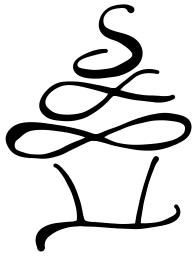
Practice Booklet

MYP 1 · Year 7 Mathematics

Unit 7.3 · Introduction to Algebra

Name: _____

7.3.1 · 7.3.2	Vocabulary · Conventions · Questions 1–16
7.3.3 · 7.3.4	Expressions · Equations · Questions 17–32
7.3.5 · 7.3.6	Like terms · Products · Questions 33–48
7.3.7 · 7.3.8	Expanding · Function machines · Questions 49–64
7.3.9 · 7.3.10	Substituting · Solving · Questions 65–80
Homework	Homework page and checking record
Answers	For checking and correcting in green pen



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How to use this booklet and your homework

READ THIS FIRST

Choosing your level

Every part of the unit has four levels. Start where you feel comfortable and move between them freely. Most questions ask you to explain as well as answer, because being able to say *why* is what makes a method stick.

Learning
Small numbers, with counters or a diagram beside you.

Practising
The standard question, with your reasoning written out.

Challenging
Working backwards, and finding what is wrong with someone else's thinking.

Mastery
Explaining why a rule must be true, and testing it on new cases.

Working on your homework

Pens and setting out

- Answers in blue or black non-erasable pen, or in pencil.
- Colour and highlighters are for annotating your work and showing the steps of a method.
- Never erase a mistake. Rework it underneath so you can see what changed.

Green pen is for checking. When you finish, use the answers at the back to check your work.

- **Got it wrong?** Circle the question number, then make your correction and write your error analysis in green pen.
- **Still can't work out how to solve it?** Put a star ★ next to the question number, so we know to go over it in class.

Each sheet

- Your name goes on every sheet, because they are handed in one at a time.
- Each question is worth up to 3 marks. If a question has parts (a, b, c...), each part is marked out of 3. At the end of each level, write your score out of the total for that level.
- Questions are numbered 1, 2, 3... all the way through the booklet, so we can say exactly which ones to do.
- If you are stuck after trying, ask for help. Showing me what you tried is a good start.

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7.3.1 Vocabulary · 7.3.2 Conventions

LEARNING · PRACTISING

Name:

Key vocabulary

Word	Meaning	In 2x − 3y + 4
variable	a letter for an unknown number	x and y
term	a part of an expression, with its sign	2x, −3y, 4
coefficient	the number (and sign) multiplying a letter	2 and −3
constant	a term that is just a number	4
expression	terms with no equals sign	2x − 3y + 4
equation	two sides joined by an equals sign	2x − 3y + 4 = 10

Conventions: leave out the × sign and write the number first (3a). Never write a coefficient of 1 (x, not 1x). Write a ÷ 5 as a fraction. a × a is a^2 ("a squared") and a × a × a is a^3 ("a cubed"). A product is the answer to a multiplication.

Learning

1 7.3.1 Use the key words to complete the sentences. In 3x + 5, x is the _____, 3 is the _____ of x and 5 is the _____. 3x + 5 is an _____ because it has no _____ sign.

2 7.3.1 Name each one (variable, term, coefficient or constant): a) x b) 7 c) the 5 in 5y d) 3y in 3y + 2

3 7.3.2 Rewrite correctly: a) 5 × a b) b × 8 c) 1c d) d ÷ 3

4 7.3.2 Write in shorthand: a) y × y b) m × m × m

Learning score _____ **/ 33**

Practising

5 7.3.1 For 6x − 2y + 9, name the three terms. What are the coefficients and what is the constant?

6 7.3.1 In 5a − b + 7: a) what is the coefficient of a? b) what is the coefficient of b? c) what is the constant?

7 7.3.2 Write in shorthand: a) 3 × n b) y × 7 c) a × b d) 2 × x × 5

8 7.3.2 Write in shorthand: a) 4 × b × b b) t ÷ 8 c) 2 × p × p × p

Practising score _____ **/ 33**

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7.3.1 Vocabulary · 7.3.2 Conventions

CHALLENGING · MASTERY

Name:

Challenging

9 7.3.1 Write “expression” or “equation” for each: a) $4x + 1$ b) $2y = 8$ c) $3a - b$ d) $\frac{n}{2} = 6$

10 7.3.1 Find and describe the mistake. Sam says the coefficient of y in $8x - y$ is 0.

11 7.3.2 Find and describe the mistake. A student writes $3 \times y$ as y3, and $b \div 2$ as 2 over b.

12 7.3.2 Write $2 \times m \times 5 \times m$ in shorthand, showing each step.

Challenging score _____ / 21

Mastery

13 7.3.1 Can an expression have no constant? Give an example. Can an equation have no variable? Give an example.

14 7.3.1 Build an expression with four terms using the variables a, b and c. Name each term, the coefficients and the constant.

15 7.3.2 Explain why $3a^2$ does not mean $3a \times 3a$. Use $a = 2$ to show the two are different.

16 7.3.2 Why do we not write the multiplication sign in algebra? Give a reason a Year 6 student would follow.

Mastery score _____ / 12

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Name:

Learning

17 7.3.3 Write an expression, using n for the number: a) 6 more than n b) n doubled c) n shared between 3

18 7.3.3 The bar model shows a number n and 5 more. Write an expression for the whole bar.



19 7.3.4 Write an equation: a) a number x plus 7 equals 15 b) a number x take away 5 equals 9

20 7.3.4 Is x = 4 a solution of 3x = 12? Substitute 4 for x and say whether both sides have the same value.

Learning score _____ / 21

Practising

21 7.3.3 Write an expression, using n for the number: a) four less than n b) triple n, then add 5 c) half of n, then add 5

22 7.3.3 A pen costs c francs. Write an expression for the cost of 4 pens, and for 4 pens and a 2-franc ruler.

23 7.3.4 A pen costs p francs. Four pens cost 12 francs. Write an equation and find p.

24 7.3.4 I think of a number x, double it and add 3. The answer is 11. Write an equation, then check that x = 4 is a solution.

Practising score _____ / 18

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Name:

Challenging

25 7.3.3 Ana is a years old. Her brother is 3 years younger. Write an expression for their total age, simplified.

26 7.3.3 Find and describe the mistake. “Five less than n” is written as 5 − n.

27 7.3.3 A rectangle has length x cm and width 3 cm. Write an expression for its perimeter, simplified.

28 7.3.4 Mia thinks of a number x and subtracts 3. She gets 5. Write an equation. Is x = 7 a solution? Is x = 8?

Challenging score _____ / 12

Mastery

29 7.3.3 Write three consecutive whole numbers using n. Show that their total is always three times the middle one.

30 7.3.3 Explain why n − 7 and 7 − n are different. Use n = 10 to show it.

31 7.3.4 A bag holds x counters. Jo has 3 bags and 5 loose counters, 26 in total. Write an equation. Is x = 7 a solution?

32 7.3.4 Explain what the equals sign tells you about the two sides of an equation. Use the idea of a balance in your answer.

Mastery score _____ / 12

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Name:

Learning

33 7.3.5 Simplify: a) 5a + 3a b) 9y − 4y c) 6b + b

34 7.3.5 Which pairs are like terms? a) 3x and 5x b) 2a and 2b c) 4 and 9

35 7.3.6 Simplify: a) 2 × 6b b) 5 × 3x c) 4a × 2

36 7.3.6 A rectangle is 4 cm by x cm. Write an expression for its area.

Learning score _____ / 30

Practising

37 7.3.5 Simplify: a) 7x + 2y − 3x b) 4m + 6 − m − 2 c) 8c − 3c + 4

38 7.3.5 Simplify: a) 3a + 4b + 2a + b b) 9 + 2x − 4 + x

39 7.3.6 Simplify: a) 2p × 4q b) 6x × 2y c) 3a × 5

40 7.3.6 A rectangle has sides 5x and 3x. Write its area as an expression.

Practising score _____ / 27

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Name:

Challenging

41 7.3.5 Simplify: a) $6a - 2b + 3b - 8a$ b) $5c + c^2 - 2c$ c) $2x^2 + 3x + x^2$

42 7.3.5 Find and describe the mistake. A student simplifies $5x + 3$ as $8x$.

43 7.3.6 Simplify: a) $3a \times 2b \times 4$ b) $x \times x \times x \times x \times x$ c) $2x \times 3y \times 4x$

44 7.3.6 Find and describe the mistake. A student says $4x + 4x = 16x^2$. Give the correct answers to $4x + 4x$ and to $4x \times 4x$.

Challenging score _____ **/ 24**

Mastery

45 7.3.5 Explain why $3x$ and $3x^2$ are not like terms. Use $x = 2$ to help you.

46 7.3.5 Write an expression with four terms that simplifies to $5x + 2$.

47 7.3.6 Show, using $x = 4$, that $x \times x$ is not the same as $2x$.

48 7.3.6 A square has side $3a$. A rectangle has sides $2a$ and $4a$. Write the area of each. Which is larger, and why?

Mastery score _____ **/ 12**

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7.3.7 Expanding · 7.3.8 Function machines

LEARNING · PRACTISING

Name:

Learning

49 7.3.7 Expand: a) 2(x + 3) b) 5(y + 1) c) 3(a − 2)

50 7.3.7 The rectangle has height 3 and length x + 4. Write the area of each part, then the total area.



51 7.3.8 A machine does × 3 then + 2. Find the output for: a) input 4 b) input 10

input → **× 3** → **+ 2** → output

52 7.3.8 A machine does + 7 and the output is 12. What was the input? Which operation undoes + 7?

Learning score _____ / 21

Practising

53 7.3.7 Expand: a) 4(2x − 5) b) x(x + 6) c) 6(3a + 2)

54 7.3.7 Expand 5(2y + 1), then check your answer by putting y = 3 into both forms.

55 7.3.8 A machine does × 4 then − 1. Write an expression for the output when the input is n. What is the output when n = 3?

n → **× 4** → **− 1** → output

56 7.3.8 A machine does ÷ 2 then + 3. Write an expression for the output when the input is n, then find the output when n = 10.

Practising score _____ / 18

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Name:

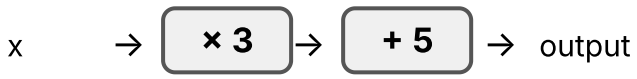
Challenging

57 7.3.7 Expand 2a(3a − 4).

58 7.3.7 Find and describe the mistake. A student expands 3(x + 4) as 3x + 4.

59 7.3.8 The machine × 4 then − 1 gives an output of 19. Work backwards to find the input.

60 7.3.8 A machine does × 3 then + 5. Write the output expression for input x, then use 3x + 5 = 20 and work backwards to find x.



Challenging score _____ / 12

Mastery

61 7.3.7 Draw an area model to show why 3(x + 4) is 3x + 12 and not 3x + 4.

62 7.3.7 Expand and simplify 3(x + 2) + 2(x + 1).

63 7.3.8 Machine A does × 2 then + 6. Machine B does + 3 then × 2. Write an output expression for each (expand the bracket for B). What do you notice?

64 7.3.8 Design a machine with two operations that has output 17 when the input is 5. Write its expression for input n.

Mastery score _____ / 12

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7.3.9 Substituting · 7.3.10 Solving

Name:

Learning

65 7.3.9 When a = 5, find a) a + 4 b) 3a c) 2a − 1

66 7.3.9 Replace the letter with the number and work out: a) 2n + 3 when n = 6 b) 5 + 3n when n = 2

67 7.3.10 Solve: a) x + 6 = 10 b) 3x = 12 c) x − 2 = 7

68 7.3.10 Solve x + 5 = 9 by undoing the + 5 on both sides. Check your answer by substituting it back.

Learning score _____ / 27

Practising

69 7.3.9 Given a = 4 and b = −2, find a) 3a + 1 b) 5b − 2 c) a + 2b

70 7.3.9 When x = 3 and y = 5, find a) xy b) 2x + y c) 3y − x

71 7.3.10 Solve: a) x − 7 = 5 b) $\frac{x}{4} = 3$ c) 5x = 35

72 7.3.10 Solve and check: a) 8 + x = 15 b) 2x = −6

Practising score _____ / 33

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Name:

Challenging

73 7.3.9 When b = −3, find a) b^2 b) $2b^2$ c) 4 − b

74 7.3.9 Find and describe the mistake. A student works out 5 + 3x when x = 2 as 8 × 2 = 16.

75 7.3.10 Find and describe the mistake. To solve x + 7 = 10, Kai writes x = 10 + 7 = 17.

76 7.3.10 Solve x + 12 = 5, and check your answer by substituting it back.

Challenging score _____ **/ 18**

Mastery

77 7.3.9 When a = −3, one student says $a^2 = -9$ and another says $a^2 = 9$. Who is right? What went wrong?

78 7.3.9 Find the value of $2x^2 - 3y$ when x = 3 and y = −4.

79 7.3.10 A ticket costs c francs. Three friends each buy one ticket and pay 21 francs in total. Write an equation and solve it.

80 7.3.10 Explain why you must do the same operation to both sides of an equation. Use x + 4 = 10 to show what goes wrong if you only change one side.

Mastery score _____ **/ 12**

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Homework and checking record

HAND THIS PAGE IN WITH YOUR SHEETS

Name:

Your teacher will tell you which sheet and questions to do. Choose your level, set out your work in pen or pencil, then check it with the answers at the back using a **green pen**: circle wrong question numbers, and star ★ any you still cannot solve.

Sheet	Questions	Which ones I did	Checked in green ✓	Teacher
7.3.1 Vocabulary · 7.3.2 Conventions	Q1–16			
7.3.3 Expressions · 7.3.4 Equations	Q17–32			
7.3.5 Like terms · 7.3.6 Products	Q33–48			
7.3.7 Expanding · 7.3.8 Function machines	Q49–64			
7.3.9 Substituting · 7.3.10 Solving	Q65–80			

Error analysis

Circle the number of any question you got wrong. Star ★ it if you still cannot solve it after correcting. Then write the questions you need to rework, and what you will do differently:

One thing I understand better now

Score: Parent / guardian signature:

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Answers

CHECK IN GREEN PEN

7.3.1 Vocabulary · 7.3.2 Conventions

Learning	**1**	In 3x + 5, x is the variable, 3 is the coefficient of x and 5 is the constant. 3x + 5 is an expression because it has no equals sign.
	2	a) variable b) constant c) coefficient d) term
	3	a) 5a b) 8b c) c (we never write a coefficient of 1) d) $\frac{d}{3}$
	4	a) y^2 (y squared) b) m^3 (m cubed)
Practising	**5**	The terms are 6x, −2y and 9. The coefficients are 6 and −2. The constant is 9.
	6	a) 5 b) −1, because −b means −1 × b c) 7
	7	a) 3n b) 7y c) ab d) 10x
	8	a) $4b^2$ b) $\frac{t}{8}$ c) $2p^3$
Challenging	**9**	a) expression b) equation c) expression d) equation
	10	The coefficient is −1, not 0. The term is −y, which means −1 × y, so the sign and the 1 both count.
	11	The number goes first, so 3 × y is 3y. b ÷ 2 is $\frac{b}{2}$, with b on top, because b is the number being divided.
	12	2 × m × 5 × m = 2 × 5 × m × m = 10 × m × m = $10m^2$
Mastery	**13**	Yes, an expression can have no constant, for example 4x + 9y. An equation can have no variable, for example 3 + 4 = 7 (true) or 3 + 4 = 8 (false).
	14	For example 2a − 3b + c + 5: the terms are 2a, −3b, c and 5; the coefficients are 2, −3 and 1; the constant is 5. Any correct four-term expression works.
	15	In $3a^2$ only the a is squared, so $3a^2$ = 3 × a × a. With a = 2: 3 × 2 × 2 = 12, but 3a × 3a = 6 × 6 = 36.
	16	The × sign looks too much like the letter x, so we leave it out and write the number first: 3a means 3 × a.

7.3.3 Expressions · 7.3.4 Equations

Learning	**17**	a) n + 6 b) 2n c) $\frac{n}{3}$
	18	n + 5
	19	a) x + 7 = 15 b) x − 5 = 9
	20	Yes. 3 × 4 = 12, so both sides have the same value and x = 4 is a solution.
Practising	**21**	a) n − 4 b) 3n + 5 c) $\frac{n}{2}$ + 5
	22	4 pens cost 4c francs. 4 pens and a ruler cost 4c + 2 francs.
	23	4p = 12, so p = 3
	24	2x + 3 = 11. Check: 2 × 4 + 3 = 8 + 3 = 11, so x = 4 is a solution.
Challenging	**25**	Brother: a − 3. Total: a + (a − 3) = 2a − 3.
	26	“Five less than n” means take 5 away from n, so it is n − 5. 5 − n is the other way round: with n = 8, n − 5 = 3 but 5 − n = −3.
	27	x + 3 + x + 3 = 2x + 6 cm
	28	x − 3 = 5. x = 7 is not a solution because 7 − 3 = 4. x = 8 is a solution because 8 − 3 = 5.
Mastery	**29**	n, n + 1, n + 2. Total: n + (n + 1) + (n + 2) = 3n + 3 = 3(n + 1), and n + 1 is the middle number.
	30	With n = 10: n − 7 = 3 but 7 − n = −3. Subtraction depends on order: n − 7 starts from n, but 7 − n starts from 7.
	31	3x + 5 = 26. Check: 3 × 7 + 5 = 21 + 5 = 26, so x = 7 is a solution.
	32	The two sides have the same value, like a balance that is level. A solution is a number that keeps the balance level.

7.3.5 Like terms · 7.3.6 Products

Learning	**33**	a) 8a b) 5y c) 7b
	34	a) yes (both are x terms) b) no (a and b are different letters) c) yes (both are constants)
	35	a) 12b b) 15x c) 8a
	36	$4 \times x = 4x$ cm²
Practising	**37**	a) $4x + 2y$ b) $3m + 4$ c) $5c + 4$
	38	a) $5a + 5b$ b) $3x + 5$
	39	a) 8pq b) 12xy c) 15a
	40	$5x \times 3x = 15x^2$
Challenging	**41**	a) $-2a + b$ b) $3c + c^2$ c) $3x^2 + 3x$
	42	5x and 3 are not like terms (one has x and one does not), so they cannot be added. $5x + 3$ is already as simple as it can be.
	43	a) 24ab b) x^4 c) $24x^2y$
	44	The student multiplied instead of adding. $4x + 4x = 8x$, but $4x \times 4x = 16x^2$.
Mastery	**45**	x and x^2 are different kinds of term. With $x = 2$: $3x = 6$ but $3x^2 = 3 \times 4 = 12$, so $3x + 3x^2$ is not $6x$ or $6x^2$.
	46	For example $2x + 3x + 4 - 2$, or $7x - 2x + 1 + 1$. Any correct expression works.
	47	$x \times x = x^2$, and with $x = 4$ that is 16. $2x = 2 \times 4 = 8$. They are different.
	48	Square: $3a \times 3a = 9a^2$. Rectangle: $2a \times 4a = 8a^2$. The square is larger because $9a^2 - 8a^2 = a^2$, which is positive.

7.3.7 Expanding · 7.3.8 Function machines

Learning	**49**	a) $2x + 6$ b) $5y + 5$ c) $3a - 6$
	50	The part with length x has area $3 \times x = 3x$. The part with length 4 has area $3 \times 4 = 12$. Total area: $3x + 12$, so $3(x + 4) = 3x + 12$.
	51	a) $4 \times 3 = 12$, then $12 + 2 = 14$ b) $10 \times 3 = 30$, then $30 + 2 = 32$
	52	The input was 5. Subtracting 7 undoes + 7: $12 - 7 = 5$.
Practising	**53**	a) $8x - 20$ b) $x^2 + 6x$ c) $18a + 12$
	54	$5(2y + 1) = 10y + 5$. Check with $y = 3$: $5 \times 7 = 35$ and $10 \times 3 + 5 = 35$.
	55	$4n - 1$. When $n = 3$ the output is $4 \times 3 - 1 = 11$.
	56	$\frac{n}{2} + 3$. When $n = 10$ the output is $5 + 3 = 8$.
Challenging	**57**	$6a^2 - 8a$
	58	The 3 multiplies everything in the bracket, not only the first term. $3(x + 4) = 3x + 12$.
	59	Undo − 1: $19 + 1 = 20$. Undo × 4: $20 \div 4 = 5$. The input is 5.
	60	Output: $3x + 5$. Undo + 5: $20 - 5 = 15$. Undo × 3: $15 \div 3 = 5$. So $x = 5$.
Mastery	**61**	A rectangle of height 3 is split into a part of width x (area 3x) and a part of width 4 (area $3 \times 4 = 12$), so the total is $3x + 12$. The 3 multiplies both parts.
	62	$3x + 6 + 2x + 2 = 5x + 8$
	63	A: $2n + 6$. B: $2(n + 3) = 2n + 6$. The machines always give the same output.
	64	For example × 3 then + 2: $3 \times 5 + 2 = 17$, and the expression is $3n + 2$. Other answers are possible.

Learning	**65**	a) 9 b) 15 c) 9
	66	a) $2 \times 6 + 3 = 15$ b) $5 + 3 \times 2 = 5 + 6 = 11$ (multiply first)
	67	a) $x = 4$ b) $x = 4$ c) $x = 9$
	68	$x = 9 - 5 = 4$. Check: $4 + 5 = 9$, which is correct.
Practising	**69**	a) 13 b) −12 c) 0
	70	a) 15 b) 11 c) 12
	71	a) $x = 12$ b) $x = 12$ c) $x = 7$
	72	a) $x = 7$. Check: $8 + 7 = 15$. b) $x = -3$. Check: $2 \times (-3) = -6$.
Challenging	**73**	a) 9 b) 18 c) 7
	74	They added $5 + 3$ first. Multiplication comes before addition: $3 \times 2 = 6$, then $5 + 6 = 11$.
	75	He did the same operation instead of the inverse. To undo + 7, subtract 7 from both sides: $x = 10 - 7 = 3$. Check: $3 + 7 = 10$.
	76	$x = 5 - 12 = -7$. Check: $-7 + 12 = 5$, which is correct.
Mastery	**77**	9 is right. $a^2 = (-3) \times (-3) = 9$. The other student squared 3 first and then applied the negative sign, but the whole number −3 is squared.
	78	$2x^2 = 2 \times 9 = 18$ and $-3y = -3 \times (-4) = +12$, so the value is $18 + 12 = 30$.
	79	$3c = 21$, so $c = 7$. A ticket costs 7 francs.
	80	An equation is a balance. If you subtract 4 from the left only, you get $x = 10$, but the real solution is $x = 6$ ($6 + 4 = 10$). Doing the same to both sides keeps the sides equal.