Session 27: Two Step Derivation - Chain Rule:

Chain Rule can be applied in questions where two or more than two elements are given. Each element has two figures except one element that has one part missing. Chain rule is used to find out this missing part of an element by subsequent comparison. The other given part of the same element is taken as base and is compared separately with all the other elements e.g. if you have a question having following elements: 'men', 'days' and 'hours'. Let us say 'hours' are missing then you will compare 'hours' with all the other elements independently. Here independently means, comparing 'hours' with 'men' ignoring the element- 'days'. Similarly while comparing 'hours' and 'days' you will ignore the element- 'men'.

Illustration1:

12 examiners (men) work 16 hours a day to check 24000 answer sheets in 18 days. Now, 24 examiners would work how many hours per day to check 36000 answer sheets in 36 days?

Answer :

Examiners	hours	answer sheets	days
12	16	24000	18
24	?	36000	36

As we have to calculate the hours in this case, the base would be hours.
Comparisons:

1. Element = Examiners: If there are 24 examiners now and there were 12 earlier, they need to work lesser hours per day.
2. Element = Answer sheets: If there are more answer sheets to be checked now, they need to work more hours per day.
3. Element = Days: If there are more days available, then they need to work lesser hours per day.

Applying chain rule: $16 \times (12/24) \times (36000/24000) \times (18/36) = 6$ hours.

In the same illustration if hours were given and answer sheets were missing, then also the method would have been same. Let us solve the same illustration in that manner as well.

Illustration 2:

12 examiners work 16 hours a day to check 24000 answer sheets in 18 days. Now, 24 examiners would check how many answer sheets working 6 hours a day in 36 days?

Answer

Examiners	hours	answer sheets	days
12	16	24000	18
24	6	?	36

Following the same steps :

As we have to calculate the answer sheets in this case, the base would be answer sheets. If there are 24 examiners now and there were 12 earlier, they will check more answer sheets. If they work for lesser hours per day, they will check lesser answer sheets. If there are more days available, then they will check more answer sheets. 24000 × (24/12) × (6/16) × (36/18) = 36000.

Illustration 3: A certain number of men can complete a piece of work in 180 days. If there are 30 men less, it will take 20 days more for the work to be completed. How many men were there originally?

1. 135

2. 165

3. 150

4. 180

5. 300

Answer & Explanation

Answer:

Let there be x men originally.

They were to complete the work in 180 days but as the number of persons is reduced to x – 30.

? Work takes 20 more days. So the equation is 180x = (x – 30)200 ? 20x = 6000 ? x = 300.

Illustration 4: A garrison is provided with ration for 90 soldiers to last for 70 days. For how much more time would the whole ration last if 10 additional soldiers join them after 20 days?

1. 40 days

2. 36 days

3. 30 days

4. 56¼ days

5. 45 days

Answer & Explanation

Part I		Part II	
Soldiers	Days	Soldiers	After 20 days till x days
90	70	90	100
		20 days	x

First 20 = 90 after 20 days = 100

Answer :

Let the whole ration now lasts for x days. Equating the consumption on both sides, we get

(90 × 70) = (90 × 20) + (100 × x) = ? x = 45

6300 = 1800+100x

6300-1800 = 100x

100x = 4500

X = 4500/100 = 45

Illustration 5: A man can walk a certain distance at a uniform speed in 100 days. How long will it take him to cover twice the distance at half the normal speed?

1. 50 days

2. 25 days

3. 12½ days

4. 200 days

5. 400 days

Answer & Explanation

Answer : Option

Earlier time = 100 days.

Distance is doubled and speed is reduced to half. ? time will become 2 × 2 i.e. 4 times.

Hence now it will take 100 × 4 = 400 days.

5. **Illustration 6: A 100 m long 3 m high and 30 cm wide wall is built by 30 men, 20 women and 50 children working 9 hours a day in 20 days. How long a wall 1.5 m high 30 cm wide can be built by 15 men, 25 women and 35 children working 2 hour a day in 15 days (given men, women and children are equally efficient)?**

1. 75 m

2. 25 m

3. 50 m

4. 100 m

5. 125 m

Answer & Explanation

Answer :
Earlier dimensions of the wall = 100 × 3 × 0.30.
New dimensions = L × 1.5 × 0.3.
∴ As men, women and children are given to be equally efficient, so in the first case, the total number of persons is 100 (i.e. 30 + 20 + 50) and the same in the second case is 75 (15 + 25 + 35).

Length of wall = L = (75x100) x (2x9) x (15x20) x (100 x 3 x 3 x 0.3)/(1.5 x 0.3) ⇒ L = 25 m.