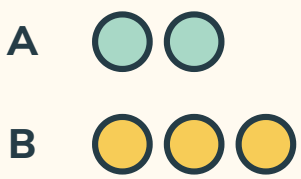
MATHS FIELD GUIDE · GRADE 7

Proportion preserves a multiplicative relationship

OPENING PROBLEM

The mix is two parts A to three parts B. How many parts in all?



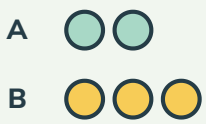
02 Keep corresponding parts together
03 Rules and worked cases
04 Compare two printing plans
05 Read the units on a rate
06 Check your reasoning

ILLUSTRATED PROBLEM SHEET

Keep corresponding parts together

Multiply or divide both counts by the same factor to preserve a ratio.

1



The mix is two parts A to three parts B. How many parts in all?

Five. A is two fifths of the whole mixture.

2

A	B
2	3
4	6
6	9

What changes across batches?

The totals change, while the amount of B for each unit of A stays at 3/2.

3

Total 35 g
↓
35 ÷ 5 = 7 g
↓
A = 14 g

How much A is in 35 g of this mix?

One part is 7 g. Two parts give 14 g and the remaining 21 g is B.

4

A	B
2	3
3	4

Does adding one to both counts preserve this recipe?

No. Cross-products 2 × 4 and 3 × 3 differ.

1:4 by parts
first share is 1/5 of the total.

1:4 by parts
first amount is 1/4 of the second.

CHAPTER PROBLEM

A taxi charges a fixed start fee plus a price per kilometre. Is total fare directly proportional to distance?

No. The fixed fee gives a nonzero total at zero distance, so the ratio is not constant.

MATHS REFERENCE · GRADE 7

Proportion preserves a multiplicative relationship

Two quantities are directly proportional when one is a constant multiple of the other. If y = kx, the constant k is the rate per unit.

Scaling one quantity by a factor scales the other by the same factor. This is stronger than merely saying both increase.

Four cases to recognise

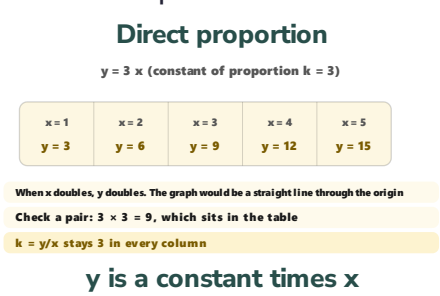
Situation	What to do and why
₹96 for 8 pens	Unit price is ₹12. With direct proportion 15 pens cost ₹180.
Plot (0,20) on a fare line	A starting fee of 20 prevents a direct proportion, even with constant extra cost per km.
Double workers on a fixed job at equal constant rates	Time halves if work splits evenly and nothing else changes.
Find x if 3/5 = x/40	Multiply numerator and denominator by eight. x = 24.

Read the model

Build the idea

For a constant price of 3 dollars per notebook, one, two and four notebooks cost 3, 6 and 12 dollars.

The quotient cost ÷ quantity stays 3 for every nonzero quantity. A table and a graph can show this same relationship.

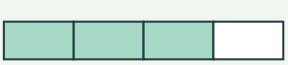


Why it works

The constant unit rate gives a reliable way to move between quantities. Doubling the notebooks doubles the variable cost.

A graph of direct proportion is a straight line through the origin because zero notebooks produces zero cost in this model.

direct proportion One quantity is a constant multiple of another.
constant of proportionality The fixed multiplier.
unit rate Amount for one unit.



A sale price of ₹450 is 75% of the tag price. What was the tag price?

Three parts total ₹450. One is ₹150, so four parts give ₹600.

WORKED INVESTIGATION

Compare two printing plans

Printer A charges ₹3 per page. Printer B charges ₹12 to start and ₹2 per page. Only the first cost is directly proportional to page count.

Look at this part	What it tells you
4 pages	A ₹12, B ₹20
8 pages	A ₹24, B ₹28
12 pages	both ₹36

Work it through

For A, dividing cost by page count always gives ₹3 per page. For B, the cost per page is ₹5 at four pages and ₹3.50 at eight pages.

Catch the mistake

A straight-line graph can have a nonzero starting value. Direct proportionality also requires a zero cost at zero pages.

Compare the cases

Follow an example

Five notebooks cost 15 dollars. Eight cost 8 × 3 = 24 dollars.

If a delivery fee of 4 dollars is added, the totals become 19 and 28. The total price is then 3x + 4, so it is no longer directly proportional to x.

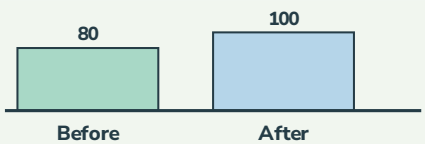
What changes? What stays true?

An additive change alone does not establish proportion. Test the ratio and the zero case.

A model relies on its assumptions. Discounts, fees or changing rates may invalidate a proportional prediction.

Change one condition

Each extra page reduces B's disadvantage by ₹1. The ₹12 starting fee is recovered after twelve pages.



How large is the increase as a percent of the starting value?

The increase is 20 out of 80. That is 25%.

ILLUSTRATED PROBLEM SHEET

Read the units on a rate

A rate compares two quantities with different units.

1

Time (h)	Distance (km)
1	18
2	36
2.5	45

At steady speed, how far in 2½ hours?

Two hours give 36 km and half an hour adds 9 km. Total 45 km.

2

600 m in 5 min

↓

120 m per min

↓

7.2 km per hour

Why divide before multiplying?

Find distance in one minute, then scale to sixty minutes and convert metres to kilometres.

3

Pack	Price
250 g	₹40
400 g	₹60

Which pack costs less per 100 g?

₹16 versus ₹15. The 400 g pack costs less per 100 g.

4

Time (min)	Water (L)
0	3
1	5
2	7

Is water volume proportional to time?

It grows by 2 L each minute but starts at 3 L. Doubling time need not double the amount.

₹45 for three equal packs
₹15 per pack.

Three packs per hour
one pack every 20 minutes at a steady rate.

CHAPTER PROBLEM

A shop sells 3 identical notebooks for ₹72, with the same price per notebook and no fixed fee. How much would 8 cost?

One notebook costs ₹72 ÷ 3 = ₹24. Eight cost 8 × ₹24 = ₹192. The cost per notebook stays constant.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Try the problem	Solution and reasoning
01 In the same mix B weighs 18 g. How much does A weigh?	Three parts weigh 18 g, so one weighs 6 g and A weighs 12 g.
02 A cyclist rides one hour at 10 km/h and two hours at 16 km/h. Average speed?	42 km over 3 hours gives 14 km/h.
03 Which plan is cheaper for 20 pages and by how much?	A costs 3 × 20 = ₹60. B costs 12 + 2 × 20 = ₹52. B is cheaper by ₹8.
04 A tap fills 18 L in 4 minutes at constant rate. How much in 10 minutes?	Rate 4.5 L/min multiplied by ten gives 45 L.
05 Does y = 5x − 3 represent direct proportion?	No. It does not pass through (0,0), and y/x varies with x.

₹200 × 1.10
↓
₹220 × 0.90
↓
₹198

Why do a 10% rise and a 10% fall fail to cancel?

The fall is 10% of ₹220. It removes ₹22 after a rise of ₹20.

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