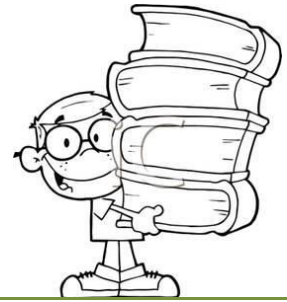


TIME AND WORK



DRILL 1: SOLUTIONS

Exercise 1

a. Answer: 24 days

Explanation:

Method 1:

What is the work done by A in a day = $\frac{1}{40}$
What is the work done by B in a day = $\frac{1}{60}$
What is the work done by A and B in a day = $\frac{1}{40} + \frac{1}{60}$
Time taken to complete the work = 24 days

Method 2:

Quantity of work to be done = 120 units

Work done by A in 1 day = 3 units
Work done by B in 1 day = 2 units
Work done by A & B in 1 day = 5 units
Time taken to complete the work = 24 days

b. Answer: 72 days

Explanation:

Method 1:

Work done by Rajeev in 1 day = $\frac{1}{64}$
Work done by Rajeev and Vikram in 1 day = $\frac{1}{48}$
Work done by Vikram in 1 day = $\frac{1}{192}$
Work done by Rajeev and Vikram in 30 days = $\frac{5}{8}$
Remaining work to be completed by Vikram = $\frac{3}{8}$
Time taken by Vikram to complete the remaining work = 72 days

Method 2:

Quantity of work to be done = 192 units
Work done by Rajeev & Vikram in 1 day = 4
Work done by Rajeev in 1 day = 3 units

Work done by Vikram in 1 day = 1 unit
 Work done by Rajeev and Vikram in 30 days = 120
 Remaining work to be completed by Vikram = 72
 Time taken by Vikram to complete the remaining work = 72 days

c. Answer: 7 days

Explanation:

Total Number of chocolates is **60**

A	10 days	= 6 choc/d
B	12 days	= 5 choc/d
C	15 days	= 4 choc/d
A + B + C	-	15 Choc/d

A leaves the work after **2 days**, so, for the first two days A, B and C are working together.

A, B and C together can eat 15 Chocolates per day.

Therefore, for the first 2 days, A, B and C work together and finish $2 \times 15 = 30$ chocolates.

Now there are 30 remaining.

After 2 days A leaves. So now only B and C work.

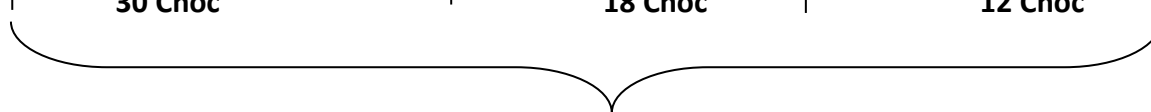
B leaves 3 days before the work is completed, which means for the last 3 days C alone is works.

C's one day work is 4 Choc/d

For 3 days, $3 \times 4 \text{ Choc/d} = 12 \text{ Choc}$

$$30 - 12 = 18 \text{ Choc/d}$$

A + B + C (2 Days)	B + C (?)	C (3 Days)
30 Choc	18 Choc	12 Choc



60 Chocolates

Remaining 18 chocolates are eaten by B and C

B and C together eat 9 Choc per day.

For two day they eat,

$$2 \times 9 \text{ ch/d} = 18 \text{ Chocolates}$$

Total number of days to complete the entire work is $= 2 + 2 + 3 = 7 \text{ days}$

Drill 2

a. Answer: 24 LITRES

Explanation:

Total Work = 336 Litres

A	42 min	8 l/m
B	56 min	6 l/m
A + B	-	14 l/m

Time taken to fill 336 litres = $336/14 = 24$ minutes

b. Answer: 8 minutes

Explanation:

Total Work = 30 Litres

A	10 min	3 l/m
B	15 min	2 l/m
A + B	-	5 l/m

1 min \rightarrow 5 litres are filled

For 3 min \rightarrow 15 litres,

Therefore the remaining to be filled = $30 - 15$
= 15 litres

After 3 min B is turned off which means 'A' alone is on.

A \rightarrow 3 l/m to fill 15 l, A will take $15/3 = 5$ mins

Total time taken = 3 mins + 5 mins = **8 minutes**

c. Answer: 12minutes

Explanation:

Total Work = 60 l

P	10 min	6 l/m
Q	15 min	4 l/m
R	12 min	- 5 l/m
P + Q + R	-	6 l/m

Total time taken = $60 \text{ l} / (5 \text{ l/m})$
= **12 minutes**

d. Answer: 60 minutes

Explanation:

A → 20 mins

Due to leak extra 10 min (i.e.) A + B → 30 min [Let us take B as Leakage pipe]

Total Work LCM = 60 L

A	20 min	3 l/m
A + B	30 min	2 l/m

By Solving we get, $3 \text{ l/m} + B = 2 \text{ l/m}$; $B = -1 \text{ l/m}$

B can empty 1l/m.

So to empty 60 litres it will take $60/1 = 60 \text{ minutes}$

DRILL 3:

a. Answer: 16 days

Explanation:

Solving by chain rule

Men	Days	Hours
12 →	15 →	8
18 →	? →	5

If we solve by chain rule, men is inversely proportional to days and to hours, therefore, multiply the data straight and equate

$$12 * 15 * 8 = 18 * X * 5$$

$$X = 16$$

Therefore, it takes **16 days**

By using formula

$$(N_1 D_1 H_1) / W_1 = (N_2 D_2 H_2) / W_2$$

Since work done is the same

$$(N_1 D_1 H_1) = (N_2 D_2 H_2)$$

$$12 * 15 * 8 = 18 * X * 5$$

$$x = 16$$

b. Answer: 9 hours

Explanation:

Solving by chain rule

Workers	Days	Hours	Tables
30 →	21 →	8 ↗ ↘	24
35 →	12 →	X ↗ ↘	18

The multiplication sequence is followed as per the proportionalities and equated

$$(30 \times 21 \times 8 \times 18) = (35 \times 12 \times X \times 24)$$

$$X = 9$$

Number of hours is **9**

c. Answer: 9 minutes

Explanation:

Solving by chain rule,

Friends	Ice Creams	Minutes
30 ↗ ↘	21 ↗ ↘	8
35 ↗ ↘	12 ↗ ↘	X

The multiplication sequence is followed as per the proportionalities and equated

$$(9 \times 15 \times 9) = (15 \times 9 \times X)$$

$$X = 9$$

Time taken = **9 minutes**

d. Answer: 56 days

Explanation:

Solving by the chain rule,

Men	Days
360 →	70
450 →	X

$$360 \times 70 = 450 \times x$$

$$x = \mathbf{56 \text{ Days}}$$

e. Answer: 8 days

Explanation:

Since the work done is the same,

$$(12B + 16G)10D = (13B + 24G)8D$$

[Equating man days]

$$120BD + 160GD = 104BD + 192GD$$

$$16BD = 32GD$$

$$B/G = 2/1 \text{ ----- } > (1)$$

Equation (1) implies boy can eat 2 choc/day meanwhile girl can eat 1 choc/day.

Therefore, efficiencies would be **2:1**

According to the man days concept and from (1) we can assume **the total units of work** done as

$$(12B + 16G) 20d = (12*2\text{Choc/d} + 16*1\text{Choc/day}) * 20d = \mathbf{400 \text{ Chocolates.}}$$

We have to find out the time taken by 15 boys and 20 girls to do the same work

$$\begin{aligned} \text{Therefore work done by 15 boys and 20 girls in one day} &= [15*2\text{Choc/d} + 20*1\text{Choc/day}] \\ &= \mathbf{50 \text{ Choc/day}} \end{aligned}$$

Therefore the time taken by them to complete the work = $400/50 = 8 \text{ days}$

Drill 4:

a. Answer: Rs. 200

Explanation:

A → 30 days

B → 40 days

If they complete the work together and earn Rs.350.

Find A's share.

Here it is going to be A, who works with higher efficiency.

So A should get more money.

The **days** are in the ratio 30:40 or **3:4**.

The **efficiency** is inversely proportional to days and hence it is of the ratio **4:3**.

So, dividing the wages in the ratio 4:3,

$$\begin{array}{rcl} 350 \text{ is divided as } & (4/7)*350 & : (3/7)*350 \\ & 200 & : 150 \end{array}$$

Therefore, **A's share is Rs.200.**

b. Answer: Rs. 600

Explanation:

A → 25 days

B → 20 days

A and B works together for 5 days and A leaves.

B completes the remaining work, paid 750.

Find B's share.

LCM (total work) = **100 chocolates**

A	25 days	= 4 choc/d
B	20 days	= 5 choc/d
A + B	-	9 Choc/d

It is given that they work together for 5 days. If they work for 1 day, they eat 9 chocolates. Then for 5 days, $9 \times 5 = 45$ chocolates would have been eaten.

Total work (LCM) = **100 chocolates**

A and B (for 5 days) = 45 chocolates

Remaining = $100 - 45$
= **55 chocolates**

This will be eaten by B (who can eat 5 choc per day) alone in $= 55/5 = 11$ days

So, totally A has worked for 5 days and B has worked for 16 days (11+5) with different efficiencies.

For 1 day, A can eat 4 choc and then for 5 days, $4 \times 5 = 20$ choc.

So the remaining 80 must be eaten by B.

Hence the ratio will be 20: 80 \Rightarrow 1: 4

Dividing 750, the shares are 150: 600.

B gets a share of Rs. 600.

c. Answer: Rs.400

Explanation:

A \rightarrow 20 days

B \rightarrow 30 days if both work along with C, they can finish the work in 8 days.

Find C's share, if the total wage is Rs.1200.

Total work - LCM (20, 30, 8) = **120 chocolates**

A \rightarrow 20 days \rightarrow 6 choc/day

B \rightarrow 30 days \rightarrow 4 choc/day

A + B + C \rightarrow 8 days \rightarrow 15 choc/day

A+B+C = 15 and A+B = 10

Therefore, C = 5 choc/day, then 120 chocolates will be eaten in 24 days. \Rightarrow C = 24 days

They will eat 6, 4, 5 choc/day respectively.

So, their efficiency is **6:4:5**.

C's share = $(5/15) \times 1200 = \text{Rs.400}$

d. Answer: Rs.200 and Rs.100

Explanation:

Since the work done is the same,

$$(12B + 16G) 10D = (13B + 24G) 8D$$

$$120BD + 160GD = 104BD + 192GD$$

Equating the man days

$$16BD = 32GD$$

$$B/G = 2/1 \text{ (1)}$$

Equation (1) implies boy can eat 2 choc/day meanwhile girl can eat 1 choc/day.

Therefore efficiencies would be **2:1**

According to the mandays concept and equation (1) we can assume **the total units of work** done as

$$(12B + 16G) 20d = (12 \times 2 \text{ choc/d} + 16 \times 1 \text{ choc/day}) \times 20d \\ = \mathbf{400 \text{ Chocolates.}}$$

To eat 400 chocolates, they are paid Rs.40, 000

For 1 chocolate = Rs.40000/400 = Rs.100

Each boy and girl's per day wage is **Rs. 200 & Rs. 100** respectively.

GOOGLY QUESTIONS

1. Wrong

The work to be done here is to build the wall of length 'L' which is done by 12 men in 15 days, working 10 hours a day. If a wall of length '2L' is to be built in 25 days working 9 hours a day, how many men will be required for that is the question

$$(N_1 D_1 H_1) / L_1 = (N_2 D_2 H_2) / L_2$$

$$(12 \times 10 \times 15) = (X \times 25 \times 9) / 2$$

$$X = 12 \times 10 \times 15 \times 2 / 25 \times 9 = 16 \text{ men}$$

2. Wrong

Total Work = **20 chocolates**

A---- > 10 days ---- > 2choc/d

B----- > 20 days ---- > 1choc/d

It is given that they work on alternate days

Starting with A, so 3 chocolates are completed in 2 days which means that to complete 20 chocolates it will take close to 13 days

3. Correct

4. Wrong

Total work **75 chocolates**

Arun	25 days	3 choc/d
Vinay	15 days	5 choc/d
A + B + C	5 days	36 choc/d

It is given that they complete the work together which means that we have to consider the total work done by Arun and Vinay together which is 8 choc in a day. Out of 8 choc, Arun will eat 3 choc/day which means that his share will be $3/8^{\text{th}}$ and the amount receives will be $3/8 \times 400 = \text{Rs.150}$

5. **Wrong**

Total volume **200 litres**

A	50 min (Filling)	4 l/min
B	40 min (Emptying)	5 l/min
A + B	-	- 1 l/m

So every minute, 1 litre is emptied and nothing is filled, so logically, the cistern can never be filled.

CONCEPT REVIEW QUESTIONS

1. Answer: option b

Explanation:

Men	Days
X	→ 90
X + 16	→ 90 - 18 = 72

As per the chain rule,

$$90x = 72(x + 16)$$

$$90x = 72x + (72 \times 16)$$

$$18x = 72 \times 16$$

$$X = (72 \times 16)/18 = \mathbf{64 \text{ men}}$$

2. Answer: Option c

Explanation:

Man	Days	Work = length x width x height
12 →	25	100 x 0.5 x 3
20 →	X	60 x 0.25 x 4

According to chain rule,

$$12 \times 25 \times 60 \times 0.25 \times 4 = 20 \times X \times 100 \times 0.5 \times 3$$

Number of days required, X = **6 days**

3. Answer: option b

Explanation:

Ratio of efficiencies of **M : W : C = 4 : 2 : 1**

This means

M \longrightarrow 4 chocolates/day

W \longrightarrow 2 chocolates/day

C \longrightarrow 1 chocolates/day

Total work completed by 16 men in 12 days

Total work = (16×4) chocolates/day \times 12 days
= 64×12 chocolates

One day's work for 32 women and 64 children

= $(32 \times 2) + (64 \times 1)$
= $64 + 64$
= $2(64)$ chocolates/day

Total number of days to complete the work by them,
= $(64 \times 12) / 2(64)$
= **6 days**

4. Answer: option d

Explanation:

Men: 45

Days: 45

Work completed: whole work

Now, 45 people can work for 30 days to complete only half of the work. To complete the remaining work, the additional men needed to join the work would be

Men	Days	Work
45 \longrightarrow	30	$\frac{1}{2}$ [Work completed]
$(45 + x) \longrightarrow$	15	$\frac{1}{2}$ [Work to be completed]

According to chain rule,

$45 \times 30 = (45 + x) 15$

X = $90 - 45$

X = **45 men**

45 additional men join to complete the work in same number of days

5. Answer: option a

Explanation:

Let us assume that **1 man can eat 1 chocolate**

First day work = 2 chocolates [Since 2 men are working]

Second day work = 3 chocolates

Total work = **2 + 3 + n**

It is given that the same work is done by 9 men in 15 days

Therefore, total work would be $9c/d \times 15 = 135$ chocolates

We can equate the work

$2 + 3 + 4 + \dots n = 135$

Adding & subtracting 1

$$[1 + (2 + 3 + 4 + \dots n)] - 1 = 135$$

$$[n(n + 1)]/2 - 1 = 135$$

$$[n(n + 1)]/2 = 136$$

$$[n(n + 1)] = 136 \times 2$$

$$= 272$$

By taking the value of n from the options

If the number of days is 15 then number of men should be 16

$$16(16+1) = 16 \times 17 = 272 \text{ (Exactly Satisfying)}$$

Therefore, number of days = **15 days**

6. Answer: option a

Explanation:

Equating man days

$$(4m + 4w)5d = (7m + 2w)4d$$

$$20md + 20wd = 28md + 8wd$$

$$8md = 12wd$$

$$m/w = 3/2 \text{ [relating men and women]}$$

I.e. a man can eat 3 choc/day, while a woman can eat 2 choc/day

$$\text{Total work to be done} = (4m + 4w) 5d$$

$$= (4 \times 3 \text{ choc/d} + 4 \times 2 \text{ choc/d})5d$$

$$= 100 \text{ Chocolates}$$

$$\text{Twice the work} = 200 \text{ Chocolates}$$

$$(6m + 1w) \text{ eat} = (6 \times 3 \text{ choc/d} + 1 \times 2 \text{ choc/d})$$

$$= 20 \text{ Chocolates/day}$$

$$\text{Twice the work by } (6m+1w) = (200 \text{ Chocolates}) / (20 \text{ Chocolates/day})$$

$$= \mathbf{10 \text{ days}}$$

7. Answer: option a

Explanation:

3m or 4w means **3m = 4w**

$$m = (4/3)w \quad \longrightarrow \quad \mathbf{1}$$

Forming the man days relation

$$4w \times 43 = (7m + 5w)d \quad \longrightarrow \quad \mathbf{2}$$

Substituting **1** in **2**

$$4w \times 43 = (7 \times 4/3w + 5w)d$$

$$4w \times 43 = (43w/3)d$$

Days will be **12 days**

8. Answer: option a

Explanation:

$$A = 3B$$

A is 3 times more efficient than B

They both can complete a task in 12 days

$A + B = 12$ days

If A eats 3 chocolates B can eat one chocolate

A	3 choc/d
B	1 choc/d
A + B	4 choc/d

Therefore, in 12 days, 48 chocolates will be consumed

We know that A can eat 3 choc/d and the total chocolates available are 48.

Therefore, A can finish in $48/3$ days = **16 days**

9. Answer: option d

Explanation:

Considering the work efficiency for 1 hour, Sanjeev can arrange 64 books in 1 hour

i.e. Sanjeev can arrange **96 books** at **1.5 hours** \Rightarrow for **0.5 hours, 32 books**

Therefore,

Rajeev	96 books/h
Sanjeev	64 books/h
Rajeev + Sanjeev	160 books/h

There are 4000 books to be arranged.

To arrange this, they both would take $4000/160 =$ **25 hours**

10. Answer: option d

Explanation:

Given that,

A	10 days
B	8 days
A + B + C	4 days

Total Work = **40 chocolates**

A	10 days	= 4 choc/d
B	8 days	= 5 choc/d
A + B + C	4 days	= 10 choc/d

$A + B + C = 10\text{choc/d}$

$4 + 5 + C = 10\text{choc/d}$

$$C = 1 \text{ choc/d}$$

Cyril eats 1 chocolate per day, so he takes 40 days to eat 40 chocolates.

11. Answer: option a

Explanation:

A + B	30 days
B + C	37.5 days
C + A	50 days

LCM for 30, 37.5 and 50 is 150

Total Work = **150 chocolates**

A + B	30 days	5 choc/d
B + C	37.5 days	4 choc/d
C + A	50 days	3 choc/d

$$2(A + B + C) \longrightarrow 12 \text{ choc/d}$$

$$A + B + C \longrightarrow 6 \text{ choc/d}$$

To complete 150 chocolates, they take $150/6 = 25$ days

12. Answer: option a

Explanation:

Total work to be done **180 Chocolates**

A	12 days	15 choc/d
B	18 days	10 choc/d
A + B + C	5 days	36 choc/d

$$\text{So, } C = 36 - 25 = 11 \text{ Choc/d}$$

Efficiency ratio of A, B and C = 15: 10: 11

The fraction of work done by C is $11/36^{\text{th}}$ and hence C's share is $(11/36)9000 = \text{Rs. 2750}$

13. Answer: option c

Explanation:

Total capacity = **160 litres**

x	32 min	5 l/min
Y	40 min	4 l/min

Since **Y** works for the entire **25 minutes**, it would have filled **100 litres** and the remaining **60 litres** would have been filled by tap **X**.

Tap X as we know can fill 5l/min, so 60 litres has been filled, it is an indication that tap X has been open for $60/5 = 12 \text{ min}$

14. Answer: option d

Explanation:

Total work LCM (30, 40, 60) = **120 litres**

X	30 min (Filling)	5 l/min
Y	40 min (Filling)	4 l/min
Z	60 min (Emptying)	- 2 lit/m

X + Y + Z → 5 litres/m

But it is working for one minute each and hence, 5 litres will be filled for every 3 minutes. So, 120 litres will be filled in, $120 / (5 \text{ litre for } 3 \text{ min}) = (120 \times 3) / 5 = 72 \text{ mins}$

But 72 minutes is wrong.

Because before the last minute itself, it would have been filled as pipe Z empties the tank and hence in the previous minute itself, it would have filled.

I.e. In **69 minutes, 115 litres** are filled.

70th minute A fills 4 litres, and then tank will have 119 litres with 1 litre to be filled.

That should be filled by B pipe in $1/3$ minutes. So tank will be filled in **70(1/3) minutes**.

The answer is not there in the option, hence the answer will be Option d) none of these.

15. Answer: option d

Explanation:

Tank capacity = 2400 cu.m.

Emptying capacity, $E_c = F_c + 10$ ----- (1)

Filling time, $t_f = t_e + 8$ ----- (2)

Filling capacity of the tank =?

We shall check from the options,

Taking **Option a**, let $F_c = 20 \text{ cu.m} \Rightarrow E_c = 20 + 10 = 30 \text{ cu.m}$

$t_f = (2400/20) = 120 \text{ m}$, $t_e = (2400/30) = 80 \text{ m}$

The **difference in time is not 8mins**; equation (2) is not satisfied.

Here the difference is 20 minutes but it should be lesser, which means that filling capacity should be higher than the option we take, i.e., 20. Hence before we take the remaining options in random, let's try 50 cu.m.

Taking **Option d**, let $F_c = 50 \text{ cu.m} \Rightarrow E_c = 50 + 10 = 60 \text{ cu.m}$

$t_f = (2400/50) = 48 \text{ m}$

$t_e = (2400/60) = 40 \text{ m}$

The **difference is 8 mins which will satisfy the equation (2)**.

Hence the answer is **Option d, $F_c = 50 \text{ cu.m}$**

16. Answer: option b

Explanation:

Fill a tank = **18 hours**

Since there was a leak, it did not fill in 18 hours. So, the leak was plugged and it took another 3 hours.

From which we can equate, **18 hours of leak = 3 hours of filling**

It is of the ratio 6: 1, 6 hour of leaking = 1 hour of filling

Therefore, it takes 18 hours to fill the tank.

18 hours of filling = 108 hours of leaking

Hence, it requires **108 hours** to empty the tank by the leakage.

