

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 = (work done by A and B) - (work done by A)

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

\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 = (work done by Raju and Siraj)

- (work done by Raju)

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

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

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

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)

$$= \frac{1}{8} - \frac{1}{24} - \frac{1}{20} = \frac{1}{30}$$

∴ 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

∴ 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 done 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,

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

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,

$$\frac{1}{3} = \frac{1}{5} + \frac{1}{x}$$

$$\text{or, } \frac{1}{x} = \frac{1}{3} - \frac{1}{5} = \frac{5-3}{15} = \frac{2}{15}$$

$$x = \frac{15}{2} = 7\frac{1}{2} \text{ days}$$

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 = $\frac{1}{6}$

$$\text{Therefore, } \frac{1}{6} = \frac{1}{16} + \frac{1}{12} + \frac{1}{x}$$

$$\Rightarrow \frac{1}{x} = \frac{1}{6} - \frac{1}{16} - \frac{1}{12} = \frac{8-3-4}{48} = \frac{1}{48}$$

$$x = 48$$

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 $\left(x + \frac{50}{100}x\right) = 1.5x$

$$A's\ 1\ day's\ work = \frac{1}{1.5x} = \frac{2}{3x}$$

$$B's\ 1\ day's\ work = \frac{1}{x}$$

$(A + B)$ takes 18 days to complete the work.

$$(A + B)'s\ 1\ day's\ net\ work = \frac{1}{18}$$

$$\text{or } \frac{1}{18} = \frac{2}{3x} + \frac{1}{x}$$

$$\Rightarrow \frac{1}{18} = \frac{5}{3x}$$

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.

$$\text{Net work done by } (A + B) \text{ in 1 day} = \frac{1}{12} = \frac{1}{x} + \frac{1}{2x} = \frac{3}{2x}$$

$$\Rightarrow 2x = 36$$

$$\Rightarrow x = 18$$

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:

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

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

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

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.

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

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 :

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

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

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

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

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

∴ 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.

$$\text{Rate of work done by one man in 1 day} = \frac{1}{36}$$

$$\text{Similarly, rate of work done by one woman in 1 day} = \frac{1}{5 \times 12} = \frac{1}{60}$$

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.

$$\therefore \text{Total work done in 1 day} = \frac{1}{6} + \frac{1}{12} = \frac{1}{4} \text{ unit}$$

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 $\frac{4}{5}$ of B's work.

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

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

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

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