

Algebraic language and substitution

Pearson Edexcel GCSE Mathematics 1MA1 • L017
Foundation and Higher • 60 minutes • Lesson resources

REACH FOR THE STAR | GCSE MATHEMATICS

Read algebraic notation accurately. Substitute signed values and distinguish expressions, equations and identities.

Work without a calculator except where a check is invited. Write on the lines or replace them with typed answers. Attempt before reading intentional practice feedback.

Connect & Check

Variable: letter representing a value. Coefficient: multiplying number. Term: part separated by addition/subtraction. Expression: calculation without an equality claim. Equation: equality to solve. Identity: equality true for all allowed values.

R1

Calculate $3 \times 4 + 2$.

R2

Calculate $(-3)^2$.

R3

Calculate $12 \div 3 + 1$.

Share | In pairs, predict the first step for this problem: Juxtaposition means multiplication: $3x$ is $3 \times x$, not $3+x$. Substitution replaces every occurrence of a letter by the same value. Brackets protect a negative value: if $x=-2$, $x^2=(-2)^2=4$ Compare your reasons before using the worked model.

Present through worked examples

Juxtaposition means multiplication: $3x$ is $3 \times x$, not $3+x$. Substitution replaces every occurrence of a letter by the same value. Brackets protect a negative value: if $x=-2$, $x^2=(-2)^2=4$, whereas $-x^2=-4$.

D1

Model: $4a$ means $4 \times a$. For $a=3$, $4a=12$. Now evaluate $5b$ when $b=-2$.

D2

Model: for $x=4$, $3x+2=3 \times 4+2=14$. Now evaluate $3x+2$ for $x=-3$.

D3

Model: $x=-2$ gives $x^2=4$ and $-x^2=-4$. Now evaluate x^2 and $-x^2$ for $x=-3$.

D4

Model: $2x+3$ is an expression; $2x+3=11$ is an equation. Classify $2(x+3) \equiv 2x+6$ and explain.

Apply with less support

Write the replacement in brackets, then use operation priority. Keep multiplication distinct from powers. Check by a second calculation and state any excluded value when division is involved.

A1

For $x=2$ then $x=-2$, evaluate $3x$, $x+3$ and x^2 . What changes when the sign changes?

A2

Evaluate $2a-3b$ for $a=-2$ and $b=3$. Then evaluate ab .

A3

A taxi cost is $C=4+2m$ pounds for m kilometres. Find C for $m=7$ and explain both terms.

Optional support: Use a substitution table.

Optional check: enter $(-3)^2$ and then $-(3^2)$. Expect 9 and -9 . Calculator models differ in negative-key precedence; use explicit brackets.

Apply and extend reasoning

C1

Is x^2 always equal to $2x$? Give a counterexample and a value where they agree.

C2

A learner says $a \div b = b \div a$. Test $a=6, b=3$, then explain why swapping the letters matters.

Intentional practice feedback — read after attempting

A1: 6,5,4; -6,1,4.

A2: -13; -6.

A3: £18. Fixed charge £4 and distance cost £14.

C1: No: $x=3$ gives 9 versus 6. They agree at $x=0$ or $x=2$.

C2: 2 is not $1/2$. Division is not commutative.

Correct one response and explain your change. Stretch is available to either tier; temporary support needs do not determine entry tier.

Recall & Review through retrieval

Work without notes. Six retrieval points; this attempt does not establish mastery. Equivalent exact numeric forms are accepted. Where accuracy is requested, also state the requested form in your written work.

Q1 $3x$ when $x=4$

Q2 $3x+2$ when $x=-3$

Q3 x^2 when $x=-3$

Q4 $-x^2$ when $x=-3$

Q5 $2a-b$ for $a=3, b=-2$

Q6 First share of 40 in ratio 3:5

Intentional retrieval feedback

Q1 12; Q2 -7 ; Q3 9; Q4 -9 ; Q5 8; Q6 15. Correct and retry tomorrow, then in one week.

Prove independently and improve

P1–P2: five minutes without notes; 4 marks. Your teacher reviews explanations and method marks.
P3 has no mark.

P1

Evaluate $4x-1$ for $x=-2$. Show substitution. [2]

P2

Evaluate a^2+2b for $a=-3, b=4$. Show substitution. [2]

P3

Explain one corrected error. Set a fresh question and a date to check it without support.

Teacher feedback: _____

Fresh question and retry date: _____

Delayed independent evidence: _____

Prepare for the next lesson

L018: Collect expand and factorise

F1

Tomorrow evaluate $2x+7$ for $x=-4$ and x^2 for $x=-4$.

F2

Before L018, explain why three bags of x counters and two bags of x counters make $5x$ counters.

Read and prepare

Like terms have the same letter part: $3x+2x=5x$. Unlike terms such as $3x+2y$ cannot normally be combined. A bracket is a group: $2(x+3)$ multiplies both parts by two.

Digital workbook: save locally where available; export a JSON backup before closing or moving the file. Restore only this lesson/version. Printing records answers, not mastery. Live browser checks remain pending; use Word/PDF if required.

Optional extension activities

Stretch

If $a = -2$ and $b = 5$, evaluate $3a^2 - 2b$ and $2(a+b)$.

Deep challenge

A learner interprets $3x^2$ as $(3x)^2$. Use $x=2$ to expose the error.

Recall & Review: feedback and extension integration

Source-integrated WWW/EBI and extension page

Lesson L017: Algebraic language and substitution

Objective: Read algebraic notation accurately. Substitute signed values and distinguish expressions, equations and identities.

Timing for a 60-minute lesson

0-7 Connect & Check; 7-14 Share; 14-25 Present/model; 25-44 Apply route choice/practice; 44-52 independent exam-style check; 52-60 Recall & Review, WWW/EBI and next step.

Recall & Review evidence

At the end of the lesson, solve a fresh question without prompts, explain a check, correct one error and record the next practice step.

What Went Well (WWW)

I wrote the algebraic structure accurately and used a valid step-by-step method.

Even Better If (EBI)

I will show inverse operations clearly, keep signs/brackets accurate and substitute back to check.

Integrated stretch and deep challenge

Stretch: If $a=-2$ and $b=5$, evaluate $3a^2-2b$ and $2(a+b)$.

Deep challenge: A learner interprets $3x^2$ as $(3x)^2$. Use $x=2$ to expose the error.

My next-step response
