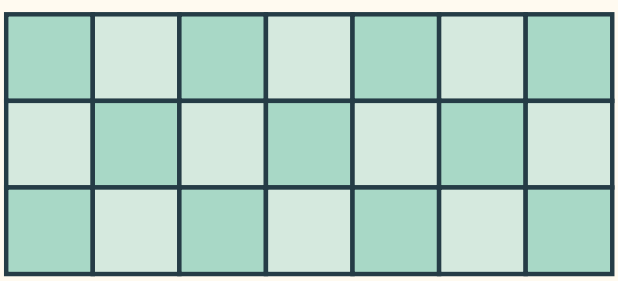
MATHS FIELD GUIDE · GRADE 7

Expressions describe structure before values are known

OPENING PROBLEM

Split this 3 by 7 array after five columns. What equality appears?



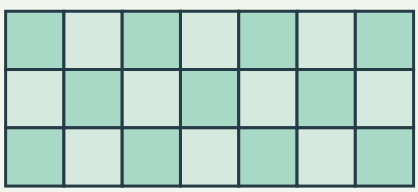
02 Split a rectangle to see the distributive law
03 Rules and worked cases
04 Frame the noticeboard
05 Change the grouping, test the result
06 Check your reasoning

ILLUSTRATED PROBLEM SHEET

Split a rectangle to see the distributive law

One common height multiplies every piece of the width.

1



Split this 3 by 7 array after five columns. What equality appears?

$3 \times 7 = 3 \times 5 + 3 \times 2$. The two pieces cover exactly the original rectangle.

2

$$4(x + 3)$$
$$\downarrow$$
$$4x + 4 \times 3$$
$$\downarrow$$
$$4x + 12$$

Which term is often missed?

The 3 is also multiplied by 4. At $x = 2$ both sides give 20.

3

$$5x + 15$$
$$\downarrow$$
$$5(x + 3)$$

Can you reverse the split?

Both terms contain 5. Dividing each by 5 leaves x and 3 inside the bracket.

4

$$-2(x - 4)$$
$$\downarrow$$
$$-2x + 8$$

Why is the constant positive?

It comes from multiplying two negative factors. Test $x = 0$: both sides give 8.

$2(x + y)$
$2x + 2y$.

$2x + y$
only x has coefficient 2.

CHAPTER PROBLEM

Why can $3x + 2x$ be combined but $3x + 2$ cannot be combined into $5x$?

The first counts five x-units. In the second, two ordinary units are not two x-units.

MATHS REFERENCE · GRADE 7

Expressions describe structure before values are known

An algebraic expression names a quantity using numbers, variables and operations. A term is a part separated by addition or subtraction at the outer level.

A coefficient is the numerical factor multiplying a variable. In 5x + 2, five is the coefficient of x and two is a constant term.

Four cases to recognise

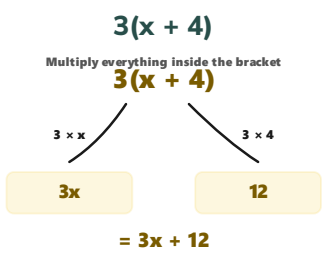
Situation	What to do and why
3x + 2 − x + 5	Combine like terms to get 2x + 7.
4(2x − 3)	Distribute four to both terms: 8x − 12.
2x and x² at x = 3	They give six and nine. They are unlike terms.
Factor 6x + 9	Both terms contain three, giving 3(2x + 3). Distribute to check.

Read the model

Build the idea

Use identical x-tiles to represent 3x + 2x. Three tiles and two more tiles make five x-tiles.

Use the distributive law for 3(x + 4). Three copies of the bracket contain three x-parts and twelve units, giving 3x + 12.



Expanding brackets

Why it works

Like terms combine because they count the same algebraic unit. An x-term and a constant count different kinds of units and cannot simply merge.

Distributing works because every part of every repeated group must be counted. Multiplying only one part loses some of the total.

term A part added or subtracted in an expression.
coefficient A numerical multiplying factor.
like terms Terms with matching variable parts.

x + 7 = 19
↓
x = 19 − 7
↓
x = 12

Which change keeps both sides balanced?

Subtract seven from each side. Substitution gives 12 + 7 = 19.

WORKED INVESTIGATION

Frame the noticeboard

A rectangular board is x units wide and x + 3 units long. Add all four sides to describe the frame length without knowing x.

Look at this part	What it tells you
Two widths	2x
Two lengths	2(x + 3)
Perimeter	4x + 6

Work it through

For x = 5, the sides are five and eight, so the boundary is 26. Substitution in 4x + 6 gives the same result.

Catch the mistake

The expression 4x + 3 misses the extra three on one long side. Distribute the factor two across both terms in the brackets.

Compare the cases

Follow an example

For 2x + 3x + 4, combine the x-terms to obtain 5x + 4. If x = 2, both forms give 14.

For 4(x − 2), four copies each contain x minus two, so the equivalent expression is 4x − 8.

What changes? What stays true?

Equivalent expressions have equal values for every allowed value of their variables. Agreement at one value is a useful check but not a proof.

x and x^2 are not like terms. Their quantities vary differently as x changes.

Change one condition

Increase each side length by one unit. The perimeter increases by four, which is also the effect of increasing x by one in 4x + 6.

3x − 4 = 14
↓
3x = 18
↓
x = 6

Which step undoes multiplication?

Dividing both sides by three. Check: 18 − 4 = 14.

ILLUSTRATED PROBLEM SHEET

Change the grouping, test the result

Brackets are calculated first. Multiplication and division at the same level run left to right.

1

$$4 + 3 \times 2 \downarrow 4 + 6 \downarrow 10$$

Which operation groups the three pairs?

Multiply three by two before adding the four.

2

$$(4 + 3) \times 2 \downarrow 7 \times 2 \downarrow 14$$

What did the brackets change?

Both the four and the three are doubled.

3

$$24 \div 4 \times 2 \downarrow 6 \times 2 \downarrow 12$$

Is multiplying first always correct?

No. Here division is first from the left at the same priority.

4

$$24 \div (4 \times 2) \downarrow 24 \div 8 \downarrow 3$$

What does the divisor include now?

The entire product eight. Grouping changes the division.

$8 - 3 + 2$
7.

$8 - (3 + 2)$
3.

CHAPTER PROBLEM

A shop sells 3 identical notebooks at ₹n each and charges ₹12 for delivery. Write the total and evaluate it for n = 20.

The total in rupees is 3n + 12. At ₹20 per notebook the total is 3 × 20 + 12 = ₹72.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Try the problem	Solution and reasoning
01 Is 3a + 2b always 5ab?	No. With a = b = 2 the two sides are 10 and 20. Unlike terms cannot be merged that way.
02 Place brackets in 18 – 6 – 2 to make 14.	18 – (6 – 2) = 14. Without the brackets the value is 10.
03 A board has perimeter 38 and these side lengths. Find x.	Solve 4x + 6 = 38. Then 4x = 32 and x = 8. Sides eight and eleven give perimeter 38.
04 Simplify 2(3a – 4) – (a + 1).	6a – 8 – a – 1 = 5a – 9.
05 Find an expression for three consecutive integers starting at n, added together.	n + (n + 1) + (n + 2) = 3n + 3.

2(x + 3) = 2x + 6
↓
2x + 6 = 2x + 6
↓
0 = 0

What does this final equality mean?

Every allowed x satisfies the original equation.

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