

GCSE MATHEMATICS

Algebraic Notation and Substitution

Eduqas-style Topic Practice

Based on WJEC Eduqas GCSE (9–1) Mathematics (C300QS)

Tier: Foundation and Higher

Name _____

Date _____

ADDITIONAL MATERIALS

- A ruler may be required.
- Section A: the use of a calculator is not permitted.
- Section B: a calculator may be used.

INSTRUCTIONS TO CANDIDATES

- Use black ink or black ball-point pen. You may use a pencil for graphs and diagrams only.
- Answer all the questions in the spaces provided.

INFORMATION FOR CANDIDATES

- You should give details of your method of solution when appropriate.
- Unless stated, diagrams are not drawn to scale. Graphs drawn on a grid are accurate.
- The number of marks is given in brackets at the end of each question or part-question.
- The questions suit both Foundation and Higher tier students.
- You are reminded of the need for good English and orderly, clear presentation in your answers.
- The maximum mark for this paper is 49.

For Examiner's use only

Question	Maximum Mark	Mark Awarded
1.	3	
2.	3	
3.	3	
4.	2	
5.	3	
6.	4	
7.	6	
8.	3	
9.	3	
10.	2	
11.	4	
12.	3	
13.	4	
14.	6	
Total	49	

These are original practice questions written in the style of WJEC Eduqas GCSE Mathematics. They are not official WJEC Eduqas examination questions and are not endorsed by WJEC.

SECTION A

You must not use a calculator in this section.

- 1.** Write each of these as simply as possible, using algebraic notation.

(a) $5 \times r \times s \times r$ [1]

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(b) $(a + 4) \div 3$ [1]

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(c) $p + p + p + p - q \times q$ [1]

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- 2.** Write an expression for each of the following.

(a) The cube of n [1]

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(b) The square of $2n$ [1]

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(c) Twice the square of n [1]

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3. Here is a list of words.

coefficient	expression	factor	formula	identity	inequality	term
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Complete the table. Write the word from the list that describes each one. [3]

	Word
The 4h in $4h - 9$	
The 4 in $4h$	
The g in $5gh$	
$ab \equiv ba$	
$P = 4s$, where P is the perimeter of a square with sides of length s	
$5k - 1 > 19$	

4. Ffion says,

" $x^2 = 2x$ is an identity, because it is true when $x = 2$."

Explain why Ffion is wrong. [2]

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5. Bethan has x stickers.

- (a) Owain has 5 more stickers than Bethan. Write an expression for the number of stickers Owain has. [1]

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- (b) Carys has twice as many stickers as Owain. Write an expression for the number of stickers Carys has.

[1]

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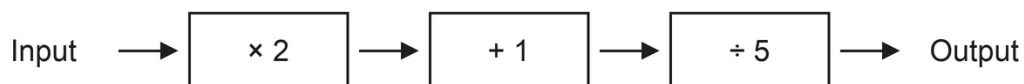
- (c) Bethan gives away a quarter of her stickers. Write an expression for the number of stickers Bethan has left.

[1]

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6. Here is a number machine.



- (a) Work out the output when the input is 7.

[1]

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- (b) Work out the output when the input is -8 .

[1]

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- (c) The input is n . Write an expression, in terms of n , for the output.

[2]

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7. $r = 4$, $s = -3$ and $t = 10$

Work out the value of

(a) $rs + t$ [2]

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(b) $t - s^2$ [2]

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(c)

$$\frac{t - 2s}{r}$$

[2]

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8. Mererid works out the value of $-k^2 + 2k$ when $k = -4$. Here is her working.

$$-k^2 + 2k = 16 + (-8) = 8$$

Mererid's answer is wrong. Explain the mistake she has made, and work out the correct value.

[3]

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9. Work out the value of $18x^2 - 3x$ when $x = -\frac{1}{3}$

[3]

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10. p is a positive number and q is a negative number. Here are four expressions.

pq	p^2q	$q - p$	pq^2
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Which expression always has a positive value? Give a reason for your answer.

[2]

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SECTION B

You may use a calculator in this section.

- 11.** The speed of sound in air, v metres per second, depends on the temperature of the air, T °C.

A formula for v is $v = 331.3 + 0.606T$

- (a) On a winter night the temperature of the air is -12.5 °C. Work out the speed of sound. Give your answer correct to 1 decimal place.

[2]

- (b) On a summer day the temperature of the air is 25 °C. How much faster does sound travel on the summer day than on the winter night?

[2]

- 12.** Iolo wants to work out the value of $a^2 + 4a$ when $a = -3.6$

He types $-3.6^2 + 4 \times -3.6$ into his calculator. The calculator shows -27.36

- (a) Explain why Iolo's calculator has not given the value of $a^2 + 4a$

[1]

- (b) Work out the correct value of $a^2 + 4a$ when $a = -3.6$

[2]

- 13.** The pressure, P newtons per square metre (N/m^2), that an object puts on the floor is given by the formula

$$P = \frac{F}{A}$$

where F is the force on the floor in newtons and A is the area in contact with the floor in m^2 .

A crate stands on the floor. It pushes down with a force of 540 N. The base of the crate is a rectangle measuring 0.75 m by 0.48 m.

- (a) Work out the pressure the crate puts on the floor.

[3]

- (b) Gareth's answer to part (a) is 0.000667 N/m^2 . What mistake has Gareth made?

[1]

14. A gardener sows grass seed on a rectangular lawn. The lawn is a metres long and b metres wide. She uses 35 grams of seed for each square metre of lawn.

- (a) Write a formula for the mass of seed, M grams, she needs for the lawn. Give your formula in its simplest form.

[2]

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- (b) The lawn is 12.4 m long and 8.75 m wide. Grass seed is only sold in boxes. Each box holds 1.5 kg of seed and costs £18.99. Work out the cost of the seed she needs to buy.

[4]

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END OF QUESTIONS

Mark scheme

Codes: M marks are for a correct method. A marks are for an accurate answer and depend on the M mark before them. B marks are independent of method. E marks are for an explanation. SC marks are for special cases. FT means follow through from an earlier answer, ISW ignore subsequent working, oe or equivalent, and CAO correct answer only.

For methods not covered by the mark scheme, give equivalent marks for equivalent correct work.

Section A: Non-calculator	Mark	Comment
1.(a) $5r^2s$	B1	Accept the letters in any order, e.g. $5sr^2$ Do not accept $5rrs$, $5 \times r^2 \times s$ or $10rs$.
1.(b) $(a + 4)/3$	B1	oe, e.g. $\frac{1}{3}(a + 4)$ or $a/3 + \frac{4}{3}$ Do not accept $a + \frac{4}{3}$ or $a + 4 \div 3$ (only the 4 has been divided by 3).
1.(c) $4p - q^2$	B1	CAO Do not accept $4p - 2q$, $p^4 - q^2$ or $4p - q \times q$.
	(3)	

Section A: Non-calculator	Mark	Comment
2.(a) n^3	B1	CAO Do not accept $3n$.
2.(b) $(2n)^2$	B1	oe, e.g. $4n^2$ or $2n \times 2n$ Do not accept $2n^2$ or $4n$.
2.(c) $2n^2$	B1	oe, e.g. $2 \times n^2$ Do not accept $(2n)^2$, $4n^2$ or n^4 .
	(3)	

Section A: Non-calculator	Mark	Comment
3. term, coefficient, factor, identity, formula, inequality, in that order	B3	B2 for 4 or 5 correct. B1 for 2 or 3 correct Expression is not used. Accept a word written once only in each row; a row with two words scores 0.
	(3)	

Section A: Non-calculator	Mark	Comment
4. An identity is true for every value of x (an equation is true only for particular values)	E1	Must say what makes a statement an identity
A value of x for which $x^2 = 2x$ is false, with both sides worked out, e.g. when $x = 3$, $x^2 = 9$ but $2x = 6$	B1	Any value other than 0 or 2 $x = 0$ is not a counter-example: $0^2 = 0$ and $2 \times 0 = 0$. Do not award E1 for "it is an equation" or "it only works for 2" on its own.
	(2)	

Section A: Non-calculator	Mark	Comment
5.(a) $x + 5$	B1	oe Do not accept $5x$.
5.(b) $2(x + 5)$	B1	oe, e.g. $2x + 10$. FT $2 \times$ their (a), with brackets where needed Do not accept $2x + 5$ (only x has been doubled).
5.(c) $\frac{3}{4}x$	B1	oe, e.g. $3x/4$, $x - \frac{1}{4}x$, $x - x/4$ or $0.75x$ Do not accept $x/4$ (the number given away) or $x - 4$.
	(3)	

Section A: Non-calculator	Mark	Comment
6.(a) 3	B1	CAO
6.(b) -3	B1	CAO $(-16 + 1) \div 5 = -15 \div 5$. Do not accept 3 or $-17/5$.
6.(c) $(2n + 1)/5$	B2	oe, e.g. $\frac{1}{5}(2n + 1)$, $(2n + 1) \div 5$, $2n/5 + \frac{1}{5}$ or $0.4n + 0.2$ B1 for $2n + 1$ seen as the output of the second box. $2n + \frac{1}{5}$ or $2n + 1 \div 5$ on its own scores 0 (only the 1 has been divided by 5).
	(4)	

Section A: Non-calculator	Mark	Comment
7.(a) $4 \times (-3) + 10$ or $-12 + 10$	M1	
-2	A1	CAO. Correct answer implies M1
7.(b) $10 - (-3)^2$ or $10 - 9$	M1	
1	A1	CAO. Correct answer implies M1 $10 - (-9) = 19$ and $10 + 9 = 19$ score 0.
7.(c) $(10 - 2 \times (-3)) \div 4$ or $\frac{16}{4}$	M1	Numerator $10 + 6$ or 16 seen, with division by 4
4	A1	CAO. Correct answer implies M1 $\frac{4}{16}$ or $\frac{1}{4}$ (quotient reversed) scores M0 A0. $(10 - 6) \div 4 = 1$ scores 0.
	(6)	

Section A: Non-calculator	Mark	Comment
8. She has worked out $(-k)^2$ instead of $-k^2$. $-k^2$ means $-(k^2)$, so she should square -4 to get 16, then take the negative, -16	E1	Must identify that $-k^2$ is the negative of k^2 , or that she has worked out $(-k)^2$ (or 4^2)
$-(-4)^2 + 2 \times (-4)$ or $-16 + (-8)$ or $-16 - 8$	M1	
-24	A1	CAO Do not award E1 for "she got the sign wrong" or "she should have got a negative" without saying which sign or why. M1 A1 may be awarded without the E1.
	(3)	

Section A: Non-calculator	Mark	Comment
9. $18 \times (-\frac{1}{3})^2$ or $18 \times \frac{1}{9}$ or 2 seen	M1	For the first term
$3 \times (-\frac{1}{3}) = -1$, or $-3x = 1$ seen	M1	For the second term
3	A1	CAO. Dependent on both M marks $18 \times (-\frac{1}{9}) = -2$ (squaring to a negative) scores M0 for the first term. $2 - 1 = 1$ scores M1 M0 A0.
	(3)	

Section A: Non-calculator	Mark	Comment
10. pq^2	B1	
q^2 is positive, because the square of a negative number is positive, and p is positive, so pq^2 is positive $\times$ positive, which is positive	E1	Dependent on B1. Must say that q^2 is positive Accept " $q^2 > 0$ and $p > 0$, so $pq^2 > 0$ ". A numerical example on its own does not earn E1: the question asks about every value.
	(2)	

Section B: Calculator allowed	Mark	Comment
11.(a) $331.3 + 0.606 \times (-12.5)$ or $331.3 - 7.575$	M1	
323.7 (m/s)	A1	CAO 323.725 seen, then 323.7, scores M1 A1. 323.725 without rounding to 323.7 scores M1 A0. $331.3 + 7.575 = 338.875$ scores 0.
11.(b) $0.606 \times (25 - (-12.5))$ or 0.606×37.5 , or 346.45 – their 323.7	M1	$331.3 + 0.606 \times 25 = 346.45$
22.7 to 22.75 (m/s)	A1	Accept 22.725, 22.73 or 22.75 (from $346.45 - 323.7$) $0.606 \times (25 - 12.5) = 7.575$ (the negative sign of -12.5 ignored) scores 0.
	(4)	

Section B: Calculator allowed	Mark	Comment
12.(a) The calculator squares only 3.6, so -3.6^2 gives -12.96 (the negative of 3.6^2); he needs brackets, $(-3.6)^2$, to square -3.6 and get 12.96	E1	Must refer to the brackets, or to only 3.6 being squared Do not accept "he typed it in wrong" or "the calculator is wrong".
12.(b) $(-3.6)^2 + 4 \times (-3.6)$ or $12.96 - 14.4$	M1	
-1.44	A1	CAO
	(3)	

Section B: Calculator allowed	Mark	Comment
13.(a) 0.75×0.48 or 0.36	M1	The area of the base
$540 \div$ their 0.36	M1	FT their area
$1500 \text{ (N/m}^2\text{)}$	A1	CAO $540 \div 0.75 \div 0.48 = 1500$ scores M1 M1 A1. Their area $\div 540$ (quotient reversed) scores M1 M0 A0.
13.(b) He has divided the area by the force ($A \div F$, $0.36 \div 540$) instead of the force by the area ($F \div A$)	E1	Must say which way round he has divided Do not accept "he divided wrongly" or "he used the wrong numbers".
	(4)	

Section B: Calculator allowed	Mark	Comment
14.(a) $M = 35ab$	B2	oe, e.g. $M = 35ba$ B1 for $35ab$ (no " $M =$ "), or a correct formula not in its simplest form, e.g. $M = 35 \times a \times b$. $M = 35 + ab$, $M = 35(a + b)$ or $M = 70(a + b)$ scores 0.
14.(b) $35 \times 12.4 \times 8.75$ or 35×108.5 , or 3797.5 (g)	M1	FT their formula from (a) if it uses the area
their $3797.5 \div 1500$ or $3.7975 \div 1.5$, or $2.53\dots$	M1	Or $3 \times 1.5 = 4.5 \text{ kg}$ compared with 3.7975 kg (and $2 \times 1.5 = 3 \text{ kg}$ seen as too little)
3 (boxes)	A1	Dependent on both M marks
$\text{£}56.97$	B1	FT $18.99 \times$ their whole number of boxes, rounded up from their division Alternative: one box covers $1500 \div 35 = 42.857\dots \text{ m}^2$ for M1; $108.5 \div 42.857\dots = 2.53\dots$ for M1, then as above. $\text{£}48.08$ (2.53×18.99 , no whole boxes) scores M1 M1 A0 B0.
	(6)	

Elite Learners Specification & Assessment Objectives Summary

For teachers: this section maps the paper to WJEC Eduqas GCSE (9–1) Mathematics content and assessment objectives. It is an Elite Learners teacher resource and is not part of the Eduqas-style mark scheme.

Question	Eduqas content (Foundation / Higher)	AO	Marks
1(a)	FA1 / HA1 Algebraic notation	AO1	1
1(b)	FA1 / HA1 Algebraic notation	AO1	1
1(c)	FA1 / HA1 Algebraic notation	AO1	1
Question 1 total			3
2(a)	FA1 / HA1 Algebraic notation	AO1	1
2(b)	FA1 / HA1 Algebraic notation	AO1	1
2(c)	FA1 / HA1 Algebraic notation	AO1	1
Question 2 total			3
3	FA3 / HA3 Algebraic vocabulary	AO1 ×3	3
Question 3 total			3
4	FA6 / HA6 Equation and identity (argument and proof component not assessed)	AO2 ×2	2
Question 4 total			2
5(a)	FA17 / HA21 Expressions from situations (deriving and solving equations not assessed)	AO1	1
5(b)	FA17 / HA21 Expressions from situations (deriving and solving equations not assessed)	AO1	1
5(c)	FA1 / HA1 Algebraic notation (coefficients as fractions)	AO1	1
Question 5 total			3
6(a)	FA7 / HA7 Inputs and outputs (inverse and composite functions not assessed)	AO1	1
6(b)	FA7 / HA7 Inputs and outputs (inverse and composite functions not assessed)	AO1	1
6(c)	FA7 / HA7 Inputs and outputs (inverse and composite functions not assessed)	AO1 ×2	2
Question 6 total			4
7(a)	FA2 / HA2 Substitution	AO1 ×2	2
7(b)	FA2 / HA2 Substitution	AO1 ×2	2
7(c)	FA2 / HA2 Substitution	AO1 ×2	2
Question 7 total			6
8	FA2 / HA2 Substitution (signs before powers)	AO1 ×2, AO2	3
Question 8 total			3
9	FA2 / HA2 Substitution (fractional values)	AO1 ×3	3

Question	Eduqas content (Foundation / Higher)	AO	Marks
Question 9 total			3
10	FA1 / HA1 Algebraic notation (interpreting powers)	AO2 ×2	2
Question 10 total			2
11(a)	FA2 / HA2 Substitution, including scientific formulae	AO1 ×2	2
11(b)	FA2 / HA2 Substitution, including scientific formulae	AO3 ×2	2
Question 11 total			4
12(a)	FA2 / HA2 Substitution (signs before powers)	AO2	1
12(b)	FA2 / HA2 Substitution	AO1 ×2	2
Question 12 total			3
13(a)	FA2 / HA2 Substitution, including scientific formulae	AO1 ×2, AO3	3
13(b)	FA2 / HA2 Substitution, including scientific formulae	AO2	1
Question 13 total			4
14(a)	FA17 / HA21 Formulae from situations (deriving and solving equations not assessed)	AO1 ×2	2
14(b)	FA5 / HA5 Using formulae (rearranging formulae not assessed)	AO3 ×4	4
Question 14 total			6
Paper total			49

Assessment objectives

AO1 — use and apply standard techniques	35 marks (71.4%)
AO2 — reason, interpret and communicate mathematically	7 marks (14.3%)
AO3 — solve problems within mathematics and in other contexts	7 marks (14.3%)
Total	49 marks (100%)