



WB - PSC

Pre & Mains

WEST BENGAL PUBLIC SERVICE COMMISSION

Paper 6

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		$\rightarrow \frac{60}{5} = 12$ days.
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)	$\rightarrow \frac{60}{15} = 4$ days.
Efficiency-	6	5	4	15	
Total Work-	60				

	A+B	B+C	C+A	(A+B+C)	A
Day	24	30	40	60 days	$\rightarrow \frac{120}{2}$
Eff	5	4	3	6	2
Total Work	120				$(A+B)+(B+C)+(C+A) = 2(A+B+C)$

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				

Efficiency of $(A+B) + (B+C) + (C+A) = 2(A+B+C)$

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 = h days

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

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

So, A can do work in = (h+4) days

B can do work in = (h+9) days

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

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

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

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

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

$$h^2 = 36$$

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

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

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

Let us assume work to be 1

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

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

$$3 \times \frac{1}{4} + 5 \times W_A = 1$$

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

$$\boxed{W_A = \frac{1}{20}}$$

$$W_{A+B} + B = \frac{1}{12}$$

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

Capacity of

$$W_{A+B} = \text{Work done by (A+B) in 1 day}$$

$$W_A = \text{Work done by A in 1 day}$$

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 = H

Capacity of A = 3H

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

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

$$\frac{1}{H} - \frac{1}{3H} = 60 \quad [\because \text{given}]$$

$$\frac{2}{3H} = 60 \Rightarrow$$

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

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

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

Putting (1) in H.

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

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 work = $\frac{60}{5/2} = 24$ 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 days = 6+1 = 7 days - 2 work is remaining, A's turn = 1 tot 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

$$= \frac{288}{12 \times 6 + 8 \times 3} = \frac{288}{24} = 3 \text{ days.}$$

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:

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

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

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

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 rows are not given, hence we remove it.

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

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

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 rows per day is not given and efficiency is Constant

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

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

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

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 row is not given

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

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

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

SIMPLIFICATION

Fraction

$1 = 100\%$

$\frac{1}{2} = 50\%$

$\frac{1}{3} = 33.33\%$

$\frac{1}{4} = 25\%$

$\frac{1}{5} = 20\%$

$\frac{1}{6} = 16.66\%$

$\frac{1}{7} = 14.28\%$

$\frac{1}{8} = 12.5\%$

$\frac{1}{9} = 11.11\%$

$\frac{1}{10} = 10\%$

$\frac{1}{11} = 9.09\%$

$\frac{1}{12} = 8.33\%$

$\frac{1}{13} = 7.69\%$

$\frac{1}{14} = 7.14\%$

$\frac{1}{15} = 6.66\%$

$\frac{1}{16} = 6.25\%$

$\frac{1}{17} = 5.88\%$

$\frac{1}{18} = 5.56\%$

$\frac{1}{19} = 5.26\%$

$\frac{1}{20} = 5\%$

$\frac{3}{8} = 37.5\%$

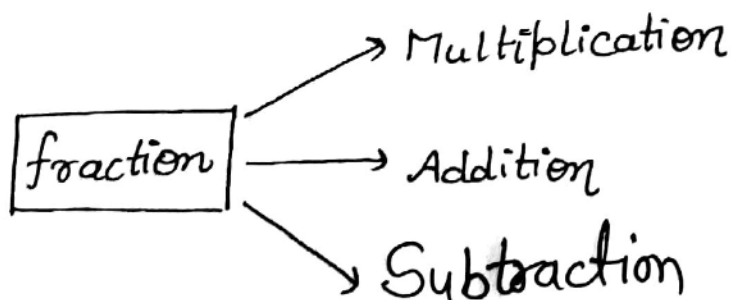
$\frac{5}{8} = 62.5\%$

$\frac{7}{8} = 87.5\%$

$\frac{5}{6} = 83.33\%$

$\frac{11}{12} = 91.67\%$

संजीवनी



शख भी बिकेगी; सोने के भाव, जल कर ली देख

Multiplication form:

(a) $\frac{1}{7} = 14.28\%$
 $\left(\begin{array}{l} \times \frac{1}{2} \\ \rightarrow \end{array} \right) \frac{1}{14} = 7.14\%$

(b) $\frac{1}{4} = 25\%$
 $\left(\begin{array}{l} \times \frac{1}{2} \\ \rightarrow \end{array} \right) \frac{1}{8} = 12.5\%$
 $\left(\begin{array}{l} \times \frac{1}{2} \\ \rightarrow \end{array} \right) \frac{1}{16} = 6.25\%$

(c) $\frac{1}{6} = 16.66\%$
 $\left(\begin{array}{l} \times \frac{1}{2} \\ \rightarrow \end{array} \right) \frac{1}{12} = 8.32\%$

(d) $\frac{1}{11} = 9.09\%$
 $\left(\begin{array}{l} \times 2 \\ \rightarrow \end{array} \right) \frac{2}{11} = 18.18\%$

Addition form:

(a) 107.69%
 $\rightarrow 100\% + 7.69\%$
 $= 1 + \frac{1}{13} = 1\frac{1}{13}$

(b) 116.66%
 $\rightarrow 100\% + 16.66\%$
 $= 1 + \frac{1}{6} = 1\frac{1}{6}$

(c) 137.5%
 $\rightarrow 100\% + 37.5\%$
 $= 1 + \frac{3}{8} = 1\frac{3}{8}$

(d) 162.5%
 $\rightarrow 100\% + 62.5\%$
 $= 1 + \frac{5}{8}$
 $= 1\frac{5}{8}, \frac{13}{8}$

Subtraction form:

(a) 90.91%

→ 100% - 9.09%

→ $1 - \frac{1}{11}$

= $\frac{10}{11}$ Ans

(b) 87.5%

→ 100% - 12.5%

→ $1 - \frac{1}{8}$

= $\frac{7}{8}$ Ans

(c) 92.86%

→ 100% - 7.14%

$1 - \frac{1}{14}$

= $\frac{13}{14}$ Ans

Eg:- $\boxed{1}$ 28.56% of 35 + 87.5% of 32 = x

= $(2 \times \frac{1}{7}) \times 35 + (100\% - 12.5\%) \times 32 = x$

= $\frac{2}{7} \times 35 + (1 - \frac{1}{8}) \times 32$

= $\frac{2}{7} \times 35 + \frac{7}{8} \times 32$

= 10 + 28 = 38 Ans

$\boxed{2}$ 37.5% of 64 + 16.66% of 24 = $\sqrt{729} + x$

= $3(12.5\%) \times 64 + (\frac{1}{6}) \times 24 = 27 + x$

= $3 \times \frac{1}{8} \times 64^3 + \frac{1}{6} \times 24^4 = 27 + x$

$$= 24 + 4 = 27 + 2x$$

$$\boxed{2x = 1}$$

3. 48% of 2434

$$\begin{array}{l} \wedge \\ 50\% - 2\% \end{array}$$

$$= 1217 - 48.68$$

$$= 1168.32 \text{ Ans}$$

$$100\% = 2434$$

$$50\% = 1217$$

$$1\% = 24.34$$

$$2\% = 48.68$$

4. 45% of 2460

$$\begin{array}{l} \wedge \\ 50\% - 5\% \end{array}$$

$$1230 - 123$$

$$= 1107 \text{ Ans}$$

$$100\% \rightarrow 2460$$

$$50\% \rightarrow 1230$$

$$5\% \rightarrow 123$$

5. 55% of 525

$$\begin{array}{l} \wedge \\ 50\% + 5\% \end{array}$$

$$262.5 + 26.25$$

$$= 288.75 \text{ Ans}$$

$$100\% \rightarrow 525$$

$$50\% \rightarrow 262.5$$

$$5\% = 26.25$$

6. 26% of 1248

$$\begin{array}{l} \wedge \\ 25\% + 1\% \end{array}$$

$$312 + 12.48$$

$$= 324.48 \text{ Ans}$$

$$100\% \rightarrow 1248$$

$$25\% \rightarrow \frac{1}{4} \times 1248 = 312$$

$$1\% = 12.48\%$$

7. $67.66\% \text{ of } 3369$

\swarrow
 $66.66\% + 1\%$
 $2246 + 33.69$
 $= 2279.69$ Ans

66.66%

$\hookrightarrow \frac{2}{3} \times 3369$
 $= 2 \times 1123$
 $= 2246$

Brahmastro-2

$x\% \text{ of } y = y\% \text{ of } x$

$\frac{x}{100} \times y = \frac{y}{100} \times x$ Both are same

How it's works :

* 56% of 50

$\rightarrow 56\% \text{ of } 50 = 50\% \text{ of } 56$

\downarrow
 Dimag ko Sochna
 Padega.

\downarrow
 Kuch bhi nahi Sochna,
 Direct

$= 28$ Ans.

68% of 150?

→ 150% of 68

100% → 68

50% → 34 +

102 Ans

90.6% of 16.67?

→ 16.67% of 90.6

$$\frac{1}{6} \times 90.6 = 15.1 \text{ Ans}$$

25.6% of 250?

→ 250% of 25.6

200% → 51.2

$$50\% \rightarrow \frac{12.8}{64.0} = 64 \text{ Ans}$$

Addition & Subtraction tricks

Q. [L.] $4859 + 6424 + 9234$

School Method

$$\begin{array}{r}
 \textcircled{000} \\
 4859 \\
 6424 \\
 + 9234 \\
 \hline
 20517 \text{ Ans}
 \end{array}$$

Sarkari Naukri lagane Wala Method

Q. $4859 + 6424 + 9234$

$$\begin{array}{r}
 4000 \\
 6000 \\
 \underline{9000} \\
 19000
 \end{array}
 +
 \begin{array}{r}
 800 \\
 400 \\
 \underline{200} \\
 1400
 \end{array}
 +
 \begin{array}{r}
 59 \\
 24 \\
 \underline{34} \\
 117
 \end{array}
 = 20517$$

Solve all Calculation in mind, not on pen & paper.

Solve in mind:

1. $4600 + 8400 + 7600 = 20,600$

2. $3848 + 5238 - 3316 = 5,770$

3. $1184 + 1982 - 768 = 2398$

4. $2368 + 1464 + 108 - 29 = 3911$

5. $49352 + 61264 + 89316 = 1,99,932$

Multiplication trick

Multiply by 5

a) eg: 648×5

$$\frac{6480}{2} = 3240 \text{ Ans}$$

Helping hand

Multiply by 10 & then divide by 2; in mind not paper.

b) 3224×5

$$\rightarrow \frac{32240}{2} = 16120 \text{ Ans.}$$

c) 325×5

$$\rightarrow \frac{3250}{2} = 1625 \text{ Ans.}$$

d) 3223×5

$$= \frac{32230}{2} = 16115 \text{ Ans.}$$

Multiply by 25

eg: (a) 313×25

$$\rightarrow \frac{31300}{4} = 7825 \text{ Ans.}$$

Helping hand:
Multiply by 100 & then
divide by 4 in mind.

(b) 1816×25

$$\rightarrow \frac{181600}{4} = 45400 \text{ Ans.}$$

(c) 2131×25

$$\rightarrow \frac{213100}{4} = 53275 \text{ Ans.}$$