# Practice Booklet

## MYP 1 · Year 7 Mathematics

## Unit 7.2 · Directed Number

Name: _____


| | |
|---|---|
| **7.2.1 · 7.2.2** | Distance from zero · Ordering · Questions 1–18 |
| **7.2.3 · 7.2.4** | Adding · Subtracting · Questions 19–37 |
| **7.2.5** | Multiplying and dividing · Questions 38–54 |
| **7.2.6 (a)** | Order of operations · Questions 55–81 |
| **7.2.6 (b)** | Order of operations · Questions 82–97 |
| **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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# 7.2.1 Distance from zero · 7.2.2 Ordering

LEARNING · PRACTISING

Name:

**Key vocabulary**

| Word | Meaning | Example |
|---|---|---|
| **directed number** | a number with a magnitude (size) and a direction (positive or negative) | +4, −4 |
| **magnitude** | the size of a number: its distance from zero, ignoring the sign | −5 has magnitude 5 |
| **direction** | the sign of a number: positive to the right of zero, negative to the left | + or − |
| **opposite** | the same magnitude and the opposite direction | 3 and −3 |
| **< and >** | less than and greater than: the open end faces the greater number | −7 < −2 |

## Learning

**1** Which is colder, −4 °C or −9 °C? How do you know?

**2** Write in ascending order (smallest first): 2, −5, 0, −1

**3** What is the magnitude of −6? And of 6? What does that tell you?

**4** Write < or > in each gap: a) −3 ___ 2 b) −7 ___ −2 c) 0 ___ −4

**5** Is every negative number smaller than every positive number? Explain.

**Learning score** _____ / 21

## Practising

**6** Write in ascending order: −12, 7, −3, 0, −15, 4

**7** Which has the greater magnitude, −8 or 5? Which is the larger number? Explain why those are different questions.

**8** Write the opposite of a) 9 b) −14 c) 0

**9** Zurich is −2 °C, Oslo −7 °C, Madrid 5 °C and Cairo 12 °C. List the cities from coldest to warmest.

**10** How many integers lie between −5 and 2? Explain how you counted them.

**Practising score** _____ / 21

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Name:

## Challenging

**11** x lies between −4 and −1. List the integers x could be, and explain how the line helped.

**12** a is negative and b is positive. Which is larger? Must that always be true?

**13** Explain why −20 is smaller than −2, even though 20 is bigger than 2.

**14** Write a number between −3 and −2. Is there another one?

**15** Find and describe the mistake. Ravi puts −7, −2, 3 and −5 in order from smallest to largest as −2, −5, −7, 3.

**Challenging score** _____ / 15

## Mastery

**16** Find two numbers that differ by 10 and are both below −5. Explain how you chose them.

**17** Describe where all the numbers with distance 7 from zero sit on the line, and what that says about the line's symmetry.

**18** Which numbers are 4 steps away from −1? Explain how you found them.

**Mastery score** _____ / 9

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# 7.2.3 Adding · 7.2.4 Subtracting



Name:

## Learning

**19** Work out a) −3 + 5 b) 4 + (−7) c) −2 − 4

**20** Continue the pattern: 5 + 2 = 7, 5 + 1 = 6, 5 + 0 = 5, 5 + (−1) = ___, 5 + (−2) = ___. What does adding a negative number do?

**21** 6 − (−2). Draw or describe the counters, and say why the answer is bigger than 6.

**22** Use counters to work out 5 + (−3). Draw them, circle the zero pairs and say what is left.

**23** Complete: a zero pair is one _____ counter and one _____ counter, and together they are worth ____

**Learning score** _____ / 21

## Practising

**24** Work out a) −8 + (−5) b) −6 − (−10) c) 12 + (−15) − (−4)

**25** Use "which way do I face?" to work out 3 − (−5). Say which way you face, whether you turn round, and where you land.

**26** Adding −5 and subtracting 5 give the same answer. Explain why, using the number line.

**27** At 06:00 it is −7 °C; at noon it is 4 °C. How much warmer, and why is the answer positive?

**28** Draw counters and circle the zero pairs to work out (−6) + 4. Write how many zero pairs there are and what is left.

**Practising score** _____ / 21

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Name:

## Challenging

**29** Fill the gaps and say how you worked backwards: a) $-5 + ___ = 3$
b) $___ - (-6) = 1$

**30** Two numbers add to $-2$ and one of them is 7. Find the other.

**31** A student says "subtracting always makes a number smaller". Give a counterexample and explain what they have missed.

**32** Find and describe the mistake. Nia works out $-3 - (-5) = -8$.

**33** Write two different additions that give $-2$ and use zero pairs. Draw one of them with counters.

**Challenging score** _____ **/ 18**

## Mastery

**34** Use counters to explain why taking away a negative gives the same answer as adding a positive. Write it as a general statement.

**35** Write two different calculations that give $-4$, one of which subtracts a negative. Explain your choices.

**36** Explain why adding a zero pair to a total never changes it. Use counters and an example.

**37** Try $a = 5$ and $b = -3$. Work out $a - b$ and $b - a$. What do you notice, and why?

**Mastery score** _____ **/ 12**

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# 7.2.5 Multiplying and dividing

LEARNING · PRACTISING

Name:

**Key vocabulary**

| Word | Meaning | Example |
|---|---|---|
| **product** | the answer to a multiplication | (−3) × 4 = −12 |
| **quotient** | the answer to a division | −12 ÷ 4 = −3 |
| **inverse** | the operation that undoes another one | division undoes multiplication |
| **sign** | plus or minus | the − in −5 |

## Learning

**38** Work out a) −3 × 4 b) −5 × (−2)

**39** Work out a) −20 ÷ 4 b) −18 ÷ (−3)

**40** −3 × 4 means "four lots of −3". Explain the answer using that sentence.

**41** Complete the pattern: 3 × 2 = 6, 3 × 1 = 3, 3 × 0 = 0, 3 × (−1) = ___, 3 × (−2) = ___. What does the answer go down by each time?

**42** Use the words product, quotient and inverse to complete: the answer to a multiplication is the _____. The answer to a division is the _____. Division is the _____ of multiplication.

**Learning score** _____ / 21

## Practising

**43** Work out a) −7 × 6 b) −8 × (−9) c) −56 ÷ 7

**44** Predict the sign of −2 × (−3) × (−4) before you calculate. Say how you knew, then work it out.

**45** Continue: −4 × 3 = −12, −4 × 2 = −8, −4 × 1 = ___, −4 × 0 = ___, −4 × (−1) = ___. What does the pattern show?

**46** 3 × (−4) = −12. Use this to write two division facts, and say what the word inverse means here.

**Practising score** _____ / 18

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# 7.2.5 Multiplying and dividing

CHALLENGING · MASTERY

Name:

## Challenging

**47** Fill the gaps: a) ___ × (−4) = 20
b) −6 × ___ = −42. Explain your reasoning for the signs.

**48** Why is the product of three negative numbers negative, but of four negatives positive?

**49** Work out $-4^2$ and $(-4)^2$, then explain what the brackets changed.

**50** Find and describe the mistake. Tom says (−4) × (−3) = −12.

**Challenging score** _____ / 15

## Mastery

**51** Use the pattern of products to explain why a negative times a negative must be positive. Write it so a Year 6 student would follow.

**52** a × b is positive and a is negative. What do you know about b, and why?

**53** Division undoes multiplication. Use that to explain why −24 ÷ (−6) = 4.

**54** What is (−1) to the power 100? And (−1) to the power 101? Explain how you know.

**Mastery score** _____ / 12

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# 7.2.6 (a) Order of operations

LEARNING

Name:

Every number in this set is a positive whole number, and no step gives an answer below zero. Show one operation per line.

**Step 1** Brackets: work out what is inside first

**Step 2** Indices: $5^2 = 5 \times 5 = 25$

**Step 3** × and ÷ from left to right

**Step 4** + and − from left to right

Square: $4^2 = 4 \times 4 = 16$. Square root: $\sqrt{16} = 4$, because $4^2 = 16$.

## Learning

**55** $4 + 3 \times 2$

**56** $(4 + 3) \times 2$

**57** $20 - 12 \div 4$

**58** $18 \div 3 + 6$

**59** $5 \times 4 - 2 \times 3$

**60** $\sqrt{16} + 3 \times 2$

**61** $2 + 3^2$

**62** $(2 + 3)^2$

**63** Look at questions 55 and 56. Why are the answers different?

**Learning score** _____ **/ 27**

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# 7.2.6 (a) Order of operations



Name:

## Practising

**64** $7 + 24 \div (9 - 3)$

**65** $4^2 - 3 \times 5$

**66** $3 \times (2 + 4)^2$

**67** $(15 - 3) \div 4 + 2^2$

**68** $\sqrt{81} \div 3 + 2 \times 4$

**69** $6^2 \div (5 - 1)$

**70** $2 \times 3^2 - 4 \times 2$

**71** $(8 - 2 \times 3)^2 + 5$

**72** Work out $5 + 2 \times (10 - 4)^2 \div 8$, one operation per line, with the equals signs underneath each other.

**Practising score** _____ **/ 27**

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# 7.2.6 (a) Order of operations

CHALLENGING · MASTERY

Name:

## Challenging

**73** Put brackets into $4 + 2 \times 5 - 3$ so that the answer is 27.

**74** Put brackets into $2 \times 3 + 4^2$ so that the answer is 100.

**75** Find the missing number: $4 + \square \times 3 = 19$

**76** Find and describe the mistake. Sam writes $10 - 4 + 2 = 4$.

**77** Which is larger, $2 \times 5^2$ or $(2 \times 5)^2$? Show how you know.

**Challenging score** _____ / 15

## Mastery

**78** Use 2, 3, 4 and 5 once each, with any operations and brackets, to make 24.

**79** A cinema ticket costs 9 francs and popcorn costs 4 francs. Three friends each buy one of each. Write one calculation with brackets for the total and work it out. Explain why $3 \times 9 + 4$ gives the wrong total.

**80** Is $(3 + 4)^2$ the same as $3^2 + 4^2$? Test it, then explain what you found.

**81** One student works out $8 - 2 \times 3 + 1$ and says the answer is 19. Another says 3. Who is right? Explain what the other student did.

**Mastery score** _____ / 12

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# 7.2.6 (b) Order of operations



Name:

## Learning

**82** $5 + 2 \times 3$

**83** $(5 + 2) \times 3$. Compare with your answer to question 82: why are the answers different?

**84** $-4 + 6 \div 2$

**85** $3^2 - 5$

Learning score _____ / 12

## Practising

**86** $-2 + 4 \times (-3)$

**87** $(-4 + 1) \times (-5)$

**88** $20 \div (-4) + 3$

**89** Work out a) $(-4)^2$ b) $-4^2$ c) $(-2)^3$

**90** Work out $-4 + 3 \times (-2)^2$, one operation per line, with the equals signs underneath each other.

Practising score _____ / 21

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# 7.2.6 (b) Order of operations

CHALLENGING · MASTERY

Name:

## Challenging

**91** Put brackets into $3 + 5 \times 2 - 1$ so that the answer is 15.

**92** Explain why $-3^2$ is not 9, using the order of operations.

**93** Work out $(-3)^2 - (-2)^3$, showing each stage.

**94** Find and describe the mistake. Ana works out $3 + 4 \times 2 = 14$.

**Challenging score** _____ / 12

## Mastery

**95** One student says $-2 \times 3^2 = 36$ and another says $-18$. Who is right, and what mistake did the other one make?

**96** Use the numbers $-2$, 3 and 3 with one pair of brackets and one other operation to make $-15$.

**97** Why does mathematics need one shared order of operations? What would happen without it?

**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 |
|---|---|---|---|---|
| 7.2.1 Distance from zero · 7.2.2 Ordering | Q1–18 | | | |
| 7.2.3 Adding · 7.2.4 Subtracting | Q19–37 | | | |
| 7.2.5 Multiplying and dividing | Q38–54 | | | |
| 7.2.6 (a) Order of operations | Q55–81 | | | |
| 7.2.6 (b) Order of operations | Q82–97 | | | |

## 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

## 7.2.1 Distance from zero · 7.2.2 Ordering

| | | |
|---|---|---|
| **Learning** | **1** | −9 °C, because it is further below zero |
| | **2** | −5, −1, 0, 2 |
| | **3** | Both have magnitude 6, so they differ only in direction |
| | **4** | a) < b) < c) > |
| | **5** | Yes: every negative is left of zero and every positive is right of it. |
| **Practising** | **6** | −15, −12, −3, 0, 4, 7 |
| | **7** | −8 has the greater magnitude (8 > 5), but 5 is the larger number: magnitude ignores direction, position on the number line does not |
| | **8** | a) −9 b) 14 c) 0 (zero is its own opposite) |
| | **9** | Oslo, Zurich, Madrid, Cairo (−7, −2, 5, 12) |
| | **10** | Six: −4, −3, −2, −1, 0, 1 |
| **Challenging** | **11** | −3 and −2 |
| | **12** | b is larger, and this is always true because every positive lies right of every negative |
| | **13** | −20 is 20 to the left of zero, which is further left than −2, and further left always means smaller. |
| | **14** | For example −2.5. There are infinitely many, such as −2.1 and −2.99 |
| | **15** | He ordered the negatives as if they were positive. The further a negative number is from zero, the smaller it is. The correct order is −7, −5, −2, 3. |
| **Mastery** | **16** | Any pair such as −6 and −16 |
| | **17** | 7 and −7, one either side of zero: the line is symmetric about zero, so every distance gives two numbers. |
| | **18** | 3 and −5: 4 steps right of −1 and 4 steps left of −1 |

## 7.2.3 Adding · 7.2.4 Subtracting

| | | |
|---|---|---|
| **Learning** | **19** | a) 2  b) −3  c) −6 |
| | **20** | 4, 3. The answer goes down by 1 each time, so adding a negative number makes the answer smaller. |
| | **21** | 8. Add 2 zero pairs so there are negative counters to take away. Taking away the 2 negatives leaves 8 positives, so the answer grows. |
| | **22** | 5 positive and 3 negative counters. 3 zero pairs make 0, so 2 positives are left: 5 + (−3) = 2. |
| | **23** | positive, negative, 0 |
| **Practising** | **24** | a) −13  b) 4  c) 1 |
| | **25** | Subtracting means face the negative direction (left). The negative sign turns you round to face right. Walk 5 steps right and land on 8. |
| | **26** | Both move five steps to the left, so the journey and the answer are the same |
| | **27** | 4 − (−7) = 11, eleven degrees warmer; a difference is a distance, so it is positive. |
| | **28** | 6 negatives and 4 positives. There are 4 zero pairs, so 2 negatives are left: (−6) + 4 = −2. |
| **Challenging** | **29** | a) 8  b) −5 |
| | **30** | −9 |
| | **31** | 5 − (−3) = 8 is larger than 5: subtracting a negative removes a debt, which increases the value. |
| | **32** | Subtracting a negative is the same as adding the positive, so −3 − (−5) = −3 + 5 = 2. She treated it as −3 − 5. |
| | **33** | For example 3 + (−5), 1 + (−3) or (−6) + 4. In each, the zero pairs cancel and 2 negatives are left. |
| **Mastery** | **34** | Building in zero pairs does not change the value, but it provides the negative counters to remove; what is left is the original plus that many positives, so a − (−b) = a + b |
| | **35** | For example 1 + (−5) = −4 and −7 − (−3) = −4 |
| | **36** | A zero pair is one positive and one negative counter, worth +1 and −1, which is 0. Adding 0 leaves the total the same. For example 4 is 4 positives; add a zero pair and there are 5 positives and 1 negative, and 5 + (−1) is still 4. |
| | **37** | 5 − (−3) = 8 and (−3) − 5 = −8. They are opposites: swapping the order of a subtraction changes the sign of the answer. |

## 7.2.5 Multiplying and dividing

| | | |
|---|---|---|
| **Learning** | **38** | a) −12  b) 10 |
| | **39** | a) −5  b) 6 |
| | **40** | Four lots of −3 is −3 − 3 − 3 − 3 = −12. |
| | **41** | −3, −6. It goes down by 3 each time. |
| | **42** | product, quotient, inverse |
| **Practising** | **43** | a) −42  b) 72  c) −8 |
| | **44** | Three negative signs, an odd number, so the answer is negative: −24 |
| | **45** | −4, 0, 4. Each step adds 4, so the answers must cross zero and become positive. |
| | **46** | −12 ÷ 3 = −4 and −12 ÷ (−4) = 3. Division is the inverse of multiplication: it undoes it. |
| **Challenging** | **47** | a) −5  b) 7 |
| | **48** | Each negative sign flips the answer's side of zero, so an odd number of flips lands on negative and an even number lands on positive |
| | **49** | $-4^2 = -16$ and $(-4)^2 = 16$: without brackets only the 4 is squared. |
| | **50** | Two negative numbers multiplied give a positive answer, so (−4) × (−3) = 12. He only used the multiplication fact and kept a negative sign. |
| **Mastery** | **51** | Going down the list −4 × 3, −4 × 2, −4 × 1, −4 × 0 the answers rise by 4 each time; continuing past zero gives −4 × (−1) = 4 |
| | **52** | b is negative, because only two negatives multiply to a positive |
| | **53** | 4 × (−6) = −24, and division undoes multiplication, so −24 ÷ (−6) = 4. |
| | **54** | 1 and −1. An even number of negative signs gives a positive; an odd number gives a negative. |

## 7.2.6 (a) Order of operations

| | | |
|---|---|---|
| **Learning** | **55** | $4 + 6 = 10$ |
| | **56** | $7 \times 2 = 14$ |
| | **57** | $20 - 3 = 17$ |
| | **58** | $6 + 6 = 12$ |
| | **59** | $20 - 6 = 14$ |
| | **60** | $4 + 6 = 10$ |
| | **61** | $2 + 9 = 11$ |
| | **62** | $(2 + 3)^2 = 5^2 = 25$ |
| | **63** | In the first, the multiplication is done first. In the second, the brackets make the addition happen first. |
| **Practising** | **64** | $7 + 24 \div 6 = 7 + 4 = 11$ |
| | **65** | $16 - 15 = 1$ |
| | **66** | $3 \times 6^2 = 3 \times 36 = 108$ |
| | **67** | $12 \div 4 + 4 = 3 + 4 = 7$ |
| | **68** | $9 \div 3 + 8 = 3 + 8 = 11$ |
| | **69** | $36 \div 4 = 9$ |
| | **70** | $2 \times 9 - 8 = 18 - 8 = 10$ |
| | **71** | $(8 - 6)^2 + 5 = 2^2 + 5 = 4 + 5 = 9$ |
| | **72** | $5 + 2 \times 6^2 \div 8 = 5 + 2 \times 36 \div 8 = 5 + 72 \div 8 = 5 + 9 = 14$ |
| **Challenging** | **73** | $(4 + 2) \times 5 - 3 = 30 - 3 = 27$ |
| | **74** | $(2 \times 3 + 4)^2 = 10^2 = 100$ |
| | **75** | 5, because $5 \times 3 = 15$ and $4 + 15 = 19$ |
| | **76** | Sam added first. Addition and subtraction go from left to right: $10 - 4 = 6$, then $6 + 2 = 8$. |
| | **77** | $2 \times 25 = 50$ and $10^2 = 100$, so $(2 \times 5)^2$ is larger. |
| **Mastery** | **78** | For example $(5 + 3 - 2) \times 4 = 24$, or $4 \times (5 + 3 - 2) = 24$ |
| | **79** | $3 \times (9 + 4) = 3 \times 13 = 39$ francs. $3 \times 9 + 4 = 31$ only adds one popcorn, because the multiplication is done first. |
| | **80** | No. $(3 + 4)^2 = 7^2 = 49$, but $3^2 + 4^2 = 9 + 16 = 25$. Squaring a bracket is not the same as squaring each number. |
| | **81** | 3 is right: $2 \times 3 = 6$ first, then $8 - 6 + 1 = 3$. The other student worked from left to right and ignored the order. |

## 7.2.6 (b) Order of operations

| | | |
|---|---|---|
| **Learning** | **82** | 11 |
| | **83** | 21; the brackets are done first, so the addition happens before the multiplication |
| | **84** | $-1$ |
| | **85** | $9 - 5 = 4$ |
| **Practising** | **86** | $-14$ |
| | **87** | 15 |
| | **88** | $-2$ |
| | **89** | a) 16 b) $-16$ c) $-8$ |
| | **90** | $-4 + 3 \times 4 = -4 + 12 = 8$ |
| **Challenging** | **91** | $(3 + 5) \times 2 - 1 = 15$ |
| | **92** | The power applies only to the 3, and the negative is applied afterwards, so $-3^2 = -9$ |
| | **93** | $9 - (-8) = 9 + 8 = 17$ |
| | **94** | She added first. Multiplication comes before addition, so $4 \times 2 = 8$ and then $3 + 8 = 11$. |
| **Mastery** | **95** | $-18$ is right: $3^2 = 9$ first, then $-2 \times 9$. The other student multiplied before squaring |
| | **96** | $(-2 - 3) \times 3 = -5 \times 3 = -15$ |
| | **97** | Without a shared order the same written calculation would have several answers, so no one could rely on anyone else's working. |