Unit 6 · Unitary Method

STUDY NOTES

WHAT THE BLE ASKS

- **CDC's grid:** Arithmetic (Units 2, 3, 4, 5, 6, 7 together): 14 of 50 marks
- **In our 10 model papers:** 1-mark ×8 · 2-mark ×7
- **Model paper:** no workers-and-days question; nearest, Arithmetic part b (1 mark, application): 8,520 liters at 30 paisa a liter: $8{,}520 \times 0.30 = \text{Rs } 2{,}556$
- **CDC's teachers' guide:** problems of up to three quantities
- a question here: a real setting, parts at different levels

Key terms

Unitary method (ऐकिक नियम): find the value of **one**, then of as many as you want.

Direct variation: one up, the other up by the same factor; one down, the other down.

Indirect (inverse) variation: one up, the other down by the same factor, and the other way round.

Proportion: an equation saying two ratios are equal.

Person-day: one person working for one day; a job's size. **Person-hour** likewise.

The quick test

Variation	What stays the same	Example
Direct	the **ratio**	$100 \div 2 = 150 \div 3 = 50$
Indirect	the **product**	$10 \times 16 = 20 \times 8 = 160$

- "both go up" is not enough: the **same factor**
- taxi: Rs 14 to start + Rs 39 a km: 2 km Rs 92, 4 km Rs 170: not direct
- height and age: not direct

Direct	Indirect
people, income	people, days
days, income	people, hours a day
workers, length of wall	hours a day, days
	speed, time for a fixed trip

The arrow table

1. the case you know on top, the case you want below; the unknown x
2. arrow in the x column: points up, away from x
3. each other column, judged **against** x, by itself: direct: the same way as x's; indirect: the opposite way
4. read each arrow **tail to head**: the tail's number goes on top
5. x's ratio = the product of the other columns' ratios

Pencils	Price (Rs)
8 ↑	120 ↑
12	x

8 pencils cost Rs 120: 12 pencils cost x.

$$\frac{x}{120} = \frac{12}{8} \qquad x = \frac{12}{8} \times 120 = 180$$

- both arrows down: $8/12 = 120/x$, the same equation; both ratios the same way
- same number in both rows: that column's ratio is 1

Three quantities

Direct: 10 people earn Rs 1,60,000 in 20 days; 15 people, 10 days:

$$\frac{x}{1{,}60{,}000} = \frac{15}{10} \times \frac{10}{20} \qquad x = 1{,}20{,}000$$

- 1 person, 1 day: $1{,}60{,}000 \div 200 = \text{Rs } 800$
- why multiply: one thing at a time; each column is one multiplier on the amount you know

Indirect: 10 people, 14 days, 8 hours a day; 7 people, 16 days:

People	Days	Hours a day
10 ↓	14 ↓	8 ↑
7	16	x

Hours a day vary indirectly with the people and with the days: those arrows point the opposite way.

$$\frac{x}{8} = \frac{10}{7} \times \frac{14}{16} \qquad x = 10 \text{ hours a day}$$

- the job: $10 \times 14 \times 8 = 1{,}120$ person-hours
- **mixed jobs:** a longer drain needs more people, more days need fewer: decide each column on its own
- **men and boys:** turn the boys into men first: 4 boys = 2 men → 6 men and 8 boys work like 10 men
- **a job measured by area:** park 40 m × 20 m = 800 m^2; the area is the work column

Person-days

- a job is a fixed amount of work; product of people and days = the job
- parma (Bigu): a house ≈ $10 \times 20 = 200$ person-days
- 8 people: $200 \div 8 = 25$ days; 10 days: $200 \div 10 = 20$ people
- the owner paid back the same number of days

Check before you write

- say the sentence: "fewer people, so **more** days"
- answer should grow → multiplier above 1; shrink → below 1
- the arrow goes with the meaning, not the position
- the answer assumes the same pace: fine over a sensible range, nonsense at the extremes (200 people, a house in one day)

Where it is used

- food for a crowd: 2,100 kcal a person a day; food varies directly with people and with days
- ₹100 = Rs 160: Nepali and Indian rupees in direct variation; ₹2,500 is Rs 4,000
- a wire at a fixed temperature: current varies directly with voltage

COMMON MISTAKES

✗ a ratio the wrong way round
✓ say the sentence first: "more students, fewer days".

✗ the new total when asked how many to **add** or **move**
✓ take the difference.

✗ the days already used left in the sum
✓ work on what is left.

✗ 3 chairs and 4 tables Rs 7,540, a chair Rs 220, done by the unitary rule
✓ take away the chairs first: $(7540 - 660) \div 4 =$ Rs 1,720.

✗ units not changed first
✓ 4 dozen is 48; 45 minutes is not 0.45 hours.

✗ stopped at $x = 25$
✓ end with a sentence and the unit.