Time and Work

Ex 13A

1. **Work from Days:**
   If A can do a piece of work in n days, then A's 1 day's work = $\frac{1}{n}$.
2. **Days from Work:**
   If A's 1 day's work = $\frac{1}{n}$, then A can finish the work in n days.
3. **Ratio:**
   If 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.

Q1.

Answer :

Work done by Rajan in 1 day $= \frac{1}{24}$

Work done by Amit in 1 day $= \frac{1}{30}$

Work done by Amit and Rajan together in 1 day $= \frac{1}{24} + \frac{1}{30} = \frac{54}{720} = \frac{3}{40}$

Q2. $\therefore$ They can complete the work in $\frac{40}{3}$ days, i.e., $13\frac{1}{3}$ days if they work together.

Answer :

Time taken by Ravi $= 15$ h

Time taken by Raman $= 12$ h

Work done per hour by Ravi $= \frac{1}{15}$

Work done per hour by Raman $= \frac{1}{12}$

Work done per hour by Ravi and Raman together $= \frac{1}{15} + \frac{1}{12} = \frac{9}{60} = \frac{3}{20}$

$\therefore$ Time taken by Ravi and Raman together to finish the work $= \frac{20}{3}$ h $= 6\frac{2}{3}$ h

Q3.

Answer :

Time taken by A and B to finish a piece of work $= 6$ days

Work done per day by A and B $= \frac{1}{6}$

Time taken by A alone $= 9$ days

Work done per day by A alone $= \frac{1}{9}$

Work done per day by B $= \left(\text{work done by A and B}\right) - \left(\text{work done by A}\right)$

$= \frac{1}{6} - \frac{1}{9} = \frac{3-2}{18} = \frac{1}{18}$

$\therefore$ B alone will take 18 days to complete the work.

Q4.

Answer :

Time taken by Raju $= 15$ h

Work done by Raju in 1 h $= \frac{1}{15}$

Time taken by Raju and Siraj working together $= 6$ h

Work done by Raju and Siraj in 1 h $= \frac{1}{6}$

Work done by Siraj in 1 h $= \left(\text{work done by Raju and Siraj}\right)$

$- \left(\text{work done by Raju}\right)$

$= \frac{1}{6} - \frac{1}{15} = \frac{5-2}{30} = \frac{3}{30} = \frac{1}{10}$

$\therefore$ Siraj will take 10 h to overhaul the scooter by himself.

Q5.

Answer :

Time taken by A to complete the work $= 10$ days

Time taken by B to complete the work $= 12$ days

Time taken by C to complete the work $= 15$ days

Work done per day by A $= \frac{1}{10}$

Work done per day by B $= \frac{1}{12}$

Work done per day by C $= \frac{1}{15}$

Total work done per day $= \frac{1}{10} + \frac{1}{12} + \frac{1}{15} = \frac{6+5+4}{60} = \frac{15}{60} = \frac{1}{4}$

A, B and C will take 4 days to complete the work if they work together.

Q6.

Answer :

Time taken by A to complete the piece of work $= 24$ h
Work done per hour by A $= \frac{1}{24}$
Time taken by B to complete the work $= 16$ h
Work done per hour by B $= \frac{1}{16}$
Total time taken when A, B and C work together $= 8$ h
Work done per hour by A, B and C $= \frac{1}{8}$
Work done per hour by A, B and C $=$ (work done per hour by A) $+$ (work done per hour by B) $+$ (work done per hour by C)
(Work done per hour by C) $=$ (work done per hour by A, B and C) $-$ (work done per hour by A) $-$ (work done per hour by B)
$= \frac{1}{8} - \frac{1}{24} - \frac{1}{16} = \frac{6-2-3}{48} = \frac{1}{48}$
Thus, C alone will take 48 h to complete the work.

Q7.

Answer :

A can complete the work in 20 h.
Work done per hour by A $= \frac{1}{20}$
B can complete the work in 24 h.
Work done per hour by B $= \frac{1}{24}$
It takes 8 h to complete the work if A, B and C work together.
Work done together per hour by A, B and C $= \frac{1}{8}$
(Work done per hour by A, B and C) $=$ (work done per hour by A) $+$ (work done per hour by B) $+$ (work done per hour by C)
OR
(Work done per hour by C) $=$ (work done per hour by A, B and C) $-$ (work done per hour by A) $-$ (work done per hour by B)
$= \frac{1}{8} - \frac{1}{24} - \frac{1}{20} = \frac{1}{30}$
$\therefore$ C alone will take 30 h to complete the work.

Q8.

Answer :

Time taken by A to complete the work $= 16$ days
Work done per day by A $= \frac{1}{16}$
Time taken by B to complete the work $= 12$ days
Work done per day by B $= \frac{1}{12}$
Work done per day by A and B $= \frac{1}{12} + \frac{1}{16} = \frac{4+3}{48} = \frac{7}{48}$
Work done by A in two days $= \frac{2}{16} = \frac{1}{8}$
Work left $= 1 - \frac{1}{8} = \frac{7}{8}$
A and B together can complete $\frac{7}{48}$ of the work in 1 day.
Then, time taken to complete $\frac{7}{8}$ of the work $= \frac{7}{8} \div \frac{7}{48} = \frac{7}{8} \times \frac{48}{7} = 6$ days
$\therefore$ Total time taken $= 6 + 2 = 8$ days.

Q9.

Answer :

Time taken by A to complete the work $= 14$ days
Work done by A in one day $= \frac{1}{14}$
Time taken by B to complete the work $= 21$ days
Work done by B in one day $= \frac{1}{21}$
Work done jointly by A and B in one day $= \frac{1}{14} + \frac{1}{21} = \frac{3+2}{42} = \frac{5}{42}$
Work done by A and B in 6 days $= \frac{5}{42} \times 6 = \frac{5}{7}$
Work left $= 1 - \frac{5}{7} = \frac{2}{7}$
With B working alone, time required to complete the work $= \frac{2}{7} \div \frac{1}{21} = \frac{2}{7} \times 21 = 2 \times 3 = 6$ days
So, the total time taken to complete the work $= 6 + 6 = 12$ days

Q10.

Answer :

A can do $\frac{2}{3}$ work in 16 days
So, work done by A in one day $= \frac{2}{48} = \frac{1}{24}$
B can do $\frac{1}{4}$ work in 3 days
So, work done by B in one day $= \frac{1}{12}$
Work done jointly by A and B in one day $= \frac{1}{24} + \frac{1}{12} = \frac{1+2}{24} = \frac{3}{24} = \frac{1}{8}$
So, A and B together will take 8 days to complete the work.

Q11.

Answer :

Time taken by A $= 15$ days
Time taken by B $= 12$ days
Time taken by C $= 20$ days
Work d by A in one day $= \frac{1}{15}$
Work done by B in one day $= \frac{1}{12}$
Work done by C in one day $= \frac{1}{20}$
Work done in one day by A, B and C together $= \frac{1}{15} + \frac{1}{12} + \frac{1}{20} = \frac{4+5+3}{60} = \frac{12}{60} = \frac{1}{5}$
Work done by A, B and C together in 2 days $= \frac{2}{5}$
Work remaining $= 1 - \frac{2}{5} = \frac{3}{5}$
Work done by A and B in one day $= \frac{1}{15} + \frac{1}{12} = \frac{9}{60} = \frac{3}{20}$
Time required by A and B to complete the remaining work together $= \frac{3}{5} \div \frac{3}{20} = \frac{3}{5} \times \frac{20}{3} = 4$ days

Q12.

Answer :

Time needed by A and B to finish the work $= 18$ days
Time needed by B and C to finish the work $= 24$ days
Time needed by C and A to finish the work $= 36$ days
Work done by A and B in one day $= \frac{1}{18}$
Work done by B and C in one day $= \frac{1}{24}$
Work done by C and A in one day $= \frac{1}{36}$
$2 \times$ Work done by A, B and C in one day $= \frac{1}{18} + \frac{1}{24} + \frac{1}{36} = \frac{4+3+2}{72} = \frac{9}{72} = \frac{1}{8}$
$\therefore$ Work done by A, B and C in one day $= \frac{1}{16}$
So, A, B and C working together will take 16 days to complete the work.

Q13.

Answer :

$(A+B)$ can complete the work in 12 days.

$(B+C)$ can complete the work in 15 days.

$(C+A)$ can complete the work in 20 days.

$(A+B)$'s 1 day work $= \frac{1}{12}$

$(B+C)$'s 1 day work $= \frac{1}{15}$

$(C+A)$'s 1 day work $= \frac{1}{20}$

$2(A+B+C)$'s 1 day work $= \frac{1}{12} + \frac{1}{15} + \frac{1}{20} = \frac{5+4+3}{60} = \frac{12}{60} = \frac{1}{5}$

$(A+B+C)$'s 1 day work $= \frac{1}{10}$

A's 1 day work $= \{(A+B+C)$'s 1 day work$\} - \{(B+C)$'s 1 day work$\} = \frac{1}{10} - \frac{1}{15} = \frac{3-2}{30} = \frac{1}{30}$

A will take 30 days to complete the work, if he works alone.

Q14.

Answer :

A can fill a tank in 10 hours.
B can fill a tank in 15 hours.

Pipe A fills $\frac{1}{10}$ of the tank in one hour.

Pipe B fills $\frac{1}{15}$ of the tank in one hour.

Part of tank filled by pipes A and B together $= \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{5}{30} = \frac{1}{6}$

Thus, pipes A and B require 6 hours to fill the tank.

Q15.

Answer :

Pipe A can fill a tank in 5 hours.
Pipe B can empty a full tank in 6 hours.

Pipe A fills $\frac{1}{5}$ of the tank in one hour.

Pipe B empties $\frac{1}{6}$ of the tank in one hour.

Part of the tank filled in one hour using both pipes A and B $= \frac{1}{5} - \frac{1}{6} = \frac{6-5}{30} = \frac{1}{30}$

It takes $\frac{30}{1}$ or 30 hours to fill the tank completely.

Q16.

Answer :

Time taken by tap A to fill the tank = 6 hours
Time taken by tap B to fill the tank = 8 hours
Time taken by tap C to fill the tank = 12 hours

A fills $\frac{1}{6}$ of the tank in one hour.

B fills $\frac{1}{8}$ of the tank in one hour.

C fills $\frac{1}{12}$ of the tank in one hour.

Part of the tank filled in one hour using all the three pipes $= \frac{1}{6} + \frac{1}{8} + \frac{1}{12} = \frac{4+3+2}{24} = \frac{9}{24}$

Time taken by A, B and C together to fill the tank $= \frac{24}{9} = \frac{8}{3} = 2\frac{2}{3}$ hours

Q17.

Answer :

Inlet A can fill the cistern in 12 minutes.
Inlet B can fill the cistern in 15 minutes.
Outlet C empties the filled cistern in 10 minutes.

Part of the cistern filled by inlet A in one minute $= \frac{1}{12}$

Part of the cistern filled by inlet B in one minute $= \frac{1}{15}$

Part of the cistern emptied by outlet C in one minute $= -\frac{1}{10}$

(water flows out from C and empties the cistern)

Part of the cistern filled in one minute with A, B and C working together $= \frac{1}{12} + \frac{1}{15} - \frac{1}{10}$

$= \frac{5+4-6}{60} = \frac{3}{60} = \frac{1}{20}$

The time required to fill the cistern with all inlets, *A*, B and C, open is 20 minutes.

Q18.

Answer :

A pipe can fill a cistern in 9 hours.

Part of the cistern filled by the pipe in one hour $= \frac{1}{9}$

Let the leak empty the cistern in x hours.

Part of the cistern emptied by the leak in one hour $= -\frac{1}{x}$

(The leak drains out the water)

Considering the leak, the tank is filled in 10 hours.

Part of the tank filled in one hour $= \frac{1}{10}$

Therefore,

$\frac{1}{9} - \frac{1}{x} = \frac{1}{10}$ or, $\frac{1}{x} = \frac{1}{9} - \frac{1}{10} = \frac{10-9}{90} = \frac{1}{90}$ x $= 90$

The leak will empty the filled cistern in 90 hours.

Q19.

Answer :

Pipe A can fill a cistern in 6 hours.
Pipe B can fill a cistern in 8 hours.

Part of the cistern filled by pipe A in one hour $= \frac{1}{6}$

Part of the cistern filled by pipe B in one hour $= \frac{1}{8}$

Part of the cistern filled by pipes A and B in one hour $= \frac{1}{6} + \frac{1}{8} = \frac{4+3}{24} = \frac{7}{24}$

Part of the cistern filled by pipes A and B in 2 hours $= \frac{7}{24} \times 2 = \frac{7}{12}$

Part of the tank empty after 2 hours $= 1 - \frac{7}{12} = \frac{5}{12}$

Time taken by pipe B to fill the remaining tank $= \frac{5}{12} \div \frac{1}{8} = \frac{5}{12} \times 8 = \frac{10}{3} = 3\frac{1}{3}$ hours

Time and Work
Ex 13B

1. **Work from Days:**
   If A can do a piece of work in n days, then A's 1 day's work = $\frac{1}{n}$.
2. **Days from Work:**
   If A's 1 day's work = $\frac{1}{n}$, then A can finish the work in n days.
3. **Ratio:**
   If 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.

Q1.

Answer :

(b) 6 days

A can do a work in 10 days.
A's 1 day work $= \frac{1}{10}$
B can do a work in 15 days.
B's 1 day work $= \frac{1}{15}$
$(A+B)$'s 1 day work $= \frac{1}{10}+\frac{1}{15}=\frac{5}{30}=\frac{1}{6}$
A and B together will take 6 days to complete the work.

Q2.

Answer :

(c) $7\frac{1}{2}$ *days*

A man can do a work in 5 days.
The man's 1 day work $= \frac{1}{5}$
The man and the son can do the work in 3 days.
The man and his son's 1 day work $= \frac{1}{3}$
Let the son's 1 day work be $\frac{1}{x}$.
Therefore,
$\frac{1}{3}=\frac{1}{5}+\frac{1}{x}$
or, $\frac{1}{x}=\frac{1}{3}-\frac{1}{5}=\frac{5-3}{15}=\frac{2}{15}$
$x = \frac{15}{2} = 7\frac{1}{2}$ days

Q3.

Answer :

(d) 48 days

A can do a job in 16 days.
B can do the job in 12 days.
Suppose C can do the job in x days.
A's 1 day work $= \frac{1}{16}$
B's 1 day work $= \frac{1}{12}$
C's 1 day work $= \frac{1}{x}$
A, B and C together can complete the work in 6 days.
$(A+B+C)$'s 1 day work $= \frac{1}{6}$
Therefore, $\frac{1}{6}=\frac{1}{16}+\frac{1}{12}+\frac{1}{x}$
$\Rightarrow \frac{1}{x}=\frac{1}{6}-\frac{1}{16}-\frac{1}{12}=\frac{8-3-4}{48}=\frac{1}{48}$
$x = 48$
Therefore, C alone can complete the job in 48 days.

Q4.

Answer :

(a) 30 days

Let B take x days to complete the work.
Then A takes $\left(x+\frac{50}{100}x\right)=1.5x$
A's 1 day's work $=\frac{1}{1.5x}=\frac{2}{3x}$
B's 1 day's work $=\frac{1}{x}$
$\left(A+B\right)$ *takes 18 days to complete the work.*
$\left(A+B\right)$*'s 1 day's net work* $=\frac{1}{18}$
or $\frac{1}{18}=\frac{2}{3x}+\frac{1}{x}$
$\Rightarrow \frac{1}{18}=\frac{5}{3x}$
By cross − multiplication, we get :
$x=30$ *days*
$\therefore$ *B alone will take 30 days to complete the work.*

Q5.

Answer :

(c) 36 days

Let A take x days to complete the work. Then B takes $2x$ days to complete the work.
A's 1 day's work $=\frac{1}{x}$
B's 1 day's work $=\frac{1}{2x}$
A and B take 12 days to complete the work.
Net work done by $\left(A+B\right)$ in 1 day $=\frac{1}{12}=\frac{1}{x}+\frac{1}{2x}=\frac{3}{2x}$
$\Rightarrow 2x=36$
$\Rightarrow x=18$
A can complete the work by himself in 18 days.
B will take 36 days, i.e., twice as long as the time taken by A.

Q6.

Answer :

(c) Rs. 1800

Since the wage distribution will follow the work distribution ratio, we have:

Work done by A in 1 day $=\frac{1}{10}$
Work done by B in 1 day $=\frac{1}{15}$

Net work done by (A+B) in 1 day $=\frac{1}{10}+\frac{1}{15}=\frac{5}{30}=\frac{1}{6}$

i.e., (A+B) will take 6 days to complete the work.

A's share of work in a day = $\frac{1}{10}\div\frac{1}{6}=\frac{1}{10}\times\frac{6}{1}=\frac{6}{10}=\frac{3}{5}$

$\therefore$ A's wage = $\frac{3}{5}\times 3000=\text{Rs } 1800$

Q7.

Answer :

(c) 4:3

The number of days taken for working is the reciprocal of the rate of work.

$\text{i.e., number of days taken } = \frac{1}{\text{rate of work}} = \frac{1}{3/4} = \frac{4}{3}$

Q8.

Answer :

(c) 10 days

$(A+B)$ can do a work in 12 days.

$(B+C)$ can do a work in 20 days.

$(C+A)$ can do a work in 15 days.

Now, we have :

Work done by $(A+B)$ in 1 day $= \frac{1}{12}$

Work done by $(B+C)$ in 1 day $= \frac{1}{20}$

Work done by $(C+A)$ in 1 day $= \frac{1}{15}$

Net work done by $2(A+B+C) = \frac{1}{12} + \frac{1}{20} + \frac{1}{15} = \frac{5+3+4}{60} = \frac{12}{60} = \frac{1}{5}$

Net work done by $(A+B+C)$ in 1 day $= \frac{1}{10}$

$\therefore$ If A, B and C work together, they will complete the work in 10 days.

Q9.

Answer :

(c) 4 days

Three men can complete the work in 12 days.
Thus, one man can complete the work in 36 days.
Rate of work done by one man in 1 day $= \frac{1}{36}$
Similarly, rate of work done by one woman in 1 day $= \frac{1}{5\times12} = \frac{1}{60}$
Now, six men will do $\frac{6}{36}$, i.e., $\frac{1}{6}$ unit of work in a day.
Five women will do $\frac{5}{60}$, i,e., $\frac{1}{12}$ unit of work in a day.
$\therefore$ Total work done in 1 day $= \frac{1}{6} + \frac{1}{12} = \frac{1}{4}$ unit
Thus, six men and five women will take 4 days to complete the work.

The work can be completed in 4 days.

Q10.

Answer :

(a) 10 days

Work done by A in 1 day $= \frac{1}{15}$
B is 50% more efficient than A.
$\therefore$ Work done by B in 1 day $= \frac{150}{100} \times \frac{1}{15} = \frac{1}{10}$
Thus, B can complete the work in 10 days.

Q11.

Answer :

(c) 6 hours

Time taken by A to finish the piece of work $= 7\frac{1}{2}$ hours $= \frac{15}{2}$ hours
Work done by A in 1 hour $= \frac{2}{15}$
Let B take x hours to finish the work.
Work done by B in 1 hours $= \frac{1}{x}$
A can work 20% less than B, or A can do $4/5$ of B's work.

Now, $\frac{\left(\frac{4}{5}\right)}{1} = \frac{\left(\frac{2}{15}\right)}{\left(\frac{1}{x}\right)}$

$\Rightarrow \frac{4}{5} = \frac{2x}{15}$

$\Rightarrow x = \frac{15 \times 4}{5 \times 2} = 6$ hours

Q12.

Answer :

(b) 5 days

A can complete the work in 20 days.
Work done by A in 1 day $= \frac{1}{20}$
B can complete the work in 12 days.
Work done by B in 1 day $= \frac{1}{12}$
In 9 days, B completes $\frac{9}{12}$, i.e., $\frac{3}{4}$ of the work and leaves $1 - \frac{3}{4}$, i.e., $\frac{1}{4}$ of the work undone.
$\therefore$ Time taken by A $= \frac{1}{4} \div \frac{1}{20} = \frac{1}{4} \times 20 = 5$ days

Q13.

Answer :

(c)

A can do the piece of work in 25 days.
Work done by A in 1 day $= \frac{1}{25}$
B can do the same work in 20 days.
Work done by B in 1 day $= \frac{1}{20}$
A alone completes $\frac{10}{25}$, i,e., $\frac{2}{5}$ of the work in 10 days. Now, work remaining $= 1 - \frac{2}{5} = \frac{3}{5}$ Work done by $(A + B)$ in 1 day $= \frac{1}{25} + \frac{1}{20} = \frac{9}{100}$ $\therefore$ Time taken if they work together $= \frac{3}{5} \div \frac{9}{100} = \frac{3}{5} \times \frac{100}{9} = \frac{20}{3} = 6\frac{2}{3}$ days

Q14.

Answer :

(b) 12 minutes

First pipe can fill a tank in 20 minutes.
Second pipe can fill the tank in 30 minutes.
Part of tank filled by the first pipe in one minute $= \frac{1}{20}$
Part of tank filled by the second pipe in one minute $\frac{1}{30}$ Part of tank filled by both pipes in one minute $= \frac{1}{20} + \frac{1}{30} = \frac{5}{60} = \frac{1}{12}$
Thus, it takes 12 minutes to fill the tank using both the pipes.

Q15.

Answer :

(c) 16 hours

A tap can fill a cistern in 8 hours.
Part of cistern filled in one hour $= \frac{1}{8}$
A tap can empty the cistern in 16 hours.
Part of cistern emptied in one hour $= -\frac{1}{16}$ (negative sign shows that the cistern is being drained)
$\therefore$ Part of cistern filled in one hour $= \frac{1}{8} - \frac{1}{16} = \frac{1}{16}$
Time required to fill the cistern $= 16$ hours

Q16.

Answer :

(d) 14 hours

A pump can fill a tank in 2 hours.
Part of the tank filled by the pump in one hour $= \frac{1}{2}$
Suppose the leak empties a full tank in x hours.
Part of the tank emptied by the leak in one hour $= -\frac{1}{x}$
Part of tank filled in one hour $= \frac{1}{2} - \frac{1}{x} = \frac{3}{7}$ (given)
$\frac{1}{x} = \frac{1}{2} - \frac{3}{7} = \frac{7-6}{14} = \frac{1}{14}$
$x = 14$ hours

Q17.

Answer :

(b) 7 hours 30 minutes

Part of the tank filled by the first pipe in one hour $= \frac{1}{10}$
Part of the tank filled by the second pipe in one hour $= \frac{1}{12}$
Part of the tank filled by the third pipe in one hour $= \frac{-1}{20}$
Part of the tank filled by three pipes in one hour $= \frac{1}{10} + \frac{1}{12} - \frac{1}{20} = \frac{2}{15}$
Total time taken to fill the tank $= \frac{15}{2}$ hrs $= 7$ hours 30 minutes