14. CHAIN RULE

IMPORTANT FACTS AND FORMULAE

1. Direct Proportion: Two quantities are said to be directly proportional, if on the increase (or decrease) of the one, the other increases (or decreases) to the same

Ex. 1. Cost is directly proportional to the number of articles.
(More Articles, More Cost)

Ex. 2. Work done is directly proportional to the number of men working on it
(More Men, More Work)

2. Indirect Proportion: Two quantities are said to be indirectly proportional,if on the increase of the one, the other decreases to the same extent and vice-versa.

Ex. 1. The time taken by a car in covering a certain distance is inversely proportional to the speed of the car.
(More speed, Less is the time taken to cover a distance)

Ex. 2. Time taken to finish a work is inversely proportional to the num of persons working at it.
(More persons, Less is the time taken to finish a job)

Remark: In solving questions by chain rule, we compare every item with the term to be found out.

SOL VED EXAMPLES

Ex. 1. If 15 toys cost Rs, 234, what do 35 toys cost?

Sol. Let the required cost be Rs. x. Then,
More toys, More cost (Direct Proportion)

. $15 : 35 : : 234 : x \Leftrightarrow (15 \times x) = (35 \times 234) \Leftrightarrow x=(35 \times 234)/15 =546$

Hence, the cost of 35 toys is Rs. 546.

Ex. 2. If 36 men can do a piece of work in 25 hours, in how many hours will 15 men do it ?

Sol. Let the required number of hours be x. Then,
Less men, More hours (Indirect Proportion)

$15 : 36 : : 25 : x \Leftrightarrow (15 \times x) = (36 \times 25) \Leftrightarrow (36 \times 25)/15 = 60$

Hence, 15 men can do it in 60 hours.

Ex. 3. If the wages of 6 men for 15 days be Rs.2100, then find the wages of for 12 days.

Sol. Let the required wages be Rs. x.

More men, More wages (Direct Proportion)
Less days, Less wages (Direct Proportion)

Men 6: 9 : :2100:x
Days 15:12

Therefore (6 x 15 x x)=(9 x 12 x 2100) ⇔ x=(9 x 12 x 2100)/(6 x 15)=2520

Hence the required wages are Rs. 2520.

Ex. 4. If 20 men can build a wall 66 metres long in 6 days, what length of a similar can be built by 86 men in 8 days?

Sol. Let the required length be x metres

More men, More length built (Direct Proportion)

Less days, Less length built (Direct Proportion)

Men 20: 35
Days 6: 3 : : 56 : x

Therefore (20 x 6 x x)=(35 x 3 x 56)⇔x=(35 x 3 x 56)/120=49

Hence, the required length is 49 m.

Ex. 5. If 15 men, working 9 hours a day, can reap a field in 16 days, in how many days will 18 men reap the field, working 8 hours a day?

Sol. Let the required number of days be x.
More men, Less days (indirect proportion)
Less hours per day, More days (indirect proportion)

Men 18 : 15
Hours per day 8: 9 } : :16 : x
(18 x 8 x x)=(15 x 9 x 16)⇔ x=(44 x 15)144 = 15

Hence, required number of days = 15.

Ex. 6. If 9 engines consume 24 metric tonnes of coal, when each is working 8 hours day, bow much coal will be required for 8 engines, each running 13hours a day, it being given that 3 engines of former type consume as much as 4 engines of latter type?

Sol. Let 3 engines of former type consume 1 unit in 1 hour.
Then, 4 engines of latter type consume 1 unit in 1 hour.

Therefore 1 engine of former type consumes(1/3) unit in 1 hour.

1 engine of latter type consumes(1/4) unit in 1 hour.

Let the required consumption of coal be x units.
Less engines, Less coal consumed (direct proportion)
More working hours, More coal consumed (direct proportion)
Less rate of consumption, Less coal consumed(direct prportion)

Number of engines 9: 8
Working hours 8 : 13 } :: 24 : x
Rate of consumption (1/3):(1/4)

[9 x 8 x (1/3) x x) = (8 x 13 x (1/4) x 24) ⇔ 24x = 624 ⇔ x = 26.

Hence, the required consumption of coal = 26 metric tonnes.

Ex. 7. A contract is to be completsd in 46 days sad 117 men were said to work 8 hours a day. After 33 days, (4/7) of the work is completed. How many additional men may be employed so that the work may be completed in time, each man now working 9 hours a day?

Sol. Remaining work = (1-(4/7) =(3/7)

Remaining period = (46 - 33) days = 13days

Let the total men working at it be x.

Less work, Less men	(Direct Proportion)
Less days, More men	(Indirect Proportion)
More Hours per Day, Less men	(Indirect Proportion)

Work (4/7): (3/7)
Days 13:33 } : : 117: x
Hrs/day 9 : 8
Therefore (4/7) x 13 x 9 x x =(3/7) x 33 x 8 x 117 or x=(3 x 33 x 8 x 117)/(4 x 13 x 9)=198

Additional men to be employed = (198 - 117) = 81.

Ex. 8. A garrison of 3300 men had provisions for 32 days, when given at the rate of 860 gns per head. At the end of 7 days, a reinforcement arrives and it was for that the provisions wi1l last 17 days more, when given at the rate of 826 gms per head, What is the strength of the reinforcement?

Sol. The problem becomes:
3300 men taking 850 gms per head have provisions for (32 - 7) or 25 days,

How many men taking 825 gms each have provisions for 17 days?

Less ration per head, more men (Indirect Proportion)

Less days, More men (Indirect Proportion)

Ration 825 : 850

Days 17: 25 } : : 3300 : x

(825 x 17 x x) = 850 x 25 x 3300 or x = (850 x 25 x 3300)/(825 x 17)=5000

Strength of reinforcement = (5500 - 3300) = 1700.