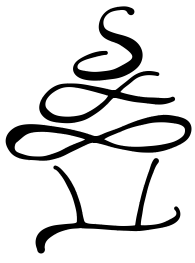
Practice Booklet

MYP 2 · Year 8 Mathematics

Unit 8.3 · Number

Name: _____

8.3.1	Multiplying and dividing · Questions 1–17
8.3.2	Order of operations · Questions 18–34
8.3.3	The distributive property · Questions 35–51
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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8.3.1 Multiplying and dividing

LEARNING

Name:

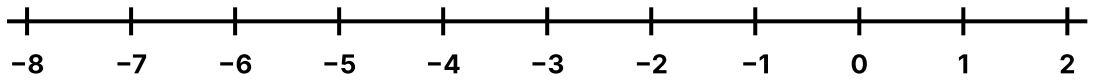
Key vocabulary

Word	Meaning	Example
directed number	a number with a size and a sign (positive or negative)	5, −3
product	the answer to a multiplication	the product of −3 and 4 is −12
quotient	the answer to a division	the quotient of −12 and 3 is −4
sign	whether a number is positive (+) or negative (−)	−7 has a negative sign

Sign rule: same signs give a positive answer, different signs give a negative answer. Work out the numbers first, then decide the sign.

Learning

1 Three jumps of −2 from 0 show 3 × (−2). Draw the jumps on the number line, write where you land and complete: 3 × (−2) = ___



2 Work out.

a) 4 × (−1)

b) 2 × (−5)

c) (−3) × 4

3 Complete the pattern and say what happens to the answers each time: 3 × (−2) = −6, 2 × (−2) = −4, 1 × (−2) = −2, 0 × (−2) = ___, (−1) × (−2) = ___, (−2) × (−2) = ___

4 Work out.

a) (−5) × (−2)

b) (−4) × (−3)

c) 6 × (−2)

5 Write positive or negative for the sign of each answer, before you calculate.

a) (−7) × 3

b) (−8) × (−2)

c) 9 × (−4)

Learning score _____ / 33

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Name:

Practising

6 Work out.

a) $(-6) \times 7$

b) $(-8) \times (-9)$

c) $12 \times (-5)$

7 Work out.

a) $-20 \div 4$

b) $-36 \div (-9)$

c) $18 \div (-6)$

8 Work out $-35 \div 7$, then check your answer by multiplying back.

9 Find the missing numbers.

a) $\square \times (-4) = 28$

b) $(-3) \times \square = -21$

c) $\square \div (-5) = 6$

10 A diver goes down 4 m every minute for 6 minutes. Write this as a multiplication of directed numbers and say how far below the surface the diver is.

Practising score _____ **/ 33**

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8.3.1 Multiplying and dividing

Name:

Challenging

11 Work out (−2) × (−3) × (−4) and then (−1) × (−2) × (−3) × (−4). What decides the sign of the answer?

12 Find and describe the mistake. Sam says (−6) × (−3) = −18 because "a negative times anything is negative".

13 Work out.
a) $(-3)^2$
b) -3^2
c) $(-2)^3$
d) -2^3

14 The temperature changes by −3 °C every hour. Use (number of hours) × (−3) to find the change in temperature.
a) after 5 hours
b) 4 hours ago (use −4 hours)
c) What does your answer to
b) mean?

Challenging score _____ **/ 27**

Mastery

15 Use the pattern 3 × (−4), 2 × (−4), 1 × (−4), 0 × (−4), … to explain why a negative times a negative must be positive.

16 Explain, with an example, why the product of an odd number of negatives is negative and the product of an even number of negatives is positive.

17 Two directed numbers a and b have a product that is positive and a sum that is negative. What can you say about a and b? Explain, and give an example.

Mastery score _____ **/ 9**

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8.3.2 Order of operations

LEARNING

Name:

Key vocabulary

Word	Meaning	Example
order of operations	the agreed order in which we do a calculation	brackets, indices, × ÷, + −
brackets	group part of a calculation to be done first	(4 + 3) × 5
indices	the small raised numbers (powers)	$3^2 = 3 \times 3$
convention	a rule everyone agrees to use	one order for everyone
tie	two operations of equal rank: work left to right	20 ÷ 5 × 2 = 4 × 2

One operation per line. Copy everything else down unchanged. Brackets first, then indices, then × and ÷, then + and −.

Learning

18 Work out, one operation per line.

a) 4 + 3 × 5

b) (4 + 3) × 5

19 Work out.

a) 12 − 8 ÷ 4

b) 6 + 2 × 3

c) 20 − 3 × 4

20 These have a tie, so work from left to right.

a) 20 ÷ 5 × 2

b) 10 − 4 + 3

21 Work out.

a) 5^2

b) 2^3

c) 10^2

22 Fill in the missing steps: $2 + 3 \times 4^2 = 2 + 3 \times ___ = 2 + ___ = ___$

Learning score _____ **/ 33**

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8.3.2 Order of operations

Name:

Practising

23 Work out, one operation per line.

a) $6 + 2 \times 3^2$

b) $(6 + 2) \times 3^2$

c) $2 \times (5 - 8) + 4$

24 Work out.

a) $3 \times (-2)^2$

b) $-2^2 + 10$

c) $(-4)^2 - 3 \times 2$

25 Work out $12 - 4 \times 2 + 3^3$, one operation per line.

26 Work out.

a) $18 \div 3 \times 2$

b) $18 \div (3 \times 2)$. Why are the answers different?

27 Work out $-3 \times (2 - 5) + 8$, one operation per line.

Practising score _____ **/ 30**

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8.3.2 Order of operations

CHALLENGING · MASTERY

Name:

Challenging

28 Work out $-3 \times (2 - 5)^2 + 8 \div (-4)$, one operation per line.

29 Find and describe the mistake. Zoe works out 2×3^2 as $6^2 = 36$.

30 Put one pair of brackets in each calculation to make the answer correct.

a) $4 + 3 \times 5 = 35$

b) $4 + 6 \div 2 = 5$

c) $8 - 2 \times 3 = 18$

31 Work out

a) $(-4)^2 - 3 \times (-2)$

b) $-4^2 - 3 \times (-2)$. Explain why the answers are different.

Challenging score _____ / 21

Mastery

32 A student says $20 \div 5 \times 2 = 2$ because "division comes before multiplication". Explain the error and give the correct answer.

33 Use 2, 3 and 4 once each, with +, − and ×, and brackets if you need them, to make each answer. Write one operation per line.

a) 14

b) 20

c) 10

34 Why do mathematicians agree on one order of operations? Give an example of a calculation that would have two answers without it.

Mastery score _____ / 15

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8.3.3 The distributive property

LEARNING

Name:

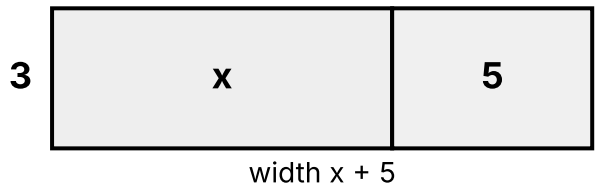
Key vocabulary

Word	Meaning	Example
expand	multiply out a bracket	3(x + 2) = 3x + 6
term	a part of an expression, with its sign	−5x, 7
distributive law	the number outside multiplies every term inside	a(b + c) = ab + ac
area model	a rectangle split into pieces to show the multiplying	3 × (x + 5) is two pieces
bracket	groups terms so they are multiplied together	2(x − 4)

Check: put the same number in for x on both sides (for example x = 3). If the two answers differ, the expansion is wrong.

Learning

35 The rectangle has height 3 and width x + 5. Write the area of each piece and the total area.



36 Split the number to work out.

a) 6 × 14

b) 7 × 12

c) 5 × 18

37 Expand.

a) 3(x + 4)

b) 2(x + 7)

c) 5(x + 1)

38 Expand.

a) 2(3x + 1)

b) 4(2x + 5)

c) 3(5x + 2)

39 Check that 2(x + 3) = 2x + 6 by putting x = 4 into both sides. Write both answers.

Learning score _____ **/ 33**

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8.3.3 The distributive property

PRACTISING

Name:

Practising

40 Expand.

a) $4(x - 2)$

b) $5(x - 3)$

c) $3(2x - 1)$

41 Expand.

a) $-3(x + 6)$

b) $-2(x + 4)$

c) $-5(x - 1)$

42 Expand.

a) $-3(2x - 5)$

b) $-2(3x - 4)$

c) $-4(x - 7)$

43 Expand $4(x + 2)$, then check your answer by putting $x = 3$ into both sides.

44 A rectangle has width 5 and length $2x + 3$. Write its area as a bracket and then expand it.

Practising score _____ **/ 33**

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8.3.3 The distributive property

CHALLENGING · MASTERY

Name:

Challenging

45 Expand and simplify.
a) 3(x + 2) + 2(x + 5)
b) 5(x − 1) + 2(x + 4)

46 Find and describe the mistake. Ali expands −2(x − 4) as −2x − 8.

47 Three friends each buy a drink costing d francs and a snack costing 4 francs. Write the total cost as 3(d + 4) and expand it. Find the total cost when d = 2.

48 Show that 6(x + 2) − 6x always equals 12, whatever the value of x.

Challenging score _____ / 15

Mastery

49 Use an area model to explain why 3(x + 4) is not equal to 3x + 4.

50 Does 4(x + 1) equal 4x + 1? Test with a number, then explain what the correct expansion is.

51 Mia says −3(x − 5) = −3x − 15 and Ben says it is −3x + 15. Put x = 2 into the original and into each answer to decide who is right.

Mastery score _____ / 9

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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
8.3.1 Multiplying and dividing	Q1–17			
8.3.2 Order of operations	Q18–34			
8.3.3 The distributive property	Q35–51			

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

8.3.1 Multiplying and dividing

Learning	**1**	You land on −6, so 3 × (−2) = −6
	2	a) −4 b) −10 c) −12
	3	0, 2, 4. The answers go up by 2 each time, so a negative times a negative is positive.
	4	a) 10 b) 12 c) −12
	5	a) negative (different signs) b) positive (same signs) c) negative (different signs)
Practising	**6**	a) −42 b) 72 c) −60
	7	a) −5 b) 4 c) −3
	8	−35 ÷ 7 = −5. Check: (−5) × 7 = −35.
	9	a) −7 b) 7 c) −30
	10	6 × (−4) = −24, so the diver is 24 m below the surface.
Challenging	**11**	−24, then 24. An odd number of negative numbers gives a negative answer and an even number gives a positive answer.
	12	The numbers are both negative, so the signs are the same and the answer is positive: (−6) × (−3) = 18. Sam only used the rule for different signs.
	13	a) 9 (it is (−3) × (−3)) b) −9 (only the 3 is squared) c) −8 d) −8
	14	a) 5 × (−3) = −15, so it is 15 °C colder. b) (−4) × (−3) = 12 c) Four hours ago it was 12 °C warmer.
Mastery	**15**	The answers are −12, −8, −4, 0, so they go up by 4 each row. The next rows give (−1) × (−4) = 4 and (−2) × (−4) = 8. Any other answer would break a pattern that already works for the positive numbers.
	16	Negatives pair up, and each pair makes a positive. With an even number there is nothing left over, so the answer is positive. With an odd number one negative is left over, so the answer is negative. For example (−2) × (−3) × (−4) = 6 × (−4) = −24.
	17	Both are negative. A positive product means the signs are the same, and a negative sum means they cannot both be positive. For example −2 and −5: product 10, sum −7.

8.3.2 Order of operations

Learning	**18**	a) 4 + 15 = 19 b) 7 × 5 = 35
	19	a) 12 − 2 = 10 b) 6 + 6 = 12 c) 20 − 12 = 8
	20	a) 4 × 2 = 8 b) 6 + 3 = 9
	21	a) 5 × 5 = 25 b) 2 × 2 × 2 = 8 c) 10 × 10 = 100
	22	2 + 3 × 16 = 2 + 48 = 50
Practising	**23**	a) 6 + 2 × 9 = 6 + 18 = 24 b) 8 × 9 = 72 c) 2 × (−3) + 4 = −6 + 4 = −2
	24	a) 3 × 4 = 12 b) −4 + 10 = 6 (only the 2 is squared) c) 16 − 6 = 10
	25	12 − 4 × 2 + 27 = 12 − 8 + 27 = 4 + 27 = 31
	26	a) 6 × 2 = 12 b) 18 ÷ 6 = 3. The brackets make the multiplication happen first.
	27	−3 × (−3) + 8 = 9 + 8 = 17
Challenging	**28**	$-3 \times (-3)^2 + 8 \div (-4) = -3 \times 9 + 8 \div (-4) = -27 + (-2) = -29$
	29	She multiplied 2 × 3 first. Indices come before multiplying, so $3^2 = 9$ and then 2 × 9 = 18.
	30	a) (4 + 3) × 5 = 35 b) (4 + 6) ÷ 2 = 5 c) (8 − 2) × 3 = 18
	31	a) 16 + 6 = 22 b) −16 + 6 = −10. In a) the bracket squares the negative number to give 16. In b) only the 4 is squared, so the answer is −16.
Mastery	**32**	× and ÷ have the same rank, so it is a tie and we work left to right: 20 ÷ 5 = 4, then 4 × 2 = 8. The student did 5 × 2 = 10 first.
	33	For example a) 2 + 3 × 4 = 2 + 12 = 14 b) (2 + 3) × 4 = 5 × 4 = 20 c) 3 × 4 − 2 = 12 − 2 = 10
	34	Without an agreed order different people would get different answers to the same calculation. For example 4 + 3 × 5 could be 35 (left to right) or 19 (multiply first). The convention means everyone gets 19.

8.3.3 The distributive property

Learning	**35**	Area of the first piece 3 × x = 3x. Area of the second piece 3 × 5 = 15. Total area 3x + 15, so 3(x + 5) = 3x + 15.
	36	a) 6 × 10 + 6 × 4 = 60 + 24 = 84 b) 7 × 10 + 7 × 2 = 70 + 14 = 84 c) 5 × 10 + 5 × 8 = 50 + 40 = 90
	37	a) 3x + 12 b) 2x + 14 c) 5x + 5
	38	a) 6x + 2 b) 8x + 20 c) 15x + 6
	39	Left side 2 × (4 + 3) = 2 × 7 = 14. Right side 2 × 4 + 6 = 8 + 6 = 14. They match, so the expansion is correct.
Practising	**40**	a) 4x − 8 b) 5x − 15 c) 6x − 3
	41	a) −3x − 18 b) −2x − 8 c) −5x + 5
	42	a) −6x + 15 b) −6x + 8 c) −4x + 28 (negative times negative is positive)
	43	4x + 8. Left side 4 × (3 + 2) = 20. Right side 4 × 3 + 8 = 12 + 8 = 20. They match.
	44	Area = 5(2x + 3) = 10x + 15
Challenging	**45**	a) 3x + 6 + 2x + 10 = 5x + 16 b) 5x − 5 + 2x + 8 = 7x + 3
	46	The second term is (−2) × (−4), which is positive 8. The correct answer is −2x + 8. Ali used the wrong sign.
	47	3(d + 4) = 3d + 12. When d = 2: 3 × 2 + 12 = 18 francs.
	48	6(x + 2) − 6x = 6x + 12 − 6x = 12. The 6x terms cancel, so x does not change the answer.
Mastery	**49**	A rectangle of height 3 and width x + 4 has two pieces: 3 × x = 3x and 3 × 4 = 12. The total area is 3x + 12. The 3 has to multiply both pieces, not only the first.
	50	Try x = 2: 4(2 + 1) = 12 but 4 × 2 + 1 = 9, so they are not equal. The 4 multiplies both terms: 4(x + 1) = 4x + 4.
	51	Original: −3(2 − 5) = −3 × (−3) = 9. Mia: −3 × 2 − 15 = −21. Ben: −6 + 15 = 9. Ben is right, because (−3) × (−5) = 15 is positive.