which will be the letter in English Alphabet, which is 7th at left from 12th from right.

1st: Here for 2 different sides we add sequence no. of the letters

i.e Right + left
 12 + 7 = 19

So, 19th letter from Right side, we subtract 19 from 27.

$$27 - 19 = 8^{\text{th}}$$

8th letters from left side is 'H'

* == When position of letter is asked from right side (Z), we minus from 27. ==

Like 1. R is 18 from left side then what is the position from right side.

Sol.ⁿ $27 - 18 = 9$

R is 9th from Right side in English Alphabet.

Example ÷ which will be the letter in English alphabet, which is 6th at right from 22nd from right?

Sol.ⁿ

Right	-	Right	
22	-	6	= 16

So, 16th letters from right means

$$27 - 16 = 11^{\text{th}} \text{ from left. and}$$

K is the 11th letter from left.

Example ÷ Which letter is 10th to Right of 19th letters from Right.

Sol.ⁿ

Right	-	Right	
19	-	10	= 9

So, $27 - 9 = 18 = R$

In short

= At the right from right] (-)
 At the left from left]
 At the left from Right] (+)
 At the Right from left]

↳ 2. When a series of letters symbol digit is given :

Example : Study the following arrangement carefully and answer the following questions :

R4PIJMQ3%T@@UKSVIw\$Y2BEG#9DHOQ*ZN

Q1. which is 6th at the left of 15th from the left in above arrangement.

Solⁿ Left - left
 15 - 6 = 9th from left
 So answer = %

Q2 : In the above arrangement ; how many numbers are such which are produced by consonant and not followed by a letter ?

Solⁿ Answer = one

 Q 3 % → not letters.
 ↓ ↓
 consonant number

↳ 3. Arrangement according to Dictionary : In this arrangement, we arrange the letters in the

Order in which they appear in the English alphabet.

For example : 1. Choose the one that comes at the second place According to Dictionary.

- | | |
|-----------------|--------------|
| A. Bathing | B. Banking |
| C. Backing | D. Banishing |
| E. Barricading. | |

Solⁿ: According to English Dictionary.

Backing Banishing Banking Barricading Bathing
 1 2 3 4 5

So, banishing is at second place.

* 2. How many letters pairs in the word PARADISE are such pairs, which contain the same no. of letters between them as they have in the English Alphabet?

Solⁿ

P	A	R	A	D	I	S	E
19	1	21	1	4	9	22	5



we have 3 letter pairs here.

* 3. If the 2nd half of the English alphabet is written in reverse order, then which letter will be the 13th at right from 8th from left?

Explanation :

According to Question $A \rightarrow MZ \rightarrow N$

A B C D E F G H I J K L M N Z Y X W V U T S R Q P O

$$\text{Now } \overset{L}{0} + \overset{R}{13} = 21$$

So, 21 letters, 13 are from A to M, remaining 8 should be counted from Z to N, which is '8'.



Solved Examples

Q.1 If the second half of the English Alphabet is reversed then which letter will be 4th to the right of 20th letter from the right?

sol: Right - Right

$$\Rightarrow 20 - 4 = 16^{\text{th}} \text{ from Right}$$

$$\text{So } 27 - 16 = 11^{\text{th}} \text{ from left} = \text{K}$$

$16^{\text{th}} \text{ from Right} = 11^{\text{th}} \text{ from Right}$

Q.2 Which letter is in the middle between the 9th letter from the right and 8th letter from the left in the English Alphabet?

sol: A $\rightarrow$ Z

$$8^{\text{th}} \text{ from left} = \text{H}$$

$$9^{\text{th}} \text{ from the right } (27 - 9 = 18 = \text{R})$$

$$\text{So middle letter} = \frac{8 + 18}{2} = 13^{\text{th}} = \text{M}$$

Q.3 A E C B % 7 D \$ E B 5 C ? 3 D E 9 @ 2 #, if all the vowels are dropped from the above arrangement which of the following will be the 12th from the left end of the above arrangement?

sol: After dropping Vowels we have

C B % 7 D \$ B 3 C ? 3 D 9 @ 2 #

↑
Ans

Q.4 If the sequence of the English alphabet is reversed then which is 7th to the left of second vowel. From the right of English Alphabet in the new series?

sol:

Second Vowel from the right of reversed English alphabet is E and 7th letter to the left of E in the new series is L.

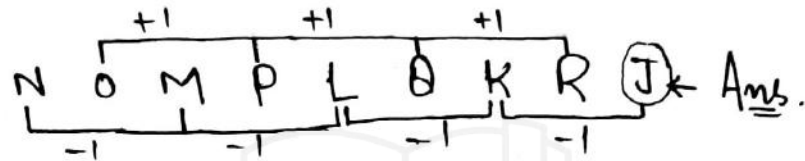
Q.5 How many pairs of letter are there in the word 'HORIZON' which have as many letters between them in the word as in the English Alphabet?

sol:


 = 4 pairs of letters.

Q.6 What is the next letter of the following sequence N, O, M, P, L, Q, K, R, ?

sol:


 Ans.

Q.7 If the first and second letters in the word 'MISFORTUNE' were interchanged, also the third and the fourth letters, the fifth and sixth letters and so on, which letter would then be the eight letter counting to your left?

sol:

New sequence = I M F S R O U ^{8th} T E N

Ans. = T.

Q.8 Arrange the given words in alphabetical order and choose the one that comes in the middle?

sol: According to alphabet order →

shout, skirt, slaughter, specify, straight

middle word = slaughter.

Q.9 If NAMO = 172 and OM = 56, then SHIVAY = ?

sol:

$$\text{NAMO} = 14 + 1 + 13 + 15 = 43 \times 4 = 172$$

$$\text{OM} = 15 + 13 = 28 \times 2 = 56$$

$$\begin{aligned} \text{SHIVAY} &= 19 + 8 + 9 + 22 + 1 + 25 = 84 \times 6 \\ &= 504 \end{aligned}$$

Directions(10-14): study the following arrangement of numbers, letters and symbols carefully and answer the questions given below.

R @ 29 T V A Y 5 @ # J I P 8 Q \$ E 3 * H % 6 W 4 I δ U Z

Q.10 Four of the following five are alike in a certain way based on their positions in the above arrangement, and so form a group. which is the one that does not belong to the group?

J P @, E * Q, W I %, 9 V @, I # δ

sol: $\begin{array}{ccccc} \text{J} & \text{P} & \text{C} & \text{E} & * & \text{Q} & \text{W} & \text{I} & \% & 9 & \text{V} & @ & \text{I} & \# & \delta \\ \hline & +2 & -4 & +2 & -4 & +2 & -4 & +2 & -4 & -2 & +16 \end{array}$

Ans I # δ

Q.11 which of the following is the fifth to the right of the 19th element from the right end?

P, V, W, 8, Q

sol: $19 - 5 = 14^{\text{th}}$ element from the right end = Q.

Q.12 How many such number are there in the given arrangement, each of which is immediately preceded by the consonant and immediately followed by a symbol?

sol: Y S @ → 1 pair

Q.13 If the positions of the last 18 elements in the given arrangement are reversed, which will be the 17th from the left end?

sol: After arrangement

R @ 29 T V A Y S @ # 2 U S I 4 W 6 % H * 3 E \$ Q P I J

Q.14 How many such vowels are there in the given arrangement, each of which is either immediately followed by a symbol?

sol:

3 Vowels = E, I and U

Q.15 How many meaningful words can be formed from the 3rd, 4th, 6th and 8th letter of the word 'CONTROVERSIAL'?

sol:

C O N T R O V E R S I A L
 ↓ ↓ ↓ ↓
 3rd 4th 6th 8th

N, T, O, E → 2 words : Note, Tone
can formed