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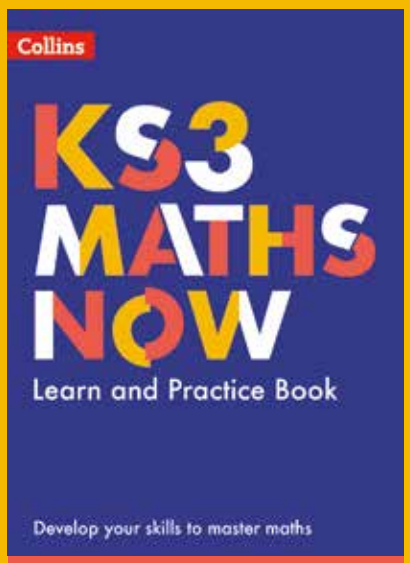

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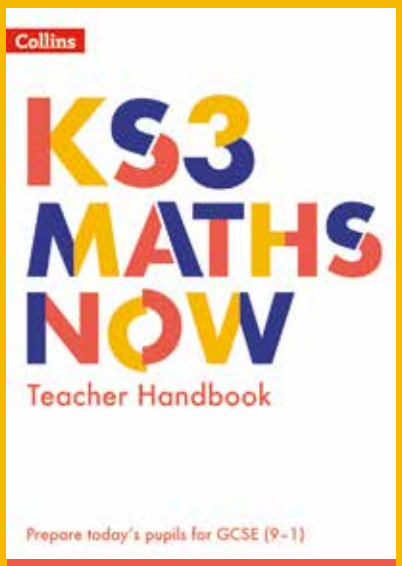

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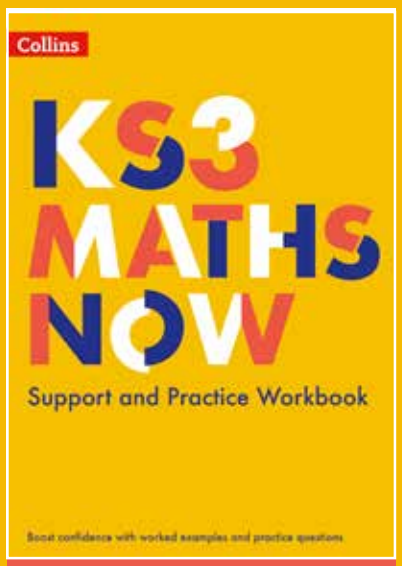

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A flexible solution that supports mastery and builds fluency, reasoning, and problem-solving at Key Stage 3

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Helping today's students master maths and be ready for GCSE 9–1

- Provides purposeful practice in fluency, reasoning and problem solving in one book
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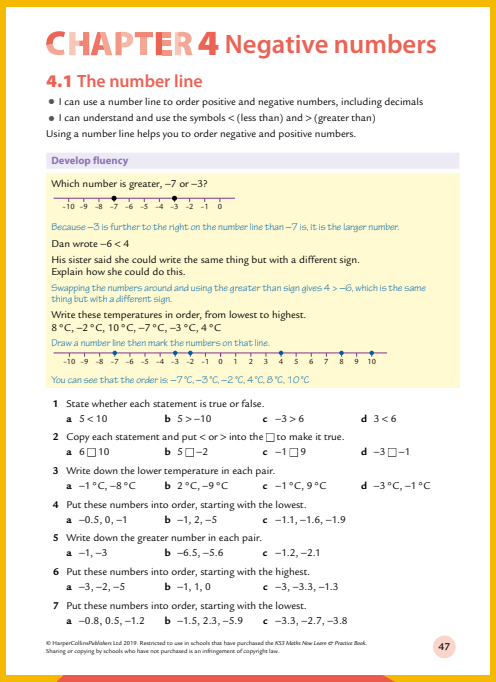

CHAPTER 4 Negative numbers

4.1 The number line

- I can use a number line to order positive and negative numbers, including decimals
- I can understand and use the symbols < (less than) and > (greater than)

Using a number line helps you to order negative and positive numbers.

Develop fluency

Which number is greater, –7 or –3?

Because –3 is further to the right on the number line than –7 is, it is the larger number.

Dan wrote –6 < 4

His sister said she could write the same thing but with a different sign.
Explain how she could do this.

Swapping the numbers around and using the greater than sign gives 4 > –6, which is the same thing but with a different sign.

Write these temperatures in order, from lowest to highest.
8 °C, –2 °C, 10 °C, –7 °C, –3 °C, 4 °C

Draw a number line then mark the numbers on that line.

You can see that the order is: –7 °C, –3 °C, –2 °C, 4 °C, 8 °C, 10 °C

1 State whether each statement is true or false.
a 5 < 10 **b** 5 > –10 **c** –3 > 6 **d** 3 < 6

2 Copy each statement and put < or > into the □ to make it true.
a 6 □ 10 **b** 5 □ –2 **c** –1 □ 9 **d** –3 □ –1

3 Write down the lower temperature in each pair.
a –1 °C, –8 °C **b** 2 °C, –9 °C **c** –1 °C, 9 °C **d** –3 °C, –1 °C

4 Put these numbers into order, starting with the lowest.
a –0.5, 0, –1 **b** –1, 2, –5 **c** –1.1, –1.6, –1.9

5 Write down the greater number in each pair.
a –1, –3 **b** –6.5, –5.6 **c** –1.2, –2.1

6 Put these numbers into order, starting with the highest.
a –3, –2, –5 **b** –1, 1, 0 **c** –3, –3.3, –1.3

7 Put these numbers into order, starting with the lowest.
a –0.8, 0.5, –1.2 **b** –1.5, 2.3, –5.9 **c** –3.3, –2.7, –3.8

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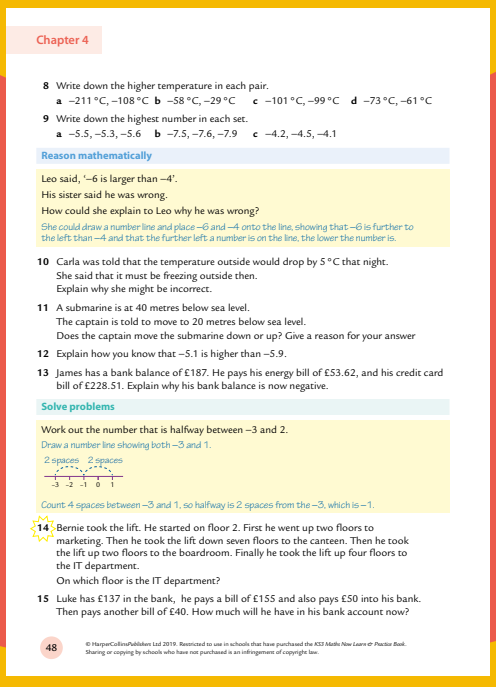

8 Write down the higher temperature in each pair.
a –211 °C, –108 °C **b** –58 °C, –29 °C **c** –101 °C, –99 °C **d** –73 °C, –61 °C

9 Write down the highest number in each set.
a –5.5, –5.3, –5.6 **b** –7.5, –7.6, –7.9 **c** –4.2, –4.5, –4.1

Reason mathematically

Leo said, '–6 is larger than –4'.
His sister said he was wrong.
How could she explain to Leo why he was wrong?

She could draw a number line and place –6 and –4 onto the line, showing that –6 is further to the left than –4 and that the further left a number is on the line, the lower the number is.

10 Carla was told that the temperature outside would drop by 5 °C that night.
She said that it must be freezing outside then.
Explain why she might be incorrect.

11 A submarine is at 40 metres below sea level.
The captain is told to move to 20 metres below sea level.
Does the captain move the submarine down or up? Give a reason for your answer

12 Explain how you know that –5.1 is higher than –5.9.

13 James has a bank balance of £187. He pays his energy bill of £53.62, and his credit card bill of £228.51. Explain why his bank balance is now negative.

Solve problems

Work out out the number that is halfway between –3 and 2.

Draw a number line showing both –3 and 1.

Count 4 spaces between –3 and 1, so halfway is 2 spaces from the –3, which is –1.

14 Bernie took the lift. He started on floor 2. First he went up two floors to marketing. Then he took the lift down seven floors to the canteen. Then he took the lift up two floors to the boardroom. Finally he took the lift up four floors to the IT department.
On which floor is the IT department?

15 Luke has £137 in the bank, he pays a bill of £155 and also pays £50 into his bank. Then pays another bill of £40. How much will he have in his bank account now?

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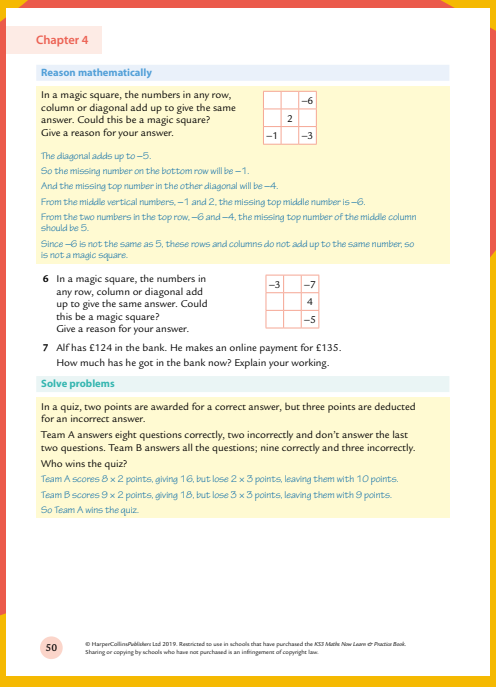

Reason mathematically

In a magic square, the numbers in any row, column or diagonal add up to give the same answer. Could this be a magic square?
Give a reason for your answer.

		–6
	2	
–1		–3

The diagonal adds up to –5.
So the missing number on the bottom row will be –1.
And the missing top number in the other diagonal will be –4.
From the middle vertical numbers, –1 and 2, the missing top middle number is –6.
From the two numbers in the top row, –6 and –4, the missing top number of the middle column should be 5.
Since –6 is not the same as 5, these rows and columns do not add up to the same number, so is not a magic square.

6 In a magic square, the numbers in any row, column or diagonal add up to give the same answer. Could this be a magic square?
Give a reason for your answer.

–3		–7
		4
		–5

7 Alf has £124 in the bank. He makes an online payment for £135.
How much has he got in the bank now? Explain your working.

Solve problems

In a quiz, two points are awarded for a correct answer, but three points are deducted for an incorrect answer.
Team A answers eight questions correctly, two incorrectly and don't answer the last two questions. Team B answers all the questions; nine correctly and three incorrectly.
Who wins the quiz?

Team A scores 8 × 2 points, giving 16, but lose 2 × 3 points, leaving them with 10 points.
Team B scores 9 × 2 points, giving 18, but lose 3 × 3 points, leaving them with 9 points.
So Team A wins the quiz.

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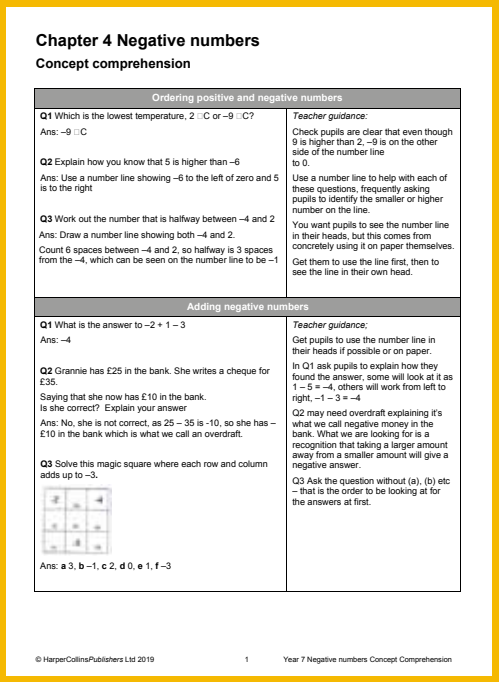
Teach a strong, coherent and well-sequenced curriculum



Chapter 4 Negative numbers

Concept comprehension

Ordering positive and negative numbers	
Q1 Which is the lowest temperature, 2 °C or –9 °C? Ans: –9 °C **Q2** Explain how you know that 5 is higher than –6 Ans: Use a number line showing –6 to the left of zero and 5 is to the right **Q3** Work out the number that is halfway between –4 and 2 Ans: Draw a number line showing both –4 and 2. Count 6 spaces between –4 and 2, so halfway is 3 spaces from the –4, which can be seen on the number line to be –1	*Teacher guidance:* Check pupils are clear that even though 9 is higher than 2, –9 is on the other side of the number line to 0. Use a number line to help with each of these questions, frequently asking pupils to identify the smaller or higher number on the line. You want pupils to see the number line in their heads, but this comes from concretely using it on paper themselves. Get them to use the line first, then to see the line in their own head.
Adding negative numbers	
Q1 What is the answer to –2 + 1 – 3 Ans: –4 **Q2** Grannie has £25 in the bank. She writes a cheque for £35. Saying that she now has £10 in the bank. Is she correct? Explain your answer Ans: No, she is not correct, as 25 – 35 is -10, so she has –£10 in the bank which is what we call an overdraft. **Q3** Solve this magic square where each row and column adds up to –3. Ans: **a** 3, **b** –1, **c** 2, **d** 0, **e** 1, **f** –3	*Teacher guidance;* Get pupils to use the number line in their heads if possible or on paper. In Q1 ask pupils to explain how they found the answer, some will look at it as 1 – 5 = –4, others will work from left to right, –1 – 3 = –4 Q2 may need overdraft explaining it's what we call negative money in the bank. What we are looking for is a recognition that taking a larger amount away from a smaller amount will give a negative answer. Q3 Ask the question without (a), (b) etc – that is the order to be looking at for the answers at first.

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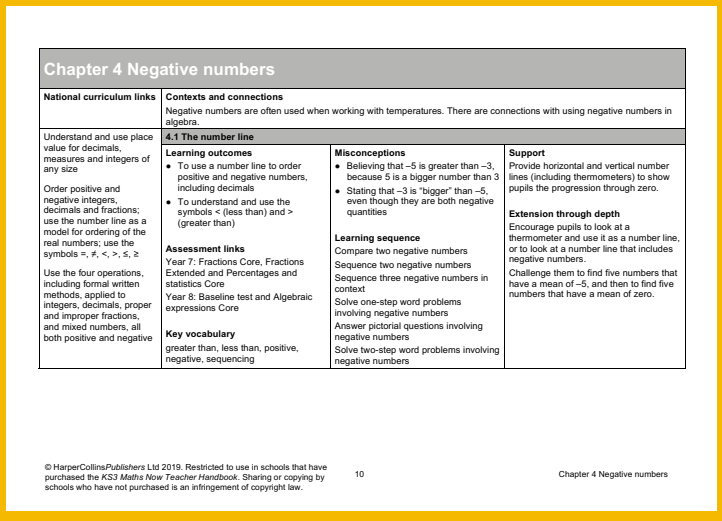
- Sets clear aims and expectations using termly schemes of learning
- Demonstrate carefully sequenced and planned knowledge mapped to national curriculum objectives
- Check understanding and assess impact of teaching with topic reviews and concept comprehension questions
- Guide students through fluency, reasoning and problem-solving questions with worked example PowerPoints
- Tackle misconceptions with support in the detailed learning schemes



Chapter 4 Negative numbers

National curriculum links	**Contexts and connections**		
	Negative numbers are often used when working with temperatures. There are connections with using negative numbers in algebra.		
Understand and use place value for decimals, measures and integers of any size Order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥ Use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative	**4.1 The number line**		
	Learning outcomes • To use a number line to order positive and negative numbers, including decimals • To understand and use the symbols < (less than) and > (greater than) **Assessment links** Year 7: Fractions Core, Fractions Extended and Percentages and statistics Core Year 8: Baseline test and Algebraic expressions Core **Key vocabulary** greater than, less than, positive, negative, sequencing	**Misconceptions** • Believing that –5 is greater than –3, because 5 is a bigger number than 3 • Stating that –3 is "bigger" than –5, even though they are both negative quantities **Learning sequence** Compare two negative numbers Sequence two negative numbers Sequence three negative numbers in context Solve one-step word problems involving negative numbers Answer pictorial questions involving negative numbers Solve two-step word problems involving negative numbers	**Support** Provide horizontal and vertical number lines (including thermometers) to show pupils the progression through zero. **Extension through depth** Encourage pupils to look at a thermometer and use it as a number line, or to look at a number line that includes negative numbers. Challenge them to find five numbers that have a mean of –5, and then to find five numbers that have a mean of zero.

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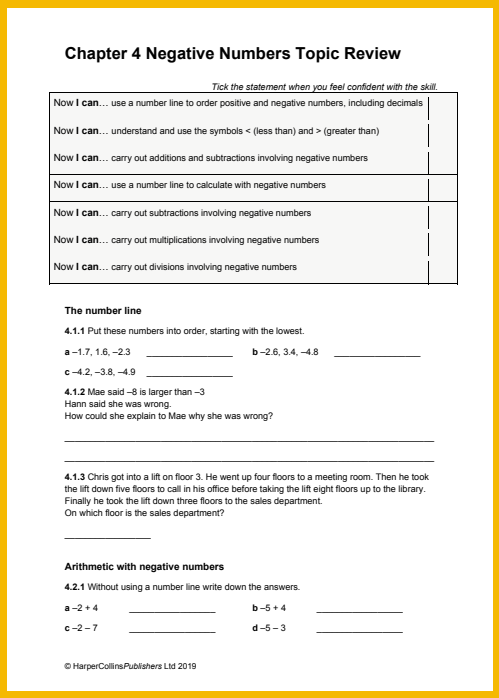

Chapter 4 Negative Numbers Topic Review

Tick the statement when you feel confident with the skill.

Now **I can**… use a number line to order positive and negative numbers, including decimals	
Now **I can**… understand and use the symbols < (less than) and > (greater than)	
Now **I can**… carry out additions and subtractions involving negative numbers	
Now **I can**… use a number line to calculate with negative numbers	
Now **I can**… carry out subtractions involving negative numbers	
Now **I can**… carry out multiplications involving negative numbers	
Now **I can**… carry out divisions involving negative numbers	

The number line

4.1.1 Put these numbers into order, starting with the lowest.

a –1.7, 1.6, –2.3 _____ **b** –2.6, 3.4, –4.8 _____

c –4.2, –3.8, –4.9 _____

4.1.2 Mae said –8 is larger than –3
Hann said she was wrong.
How could she explain to Mae why she was wrong?

_____

_____

4.1.3 Chris got into a lift on floor 3. He went up four floors to a meeting room. Then he took the lift down five floors to call in his office before taking the lift eight floors up to the library. Finally he took the lift down three floors to the sales department.
On which floor is the sales department?

_____

Arithmetic with negative numbers

4.2.1 Without using a number line write down the answers.

a –2 + 4 _____ **b** –5 + 4 _____

c –2 – 7 _____ **d** –5 – 3 _____

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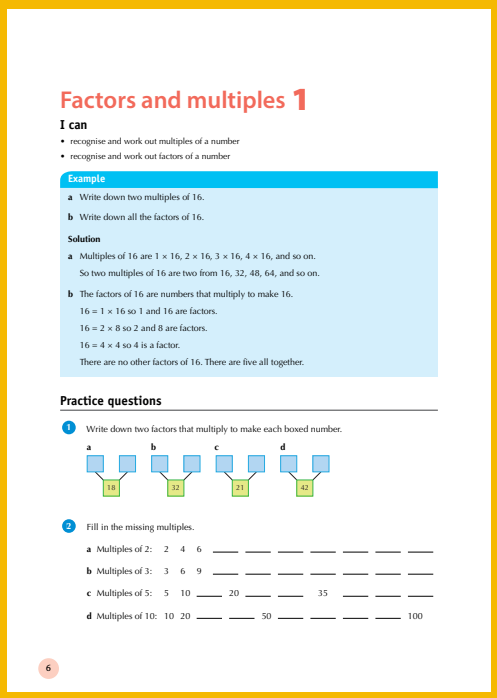


Factors and multiples 1

I can

- recognise and work out multiples of a number
- recognise and work out factors of a number

Example

a Write down two multiples of 16.

b Write down all the factors of 16.

Solution

a Multiples of 16 are 1 × 16, 2 × 16, 3 × 16, 4 × 16, and so on.
So two multiples of 16 are two from 16, 32, 48, 64, and so on.

b The factors of 16 are numbers that multiply to make 16.
16 = 1 × 16 so 1 and 16 are factors.
16 = 2 × 8 so 2 and 8 are factors.
16 = 4 × 4 so 4 is a factor.
There are no other factors of 16. There are five all together.

Practice questions

1 Write down two factors that multiply to make each boxed number.

a 18 b 32 c 21 d 42

2 Fill in the missing multiples.

a Multiples of 2: 2 4 6 ___ ___ ___ ___ ___ ___ ___

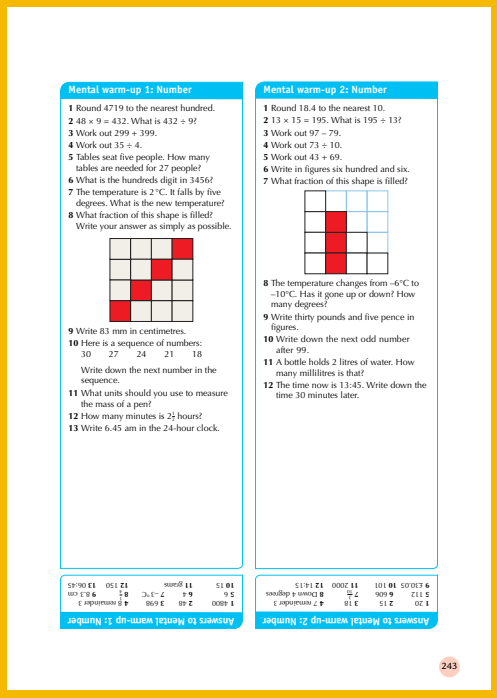
b Multiples of 3: 3 6 9 ___ ___ ___ ___ ___ ___ ___

c Multiples of 5: 5 10 ___ 20 ___ ___ 35 ___ ___ ___

d Multiples of 10: 10 20 ___ ___ 50 ___ ___ ___ ___ 100

6

- ☑ Support students struggling to access KS3 Maths
- ☑ Help pupils feel a sense of achievement with realistic, tailored practice
- ☑ Boost confidence with worked examples and scaffolded practice
- ☑ Provide practice, maths facts and mental maths tests for fluency
- ☑ Easy to use in one-to-one interventions or catch-up sessions



Mental warm-up 1: Number

1 Round 4719 to the nearest hundred.
2 48 × 9 = 432. What is 432 ÷ 9?
3 Work out 299 + 399.
4 Work out 35 ÷ 4.
5 Tables seat five people. How many tables are needed for 27 people?
6 What is the hundreds digit in 3456?
7 The temperature is 2 °C. It falls by five degrees. What is the new temperature?
8 What fraction of this shape is filled? Write your answer as simply as possible.

9 Write 83 mm in centimetres.
10 Here is a sequence of numbers:
30 27 24 21 18
Write down the next number in the sequence.
11 What units should you use to measure the mass of a pen?
12 How many minutes is 2½ hours?
13 Write 6.45 am in the 24-hour clock.

Mental warm-up 2: Number

1 Round 18.4 to the nearest 10.
2 13 × 15 = 195. What is 195 ÷ 13?
3 Work out 97 − 79.
4 Work out 73 ÷ 10.
5 Work out 43 + 69.
6 Write in figures six hundred and six.
7 What fraction of this shape is filled?

8 The temperature changes from −6 °C to −10 °C. Has it gone up or down? How many degrees?
9 Write thirty pounds and five pence in figures.
10 Write down the next odd number after 99.
11 A bottle holds 2 litres of water. How many millilitres is that?
12 The time now is 13:45. Write down the time 30 minutes later.

Answers to Mental warm-up 1: Number

1 4800 2 48 3 698 4 8 remainder 3
5 6 6 4 7 −3 °C 8 8 9 81.5 cm
10 15 11 grams 12 150 13 06:45

Answers to Mental warm-up 2: Number

1 20 2 15 3 18 4 7 remainder 3
5 112 6 606 7 $\frac{1}{2}$ 8 Down 4 degrees
9 £30.05 10 101 11 2000 12 14:15

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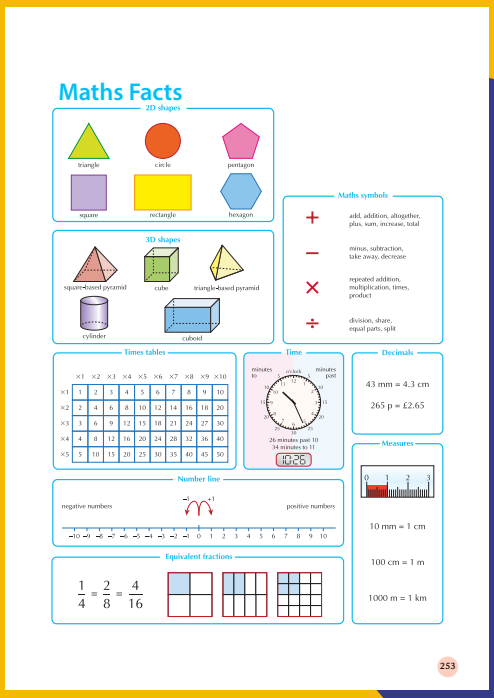

Maths Facts

2D shapes

triangle, circle, pentagon, square, rectangle, hexagon

3D shapes

square-based pyramid, cube, triangle-based pyramid, cylinder, cuboid

Maths symbols

\+ add, addition, altogether, plus, sum, increase, total

− minus, subtraction, take away, decrease

× repeated addition, multiplication, times, product

÷ division, share, equal parts, split

Times tables

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50

Time

minutes to, minutes past

26 minutes past 10
34 minutes to 11

Decimals

43 mm = 4.3 cm

265 p = £2.65

Measures

10 mm = 1 cm

100 cm = 1 m

1000 m = 1 km

Number line

negative numbers, positive numbers

Equivalent fractions

$\frac{1}{4} = \frac{2}{8} = \frac{4}{16}$

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Further support for KS3

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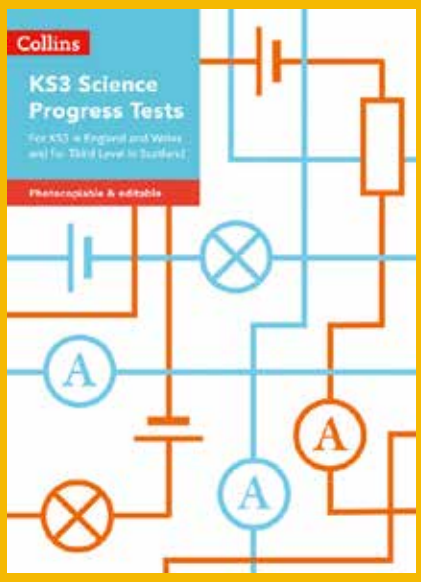

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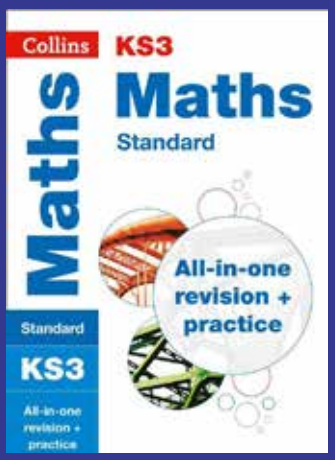

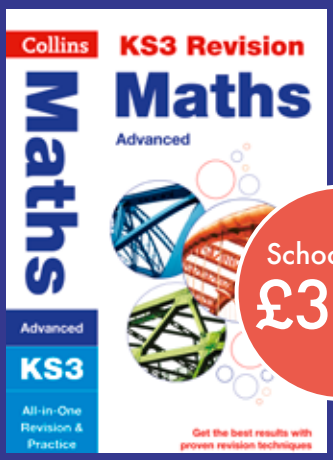

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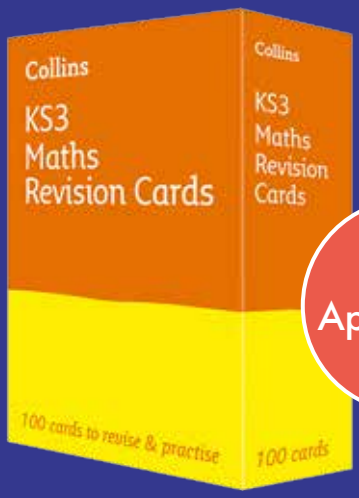

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