

O LEVEL MATHEMATICS

Problem-Solving Success Pack

Ratios - Percentages - Data - Probability

Use the READ method to turn words into mathematics, then test yourself with 24 original practice questions.



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FREE MASTERCLASS WORKBOOK

Math Gets Easier When You Know What the Question Is Asking

Students often know the arithmetic but still lose marks because they choose the wrong operation. This workbook focuses on four high-value problem-solving areas: ratio, percentages, data and probability.

Your Goal

Learn to recognise the mathematical structure hidden inside a word problem, extract only the useful information, choose the correct operation and check whether your answer makes sense.

The Digital Tutor READ Method

Step	Question to ask
R - Recognise	What topic is hiding inside the problem?
E - Extract	Which numbers, units and relationships actually matter?
A - Act	Which mathematical operation or model should I use?
D - Decide	Does the final answer make sense in context?

This workbook contains original Digital Tutor practice. It does not reproduce Cambridge examination questions.

Ratio: Compare and Share

A ratio compares quantities. The key is to keep the quantities in the correct order and reduce them using a common factor.

Example 1 - Simplify

Simplify 42:63.

The highest common factor is 21.

$$42 \div 21 : 63 \div 21 = 2:3.$$

Example 2 - Share in a ratio

PKR 960 is divided between Hamza and Ali in the ratio 5:3.

Total parts = $5 + 3 = 8$.

One part = $960 \div 8 = 120$.

Hamza = $5 \times 120 = 600$.

Ali = $3 \times 120 = 360$.

Example 3 - Scaling

A recipe for 4 people requires 300 g of flour. For 10 people:

$$300 \div 4 = 75 \text{ g per person.}$$

$$75 \times 10 = 750 \text{ g.}$$

READ Check

Recognise: ratio/proportion. Extract: 300 g for 4 people. Act: find one person's amount, then scale.

Decide: 750 g is sensible because 10 people need more than 4.

Percentages and Reverse Percentages

Percentage change becomes much easier when you think in terms of what percentage remains.

Increase by 15%

$$100\% + 15\% = 115\% = 1.15.$$

$$\text{New value} = \text{original value} \times 1.15.$$

Decrease by 15%

$$100\% - 15\% = 85\% = 0.85.$$

$$\text{New value} = \text{original value} \times 0.85.$$

Reverse percentage

A jacket costs PKR 5,950 after a 15% discount.

The discounted price represents 85% of the original.

$$0.85 \times \text{original} = 5,950.$$

$$\text{Original} = 5,950 / 0.85 = \text{PKR } 7,000.$$

Remember

Reverse percentage means working backwards from the percentage that remains - not simply adding the discount percentage back.

Data: Centre and Spread

A single average does not tell the whole story. Strong data interpretation compares both centre and spread.

Example dataset

8, 11, 9, 12, 10

Measure	Calculation	Answer
Mean	$(8 + 11 + 9 + 12 + 10) / 5$	10
Median	Order: 8, 9, 10, 11, 12	10
Range	$12 - 8$	4

Interpretation

Two groups can have similar means but very different consistency. A smaller range generally indicates that the values are more tightly grouped.

When a question asks which group is more consistent, do not automatically choose the group with the higher mean. Look at the spread.

Probability: From Impossible to Certain

Probability lies between 0 and 1. A probability of 0 represents an impossible event; a probability of 1 represents a certain event.

Example

A bag contains 5 red, 3 blue and 2 green counters. Total = 10.

$P(\text{blue}) = 3/10$.

$P(\text{not green}) = 1 - 2/10 = 8/10 = 4/5$.

Type	Key idea
Theoretical probability	Use equally likely outcomes or given probabilities.
Experimental probability	Use observed frequency / total trials.
Expected frequency	Probability x number of trials.
Without replacement	The total and available outcomes change after the first selection.

Common trap

If an item is selected without replacement, you cannot reuse the original denominator for the second selection.

Ratio Practice

1. Simplify 42:63.

2. Divide PKR 960 in the ratio 5:3.

3. A recipe uses 300 g of flour for 4 people. How much is needed for 10 people?

4. A map has scale 1:50,000. Two places are 7.2 cm apart on the map. Find the actual distance in kilometres.

5. Boys and girls are in the ratio 7:9. There are 288 students. How many are boys?

6. $A:B = 3:5$ and $B:C = 10:7$. If $A + B + C = 460$, find A, B and C.

Percentage Practice

7. Find 18% of 2,400.

8. A quantity increases from 125 to 145. Find the percentage increase.

9. A jacket costs PKR 5,950 after a 15% discount. Find the original price.

10. An item costs PKR 4,800 and sells for PKR 5,640. Find the percentage profit.

11. PKR 50,000 earns 8% compound interest per year. Find its value after two years.

12. A machine worth PKR 200,000 loses 15% of its value each year. Find its value after three years.

Data Practice

13. Find the mean of 8, 11, 9, 12, 10.

14. Find the median of 4, 6, 6, 8, 9, 10, 12.

15. The scores are 12, 15, 15, 17, 18, 18, 18, 21. Find the mode and range.

16. A frequency table has values 1, 2, 3, 4 with frequencies 3, 5, 4, 2 respectively. Calculate the mean.

17. Class A has a mean score of 62 and a range of 18. Class B has a mean score of 60 and a range of 8. Which class has the higher average? Which appears more consistent?

18. In a survey of 240 students, 72 choose cricket as their favourite sport. What angle should represent cricket on a pie chart?

Probability Practice

19. A bag contains 5 red, 3 blue and 2 green counters. Find the probability of selecting blue.

20. Using the same bag, find the probability of not selecting green.

21. A spinner lands on red 78 times in 120 spins. Estimate the probability of red.

22. The probability that a student chooses the bus is 0.35. Out of 400 students, how many would you expect to choose the bus?

23. Two fair coins are tossed. Find the probability of obtaining exactly one head.

24. A bag contains 4 red balls and 6 blue balls. Two balls are selected without replacement. Find the probability that both are red.

Questions 1-12

Q	Answer / working
1	2:3
2	PKR 600 and PKR 360
3	750 g
4	3.6 km
5	126 boys
6	A:B:C = 6:10:7. There are 23 parts, so 1 part = 20. A = 120, B = 200, C = 140.
7	432
8	$(20 / 125) \times 100 = 16\%$
9	PKR 7,000
10	Profit = 840. $(840 / 4,800) \times 100 = 17.5\%$
11	$50,000 \times 1.08^2 = \text{PKR } 58,320$
12	$200,000 \times 0.85^3 = \text{PKR } 122,825$

Check your process

If you got an answer wrong, identify whether the error came from recognising the topic, extracting information, choosing an operation or carrying out the arithmetic.

Questions 13-24

Q	Answer / working
13	10
14	8
15	Mode = 18; range = 9
16	Weighted total = 33, total frequency = 14, mean = $33/14$ = about 2.36
17	Class A has the higher mean. Class B is more consistent because its range is smaller.
18	$(72 / 240) \times 360 = 108$ degrees
19	$3/10$
20	$4/5$
21	$78/120 = 0.65$
22	$400 \times 0.35 = 140$
23	$1/2$
24	$(4/10) \times (3/9) = 2/15$

Can You Get All Three?

Challenge 1

An item increases in price by 20% and is then discounted by 20%. Does it return to its original price?

Answer: No. For example, $100 \rightarrow 120 \rightarrow 96$. The final value is 4% below the original.

Challenge 2

A school has boys and girls in the ratio 4:5. After 24 boys join, the ratio becomes 8:9. Find the original number of boys and girls.

Challenge 2 Solution

Let the original numbers be $4k$ and $5k$. Then $(4k + 24)/(5k) = 8/9$. So $36k + 216 = 40k$, giving $k = 54$.
Original boys = 216; original girls = 270.

Challenge 3

Create your own probability problem. Make sure there is enough information for another student to solve it, then check whether your answer lies between 0 and 1.

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