Primary Mathematics Scheme of Work: Class 3
Year 3 and Year 4

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Autumn 1	Number: Place Value				Number: Addition and Subtraction		
Autumn 2	Number: Multiplication and Division			Measurement Y3-Length and Perimeter Y4- Length, Perimeter and Area			Geometry: Shape
Spring 1	Number: Multiplication and Division			Number: Fractions			
Spring 2	Number: Y3- Place Value Y4- Decimals		Measurement: Mass and capacity		Number: Four operations Consolidation		
Summer 1	Number Y3-Fractions Y4-Decimals		Measurement: Money		Measurement: Time		
Summer 2	Geometry: Shape		Geometry: Position and Direction		Statistics		Number: Four operations Consolidation

Year 3

Place Value

Key concepts (National Curriculum statements)

- count from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number
- recognise the place value of each digit in a three-digit number (hundreds, tens, ones)
- compare and order numbers up to 1000
- identify, represent and estimate numbers using different representations
- read and write numbers up to 1000 in numerals and in words
- solve number problems and practical problems involving these ideas.

Notes and guidance (non-statutory)

- Pupils now use multiples of 2, 3, 4, 5, 8, 10, 50 and 100.
- They use larger numbers to at least 1000, applying partitioning related to place value using varied and increasingly complex problems, building on work in year 2 (for example, 146 = 100 + 40 and 6, 146 = 130 + 16).
- Using a variety of representations, including those related to measure, pupils continue to count in ones, tens and hundreds, so that they become fluent in the order and place value of numbers to 1000.

Possible Themes

- Work with numbers up to 1000
- Explore ways of representing numbers
- Develop skills of estimation
- Solve problems involving numbers and the number system

Key learning points

- Understand place value in numbers up to 1000
- Write numbers up to 1000
- Read numbers up to 1000
- Use zero as a place holder in numbers up to 1000
- Interpret numbers up to 1000 on a number line
- Represent numbers up to 1000 using a number line
- Interpret and use scales representing measurements with numbers up to 1000
- Use scales to represent measurements with numbers up to 1000

Prerequisite

- ✓ Understand place value in numbers up to two digits
- ✓ Read and write numbers up to 100
- ✓ Use zero as a place holder in two-digit numbers
- ✓ Use and interpret a number line to represent numbers

NCETM – Ready to Progress

Recognise the place value of each digit in a three-digit number (hundreds, tens, ones)

- For each of these numbers: 428, 205, 130, 25, 7, 909.
  Tell me:
  How many hundreds? How many tens it has? How many ones?

Identify, represent and estimate numbers using different representations

- Show me 642 on a number line, with Dienes apparatus, with place value cards, on a Gattegno grid; b) What number is halfway between 65 and 95? How do you know?

Read and write numbers up to 1000 in numerals and words

- Read these numbers 428, 205, 130, 25, 7, 909

Solve number problems and practical problems involving these ideas

- a) Jack walks 645 metres to school. Suzy walks 100 metres less. How far does Suzy walk?;
  b) What is 1 more than 485? Than 569? Than 299?;
  c) What number needs to go into each triangle? Explain why?
  642 = 600 + Δ + 2 967 = Δ + 60 + 7

Reasoning opportunities and probing questions	Mathematical Language	Possible misconceptions
• Show me a three-digit number with a tens unit of '6'. And another. And another … • Benny writes the number three hundred and six as '3006'. Do you agree with Benny? • Using a number line, show me the number 243, 567, 909, etc.	Place value Digit Hundreds Tens Ones Estimate Number line Scale	• Some pupils may write three-digit numbers literally, for example, four hundred and six as '4006' • Some pupils may ignore place value and simply write the digits mentioned in a number, for example, four hundred and six as '46'

Addition and Subtraction

Key concepts (National Curriculum statements)
Pupils should be taught to:

- add and subtract numbers mentally, including:
  a three-digit number and ones
  a three-digit number and tens
  a three-digit number and hundreds
- add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction
- estimate the answer to a calculation and use inverse operations to check answers
- solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.

Notes and guidance (non-statutory)

- Pupils practise solving varied addition and subtraction questions. For mental calculations with two-digit numbers, the answers could exceed 100.
- Pupils use their understanding of place value and partitioning, and practise using columnar addition and subtraction with increasingly large numbers up to three digits to become fluent

Possible Themes	Key learning points
• Extend mental methods of addition and subtraction • Develop written methods of addition and subtraction • Estimate answers to calculations • Solve problems involving addition and subtraction	• Add three-digit numbers and ones or tens mentally • Add three-digit numbers and hundreds mentally • Subtract three-digit numbers and one or tens mentally • Subtract three-digit numbers and hundreds mentally • Use column addition for numbers with up to three digits when carrying is not required • Use column addition for three-digit and two-digit numbers when carrying is required • Use column addition for numbers with three-digits when carrying is required • Use column subtraction for numbers with up to three digits when exchanging is not required • Use column subtraction for three-digit and two-digit numbers when exchanging is required • Use column subtraction for numbers with up to three-digits when exchanging is required • Estimate the answer to a calculation • Identify when addition or subtraction is needed as part of solving a problem

Prerequisite	NCETM – Ready to Progress
✓ Know that addition and subtraction are inverse operations ✓ Recall addition and subtraction facts to 20 ✓ Derive addition and subtraction facts to 100 ✓ Add and subtract two-digit numbers and ones (or tens) mentally	add and subtract numbers mentally, including a three-digit number and ones, a three-digit number and tens, three-digit number and hundreds add and subtract numbers with up to three digits, using formal written methods of column addition and subtraction estimate the answer to a calculation and use inverse operations to check answers solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction Examples below, addressing combinations of the requirements above, are taken from a variety of publications. ➢ What number is 27 more than 145? What number is 19 more than 145? Explain how you worked out these two calculations. ➢ Work out the missing digits: 3☐ + ☐2 = 85 ➢ Work out these subtraction calculations: 72 – 5 372 – 68 270 – 3 82 – 15 132 – 28 70 – 66 Did you use the same method for each calculation? If not, why not? Explain your methods to a friend and compare your methods with theirs. ➢ Paul says 172 – 15 = 163. Write down an addition calculation that you could do to check this. Paul's working is: 170 – 10 = 160 and 5 – 2 = 3 so 172 – 15 = 163 Can you identify where Paul has gone wrong? ➢ Layla has 45p in her money bank and 28p in her purse. How much more money does she need to buy a comic that costs £1? ➢ Ben and Jess are answering this problem: Mary has collected 61 key rings, Jo has 45. How many more key rings does Mary have than Jo? Ben does the calculation 61 + 45. Jess does the calculation 61 – 45. Who is correct? Explain how you know. Josh buys one coconut and half a kilogram of bananas. What does he pay? Show your working. Coconut Bananas 78p £1.50 per kg Explain your method to a friend.  ➢ Holly has these coins.  She wants to buy a notebook costing £1.50. How much more money does she need? I pay for a coach trip costing £7.80 with a £10 note. How much change should I get? ➢ A film starts at 6:30 pm and ends at 8:10 pm. How many minutes does the film last? ➢ I travel on a journey lasting 1 hour 25 minutes. The train leaves the station at 7:45 am. What time does the train arrive? ➢ What number is 199 more than 428? ➢ What is the difference between 1999 and 4003? ➢ One orange costs 15p. How much wo ➢ Would you use a mental, written or calculator method to solve each of these? Explain your choice. o 23.05 + ☐ = 176.25 o What is the total cost if I buy food costing £3.86 and £8.57? ➢ These are the start and finish times of a film. START 14:05 FINISH 16:25 How long was the film? ➢ A packet of crisps costs 32p. Josh buys two packets. How much change does he get from £1? Ryan buys sunglasses for £4.69 and a sun hat. How much change does he get from £10? 

Reasoning opportunities and probing questions	Mathematical Language	Possible misconceptions
• Provide examples of column addition and subtraction with missing digits. Challenge pupils to find these digits and explain their reasoning. • Show me an example of a column addition (that does not includes carrying) with the answer 576. And Another … • Show me an example of a column addition (that includes carrying) with the answer 512. And Another … • Convince me that 428 – 136 = 292 • NCETM: Addition and Subtraction Reasoning	Calculation Calculate Addition Subtraction Sum, Total Difference, Minus, Less Column addition Column subtraction Exchange Operation Estimate Inverse Operation	• Some pupils may carry the wrong carry digit (i.e. the ones digit rather than the tens digit) • Some pupils incorrectly assume and use commutativity within column subtraction; for example: 9 2 6 – 7 3 4 2 1 2 • Some pupils may not use place value settings correctly (especially when the numbers have a different number of digits)

Multiplication and Division

Key concepts (National Curriculum statements)
Pupils should be taught to:

- recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.

Notes and guidance (non-statutory)

- Pupils continue to practise their mental recall of multiplication tables when they are calculating mathematical statements in order to improve fluency. Through doubling, they connect the 2, 4 and 8 multiplication tables.
- Pupils develop efficient mental methods, for example, using commutativity and associativity (for example, $4 \times 12 \times 5 = 4 \times 5 \times 12 = 20 \times 12 = 240$) and multiplication and division facts (for example, using $3 \times 2 = 6$, $6 \div 3 = 2$ and $2 = 6 \div 3$) to derive related facts (for example, $30 \times 2 = 60$, $60 \div 3 = 20$ and $20 = 60 \div 3$).
- Pupils develop reliable written methods for multiplication and division, starting with calculations of two-digit numbers by one-digit numbers and progressing to the formal written methods of short multiplication and division.
- Pupils solve simple problems in contexts, deciding which of the four operations to use and why. These include measuring and scaling contexts, (for example, four times asn high, eight times as long etc.) and correspondence problems in which m objects are connected to n objects (for example, 3 hats and 4 coats, how many different outfits?; 12 sweets shared equally between 4 children; 4 cakes shared equally between 8 children).

Possible Themes	Key learning points
• Develop mental arithmetic skills • Develop knowledge of multiplication tables • Explore ways of writing calculations • Solve problems involving multiplication and division	• Recall and use multiplication facts for the 3 times table • Recall and use multiplication facts for the 4 times table • Recall and use multiplication facts for the 8 times table • Recall and use division facts for the 3 times table • Recall and use division facts for the 4 times table • Recall and use division facts for the 8 times table • Understand the distributive law applied to a multiplication of a two-digit number by a one-digit number • Identify the correct operation(s) required in order to solve a problem and create mathematical statements • Use known and derived facts when multiplying and dividing mentally • Use efficient methods to multiply a two-digit number by a one-digit number • Identify when a scaling (or correspondence problem) can be solved using multiplication or division

Prerequisite	NCETM – Ready to Progress
✓ Recall multiplication and division facts for 2, 5 and 10 multiplication tables ✓ Understand that multiplication and division are inverse operations ✓ Understand that multiplication is commutative	recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables ➢ multiply seven by three; what is four multiplied by nine? Etc. ➢ Circle three numbers that add to make a multiple of 4 11 12 13 14 15 16 17 18 19 ➢ Leila puts 4 seeds in each of her pots. She uses 6 pots and has 1 seed left over. How many seeds did she start with? ➢ At Christmas, there are 49 chocolates in a tin and Tim shares them between himself and 7 other members of the family. How many chocolates will each person get? write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods ➢ One orange costs nineteen pence. How much will three oranges cost? ➢ Mark drives 19 miles to work every day and 19 miles back. He does this on Mondays, Tuesdays, Wednesdays, Thursdays and Fridays. How many miles does he travel to work and back in one week? solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects ➢ Miss West needs 28 paper cups. She has to buy them in packs of 6 How many packs does she have to buy?

Reasoning opportunities and probing questions	Mathematical Language	Possible misconceptions
• Show me a multiplication (division) fact from the 3 multiplication table, 4 multiplication table, 8 multiplication table. And Another … • Ask pupils to complete the statement: '*If I know 7* × 4 = 28, then …' • Show me a problem that can be solved using multiplication, division. And Another … • Convince me that 40 × 8 = 320 • Convince me that 43 × 8 = 344 • NCETM: Multiplication and Division Reasoning	Calculation Calculate Mental arithmetic Multiplication table, Times table Multiply, Multiplication Times Product Commutative Divide, Division Inverse Operation Estimate	• Some pupils 'see' the times tables as a list of 12 unconnected facts • Some pupils do not understand multiplication is commutative. • Some pupils may write statements such as 2 ÷ 8 = 4 • Some pupils think because 3 × 5 = 5 × 3 then 15 ÷ 3 = 3 ÷ 15

Fractions

Key concepts (National Curriculum statements)
Pupils should be taught to:

- count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10
- recognise, find and write fractions of a discrete set of objects: unit fractions and nonunit fractions with small denominators
- recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators
- recognise and show, using diagrams, equivalent fractions with small denominators
- add and subtract fractions with the same denominator within one whole
- compare and order unit fractions, and fractions with the same denominators
- solve problems that involve all of the above.

Notes and guidance (non-statutory)

- Pupils connect tenths to place value, decimal measures and to division by 10. They begin to understand unit and non-unit fractions as numbers on the number line, and deduce relations between them, such as size and equivalence. They should go beyond the [0, 1] interval, including relating this to measure.
- Pupils understand the relation between unit fractions as operators (fractions of), and division by integers.
- They continue to recognise fractions in the context of parts of a whole, numbers, measurements, a shape, and unit fractions as a division of a quantity.
- Pupils practise adding and subtracting fractions with the same denominator through a variety of increasingly complex problems to improve fluency.

Possible Themes	Key learning points
• Understand the meaning of a fraction • Investigate the equivalence of fractions • Compare fractions • Develop knowledge of place value • Explore decimals • Calculate with fractions	• Recognise a unit fraction of a set of objects • Recognise a non-unit fraction of a set of objects • Write a fraction of a set of objects • Understand a unit fraction as a number • Understand a non-unit fraction as a number • Understand the concept of equivalent fractions • Recognise equivalent fractions from diagrams • Complete diagrams to show equivalent fractions • Create diagrams to show equivalent fractions • Compare a set of unit fractions • Compare a set of fractions which have the same denominator • Recognise that tenths arise from dividing a number or object into ten equal parts • Write tenths as a fraction and as a decimal • Count up in tenths • Count down in tenths • Add fractions with the same denominator within one whole • Subtract fractions with the same denominator within one whole
Prerequisite	NCETM – Ready to Progress

- ✓ Recognise, find, name and write the fractions $^1/_3$, $^1/_4$, $^2/_4$ and $^3/_4$ of a length, shape, set of objects or quantity
- ✓ Write simple fraction statements; e.g. $^1/_2$ of 6 = 3
- ✓ Recognise the equivalence of $^2/_4$ and $^1/_2$
- ✓ Understand place value in numbers up to 1000
- ✓ Connect the ten times table to place value
- ✓ Recognise and write unit and non-unit fractions
- ✓ Understand unit and non-unit fractions as numbers on a number line

recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators

Children should be able to:

- Recognise and write unit and non-unit fractions of shapes.
- **Unit Fractions.** Unit means one. Here are some examples of unit fractions.

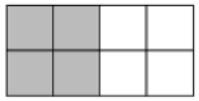
Can you spot the pattern? A unit fraction is one part of a whole that is divided into equal parts.

- **Non-unit fractions.** Unit means one, so non-unit is any number apart from one. Here are some examples of non-unit fractions.

Many (or, rather, more than one of the) parts, of an equally divided whole, is a non-unit fraction.

Taken from: BBC skillswise different types of fraction

- Understand that the number on the bottom of a fraction tells me how many pieces the whole is divided into
- What fraction of this shape is shaded? How do you know? Is there another way that you can describe the fraction?



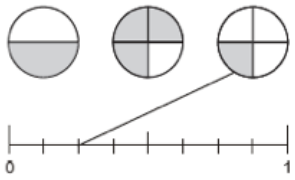
- Find fractions of amounts
  - Here are 21 apples.

Put a ring around one third of them.

recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators

Children should be able to:

- Position fractions on a number line; eg. mark fractions such as ½, 3 ½ and 2 3/10 on a number line marked from zero to 5.
- A fraction of each shape is shaded. Match each fraction to the correct place on the number line. One has been done for you.

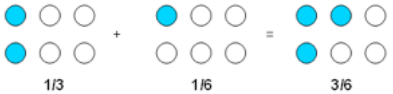


recognise and show, using diagrams, equivalent fractions with small denominators

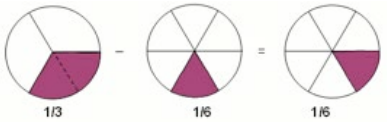
Children should be able to:

- Identify pairs of fractions that total 1.
- Circle two fractions that have the same value.
- add and subtract fractions with the same denominator within one whole (e.g. 5/7 + 1/7 = 6/7)
- This could also be done by using drawings and in the array form:

For addition:



and for subtraction:



compare and order unit fractions, and fractions with the same denominators

Children should be able to:

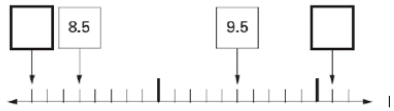
Would you rather have 1/3 of 30 sweets or 1/5 of 40 sweets? Why?

Children should be able to:

count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10

Children should be able to:

- Use decimal notation for tenths
- Divide single digits or whole numbers by 10
- Explain how finding 1/10 is the same as dividing by 10
- Here is part of a number line. Write in the numbers missing from the two empty boxes.



Reasoning opportunities and probing questions

- Show me a fraction. And another. And another.
- Which you would prefer, ½ of a cake, ⅓ of a cake or ¼ of a cake?
- Convince me that $\frac{1}{2} = \frac{2}{4}$
- Show me a picture of $\frac{1}{5}$. And another. And another.
- NCETM: Fractions Reasoning
- Show me a decimal and fraction equivalent pair. And another. And another.
- Jenny is counting in tenths '…. 2.7, 2.8, 2.9, 2.10, 2.11 …'. Do you agree with Jenny? Explain your answer.
- Convince me that 6 ÷ 10 = 0.6
- Show me two fractions that add together to make a whole. And another pair. And another pair.
- Kenny thinks that $\frac{1}{4} + \frac{1}{4} = \frac{2}{8}$. Do you agree with Kenny? Explain your answer.
- Convince me how to subtract fractions.

Mathematical Language

Fraction
Unit fraction
Non-unit fraction
Numerator
Denominator
Equivalent (fraction)
Compare
Greater than, less than
Place value
Tenth
Decimal
Divide
Fraction
Unit fraction
Non-unit fraction
Numerator
Denominator
Add
Subtract

Possible misconceptions

- Some pupils may think that diagrams to show fractions must always be circular
- Some pupils may not acknowledge that the parts in a fraction must be equal; e.g. they talk about the 'bigger half'.
- Some pupils may not appreciate the fact that a non-unit fraction is a multiple of a unit fraction
- Some pupils may think that the first place value heading after the decimal point is 'one-ths' or 'unit-ths'
- Some pupils may think that you simply add the numerators and add the denominators when adding fractions.
- Some pupils may think that you simply subtract the numerators and subtract the denominators when subtracting fractions.
- Some pupils may move from 2.9 to 2.10 when counting in tenths
  Some pupils may read the number 2.10 as 'two point ten'

Measurement

Key concepts (National Curriculum statements)
Pupils should be taught to:

- measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)
- measure the perimeter of simple 2-D shapes
- add and subtract amounts of money to give change, using both £ and p in practical contexts
- tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks
- estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes and hours; use vocabulary such as o'clock, a.m./p.m., morning, afternoon, noon and midnight
- know the number of seconds in a minute and the number of days in each month, year and leap year
- compare durations of events [for example to calculate the time taken by particular events or tasks].

Notes and guidance (non-statutory)

- Pupils continue to measure using the appropriate tools and units, progressing to using a wider range of measures, including comparing and using mixed units (for example, 1 kg and 200g) and simple equivalents of mixed units (for example, 5m = 500cm).
- The comparison of measures includes simple scaling by integers (for example, a given quantity or measure is twice as long or five times as high) and this connects to multiplication.
- Pupils continue to become fluent in recognising the value of coins, by adding and subtracting amounts, including mixed units, and giving change using manageable amounts. They record £ and p separately. The decimal recording of money is introduced formally in year 4.
- Pupils use both analogue and digital 12-hour clocks and record their times. In this way they become fluent in and prepared for using digital 24-hour clocks in year 4.

Possible Themes	Key learning points

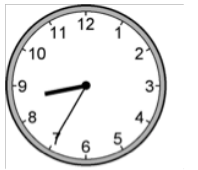
• Understand and use Roman numerals • Tell the time • Estimate time • Solve problems involving time • Develop measurement skills • Solve problems involving measurement Understand perimeter	• Read Roman numerals up to XII • Know the vocabulary of telling the time • Know the number of seconds in a minute • Know the number of days in each month, year and leap year • Tell the time from a 12-hour analogue clock to the nearest minute • Tell the time from a 24-hour analogue clock to the nearest minute • Tell the time from a clock using Roman numerals to the nearest minute • Write times using 12-hour format • Estimate times • Compare times given in seconds, minutes and/or hours • Calculate the time taken by particular events or tasks • Use a ruler to measure lengths to the nearest millimetre • Use a ruler to measure lengths to the nearest centimetre • Use measuring equipment to measure lengths to the nearest metre • Use digital and mechanical scales to measure mass to the nearest kg • Use digital and mechanical scales to measure mass to the nearest g • Use measuring vessels to measure a volume of liquid • Choose appropriate units to state the result of a measurement • Compare the length of two or more objects • Compare the mass of two or more objects • Compare the volume of two or more objects • Compare the capacity of two or more objects • Find the perimeter of a 2-D shape by measuring • Recognise the value of coins • Add amounts of money when the units are the same • Add amounts of money when the units are different • Subtract amounts of money when the units are the same • Subtract amounts of money when the units are different • Record a practical money problem using £ and/or p notation • Solve practical problems that involve calculating change in manageable amounts
Prerequisite	NCETM – Ready to Progress

- ✓ Know the number of minutes in an hour, hours in a day, and days in a week
- ✓ Tell and write the time to the nearest five minutes
- ✓ Measure length using m, cm
- ✓ Measure mass using kg, g
- ✓ Measure volume / capacity using l, ml
- ✓ Recognise the coins: 1p, 2p, 5p, 10p, 20p, 50p, £1 and £2
- ✓ Read and say amounts of money using the coins 1p, 2p, 5p, 10p, 20p, 50p, £1 and £2
- ✓ Count, say and record amounts of money using the coins 1p, 2p, 5p, 10p, 20p, 50p, £1 and £2
- ✓ Recognise the notes: £5 and £10
- ✓ Recognise the symbols for pounds (£) and pence (p)
- ✓ Record amounts of money using either pounds (£) or pence (p)
- ✓ Find different combinations of coins that equal the same amounts of money
- ✓ Solve simple problems involving money, including giving change

tell and write the time from an analogue clock, including Roman numerals from I to XII, and 12-hour and 24-hour clocks How would this time appear on a 12-hour digital clock?

Children should be able to:

- Read times like this in analogue and digital formats, including those with Roman numerals.



- Solve problems such as: Ben's clock says 7:50 when he gets up. Place the hands on this clock to show this time.

estimate and read time with increasing accuracy to the nearest minute, record and compare time in terms of seconds, minutes, hours and o'clock; use vocabulary such as a.m./p.m., morning, afternoon, noon and midnight

Children should be able to:

- Solve problems such as:
  - Kevin leaves home at quarter past 8 and arrives in school at 20 to 9. How long is his journey? How did you work this out?
  - How long is it between the times shown on these two clocks? How did you work it out?(oral question)

know the number of seconds in a minute and the number of days in each month, year and leap year

Children should be able to:

- Solve problems such as:
  - Milly uses a stop-watch to time her cat eating its breakfast one morning. The reading on the stop-watch, once the cat had finished eating, says 135 seconds. Can you convert this into minutes and seconds?

compare durations of events, for example to calculate the time taken by particular events or tasks

Children should be able to:

- Solve problems such as:
  - Estimate how long your favourite TV programme lasts. Use a television guide to work out how close your estimation was.
  - It takes 35 minutes to walk from home to school. I need to be there by 8.55 am. What time do I need to leave home?
  - How much does it cost to hire a rowing boat for three hours?
  - Sasha pays £3.00 to hire a motor boat. She goes out at 3:20 pm. By what time must she return? Explain how you solved this problem. Could you have done it in a different way?

Boat Hire	
Motor boats £1.50 for 15 minutes	Rowing boats £2.50 for 1 hour

Sally and Maria both went to the gym on Saturday. Sally was there from 2 pm until 3.30pm. Maria was there from 12.30 pm until 3.15 pm. Who spent the longer time at the gym? How much longer was she there than her friend?

Children should be able to:

- Length: Show something that they think is just shorter/longer than a metre/centimetre/millimetre. They should be able to check whether they are right.
- Mass: Say which object in the classroom is heavier than 100 g/kilogram/half-kilogram and know how to check if they are correct.
- Capacity: Find a container that they think would hold one litre and check to find out if they were correct.
- General: Say what each division on this scale is worth and explain how they worked this out. Read scales on practical equipment
- Read times like this in analogue and digital formats, including those with Roman numerals.

Measure the sides of regular polygons in centimetres and millimetres and find their perimeters in centimetres and millimetres?

add and subtract amounts of money to give change, using both £ and p in practical contexts

Children should be able to:

- Solve problems like this:

	○ Jake wants to buy a comic that costs £1. He saves 25p one week and 40p the next. How much more money does he need to buy the comic? Add these prices: £6.73, £9.10 and £7.00 to find the total. Find out how much they need to add to get £23?

Reasoning opportunities and probing questions	Mathematical Language	Possible misconceptions
• Can a 24-hour clock be analogue? For example, try and tell the time using images of the Greenwich Observatory Clock. • What is the same and what is different: *VII, 7, I, IV* ? • Always, sometimes, never: Only one month has 28 days. • NCETM: Measurement Reasoning • Show me something in the classroom that is between 20 cm and 40 cm. And another. And another. • Kenny measures two lines; 1 m and 35 cm. He says the difference is 650 mm. Do you agree with Kenny? Explain your answer. • Convince me how to find the perimeter of a shape. • Create a shape with a perimeter greater than 30 cm. • Kenny thinks that 'the larger the size of the coin, the greater the value of the coin'. Do you agree with Kenny? • What is the same and what is different: *2p coin, 5p coin, 10p coin, 20p coin?* • Jenny buys four items and pays with a £5 note. She gets three £1 coins and three 10p coins in her change. Convince me she could have paid for the four items using exactly five coins. Benny buys four items costing 10p, 50p, 10p and 5p. He pays with a £1 coin. He only expects to get one coin in his change. Do you agree with Benny? Explain your answer	Analogue 12-hour 24-hour o'clock Morning Afternoon Noon, Midnight Second, Minute, Hour Day, Week, Month Year Leap year Roman Numeral Length, distance Mass Volume Capacity Metre, centimetre, millimetre Kilogram, gram Litre, millilitre Perimeter 2-D Money Coin Change Note **Notation** Pounds (£) Pence (p)	• The use of IIII on a clock face suggests that a Roman numeral can be repeated four times, but this is a special case. In general, three is the maximum number of repeats and the subtractive method should be used instead (i.e. IV) • Some pupils may think that all months have the same number of days. • Some pupils do not have a realistic sense of the length of one minute (usually they count one, two, three … etc. far too quickly!) • Some pupils may think that you put the end of the ruler (rather than the '0') at the start of a line to measure it. • Some pupils may think that the conversion factor between all measures is multiply or divide by 10. • Some pupils may think that milli- refers to 'million' • Some pupils may think that the larger the size of the coin, the greater the value of the coin, for example, a 2p coin is greater in value than a 5p coin. • Some pupils may ignore the units in the first instance and simply add the numerical value of the coins, for example, 10p coin + £1 coin = 11p or £11 • Some pupils may try and use the £ and p notation together, such as £3p rather than £3 or 300p.

Geometry

Key concepts (National Curriculum statements)
Pupils should be taught to:

- draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them
- recognise angles as a property of shape or a description of a turn
- identify right angles, recognise that two right angles make a half-turn, three make three quarters of a turn and four a complete turn; identify whether angles are greater than or less than a right angle
- identify horizontal and vertical lines and pairs of perpendicular and parallel lines.

Notes and guidance (non-statutory)

- Pupils' knowledge of the properties of shapes is extended at this stage to symmetrical and non-symmetrical polygons and polyhedra. Pupils extend their use of the properties of shapes. They should be able to describe the properties of 2-D and 3-D shapes using accurate language, including lengths of lines and acute and obtuse for angles greater or lesser than a right angle.
- Pupils connect decimals and rounding to drawing and measuring straight lines in centimeters, in a variety of contexts.
-

Possible Themes

- Classify lines
- Construct 2D shapes
- Explore 3D shapes
- Explore angles and turning
- Compare angles

Key learning points

- Identify and draw horizontal and vertical lines
- Identify and draw parallel lines
- Identify and draw perpendicular lines
- Sketch common 2D shapes
- Draw and measure a line in centimetres
- Construct common 2D shapes using a ruler
- Make and identify 3D shapes using modelling materials
- Describe 3D shapes using mathematical language
- Understand that angle is a description of turn
- Understand that angles are a feature of shapes
- Identify a right angle as a quarter turn and when a shape has a right angle
- Recognise that two right angles make a half-turn
- Recognise that three right angles make three quarters of a turn
- Recognise that four right angles make a complete turn
- Identify angles that are less than right angle
- Identify angles that are greater than a right angle

Prerequisite

- ✓ Know the names of common 2D shapes
- ✓ Know the names of cuboids, prisms, spheres, pyramids and cones
- ✓ Know the meaning of side, edge, vertex (vertices) and face
- ✓ Use a straight edge to construct lines and shapes
- ✓ Recognise and name the fractions $^1/_2$, $^1/_4$, $^2/_4$, $^3/_4$

NCETM – Ready to Progress

The requirements for Year 3 in Geometry: Properties of Shapes are quite explicit and exemplars are not particularly helpful. It is helpful, however, to understand that, in Year 3, pupils should be expected to demonstrate understanding in this area by:

- using appropriate mathematical vocabulary to describe the features of common 2-D and 3-D shapes including semicircles, hemispheres and prisms
- sorting and classifying collections of 2-D shapes in different ways using a range of properties including: 'all sides are of equal length,' 'has at least one right angle' or 'has at least one line of symmetry'

recording their classifications on Venn and Carroll diagrams, including diagrams involving more than one criterion.

Reasoning opportunities and probing questions

- Show me a pair of parallel lines, perpendicular lines, a vertical line, a horizontal line. And Another …
- Always/Sometimes/Never: Perpendicular lines are horizontal and vertical.
- Convince me that parallel lines can be curved.
- Convince me that a square is a rectangle.
- NCETM: Geometry - Properties of Shapes Reasoning
- Show me a right angle in this classroom. And another. And another.
- Show me an angle in this classroom less (greater) than a right angle. And another. And another.
- Is this a right angle? Explain your answer.

- Convince me why this is not called a 'left' angle!

Mathematical Language

Horizontal
Vertical
Perpendicular
Parallel
Face, Edge, Vertex (Vertices)
Cube, Cuboid, Prism, Cylinder, Pyramid, Cone, Sphere
Quadrilateral
Square, Rectangle, Parallelogram, (Isosceles) Trapezium, Kite, Rhombus
Triangle, Circle
Polygon, Hexagon, Pentagon, Octagon, Decagon
Half
Quarter
Three quarters
Angle
Turn
Right angle
Greater than, less than

Possible misconceptions

- Pupils may believe, incorrectly, that:
  - perpendicular lines have to be horizontal / vertical
  - only straight lines can be parallel
- Some pupils may think that a square and rectangle are two different shapes.
- Pupils may believe, incorrectly, that all 3-D shapes are prisms
- Some pupils may think that right angles have to look like this:

- Some pupils may think that right angles have to be created from a horizontal and vertical line
  Some pupils may think that all turns have to be in a clockwise direction

Statistics

Key concepts (National Curriculum statements)
Pupils should be taught to:

- interpret and present data using bar charts, pictograms and tables
- solve one-step and two-step questions [for example, 'How many more?' and 'How many fewer?'] using information presented in scaled bar charts and pictograms and tables.

Notes and guidance (non-statutory)

- Pupils understand and use simple scales (for example, 2, 5, 10 units per cm) in pictograms and bar charts with increasing accuracy.
- They continue to interpret data presented in many contexts.

Possible Themes

- Explore ways to show data
- Solve problems involving charts and tables

Key learning points

- Interpret a pictogram where the symbol represents multiple items
- Construct a pictogram where the symbol represents multiple items
- Interpret a bar chart
- Construct a bar chart
- Interpret data in a table
- Create a table to show data
- Answer one-step questions about data in charts and tables (e.g. 'How many?')
- Answer two-step questions about data in charts and tables (e.g. 'How many more?')

Prerequisite

- ✓ Interpret and construct block diagrams
- ✓ Interpret and construct pictograms where the symbol represents a single item or 2,5 and 10 units.
- ✓ Interpret and construct simple tables
- ✓ Understand tallying

NCETM – Ready to Progress

interpret and present data using bar charts, pictograms and tables

- Process, present and interpret data to pose and answer questions. They use all representations such as Venn and Carroll diagrams, bar charts, pictograms. They collect data quickly onto a class tally chart.
- Children recognise that a tally involves grouping in fives and that this helps them to count the frequencies quickly and accurately. They produce a simple pictogram and/or bar chart, where a symbol represents 2 units.
- Children sort and classify objects, numbers or shapes according to two criteria, and display this work on Venn and Carroll diagrams.

solve one-step and two-step questions such as 'How many more?' and 'How many fewer?' using information presented in scaled bar charts and pictograms and tables

- Collect, represent and interpret data in order to answer a question that is relevant to them, for example:
  - What new addition to the school play equipment would you like?
  - Which class race shall we choose for sports day?
- They decide on the information they need to collect and collect it efficiently. They collate the information on a tally chart or frequency table, then use this to make simple frequency diagrams such as bar charts, using ICT where appropriate. They discuss the outcomes, responding to questions such as:
  - Which items had fewer than five votes?
  - Would the table be the same if we asked Year 6?
  - How might the table change if everyone had two votes?

Children present their conclusions to others, identifying key points that should be included. They make suggestions as to how this data could be used; for example, they may decide that they need to investigate the price of different equipment or discuss what they need to do to prepare for their chosen race.

Reasoning opportunities and probing questions	Mathematical Language	Possible misconceptions
• Show me a bar chart. And another. And another. • Kenny thinks that a bar chart is the same as a block diagram. Do you agree with Kenny? Explain your answer. • Jenny draws a bar chart with gaps between the bars. Lenny draws a bar chart with no gaps between the bars. Who is correct? Explain your answer. • Penny draws a bar chart with horizontal bars. Benny says the bars must be vertical. Who is correct? Explain your answer. • Always/Sometimes/Never**:** One centimetre on the frequency axis of a bar chart represents one unit. • NCETM: Statistics Reasoning	Data Pictogram Symbol Key Tally Bar chart Table Total Compare Axis **Notation** When tallying, groups of five are created by striking through each group of four	• Some pupils may not leave gaps between the bars in a bar chart • Some pupils may think that one centimetre on the frequency axis of a bar chart always represents one unit in a bar chart. • Some pupils may think that a symbol always represents one unit in a pictogram. • Some pupils may think that the bars of a bar chart must be vertical.

Year 4

Place Value

Key concepts (National Curriculum statements)

- count in multiples of 6, 7, 9, 25 and 1000
- find 1000 more or less than a given number
- count backwards through zero to include negative numbers
- recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones)
- order and compare numbers beyond 1000
- identify, represent and estimate numbers using different representations
- round any number to the nearest 10, 100 or 1000
- solve number and practical problems that involve all of the above and with increasingly large positive numbers
- read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value.

Notes and guidance (non-statutory)

- Using a variety of representations, including measures, pupils become fluent in the order and place value of numbers beyond 1,000, including counting in 10s and 100s, and maintaining fluency in other multiples through varied and frequent practice.
- They begin to extend their knowledge of the number system to include the decimal numbers and fractions that they have met so far.
- They connect estimation and rounding numbers to the use of measuring instruments.
- Roman numerals should be put in their historical context so pupils understand that there have been different ways to write whole numbers and that the important concepts of 0 and place value were introduced over a period of time.

Possible Themes	Key learning points
• Work with numbers less than 10 000 • Understand and use Roman numerals • Explore the history of our number system • Explore ways of representing numbers • Develop skills of estimation	• Order numbers up to and including those with four digits • Write numbers up to and including those with four digits • Read numbers up to and including those with four digits • Read Roman numerals up to C • Understand the difference between the Roman numeral system and the decimal number system • Interpret numbers up to 10 000 on a number line • Represent numbers up to 10 000 using a number line • Use and interpret scales representing measurements with numbers up to 10 000 • Approximate any number by rounding to the nearest 10, 100 or 1000 • Approximate any number with one decimal place by rounding to the nearest whole number • Understand checking as the process of working backwards from the answer to ensure that it makes sense • Understand estimating as the process of finding a rough value of an answer or calculation • Order numbers up to and including those with four digits • Write numbers up to and including those with four digits • Read numbers up to and including those with four digits • Read Roman numerals up to C • Understand the difference between the Roman numeral system and the decimal number system • Interpret numbers up to 10 000 on a number line • Represent numbers up to 10 000 using a number line • Use and interpret scales representing measurements with numbers up to 10 000
Prerequisite	NCETM – Ready to Progress

- ✓ Understand place value in numbers up to three digits
- ✓ Know the Roman numerals I, V and X
- ✓ Read Roman numerals up to XII
- ✓ Use zero as a place holder in two- and three-digit numbers
- ✓ Use and interpret a number line to represent numbers
- ✓ Order and compare numbers up to 10 000
- ✓ Order and compare numbers with one decimal place
- ✓ Know that addition and subtraction are inverses of each other
- ✓ Know that multiplication and division are inverses of each other

Recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones)

Children should be able to:

- Give the value of a digit in a given number e.g. the 7 in 3 274
- Write in figures a given number e.g. four thousand and twenty.
- Recognise a number partitioned like this: 4 000 + 200 + 60 + 3 and be able to read and write the number.
- Create the biggest and smallest whole number with four digits eg. 3, 0, 6, 5
- Find missing numbers in a number sentence e.g. _ +_ = 1249

Order and compare numbers beyond 1000

Children should be able to:

- Find numbers that could go in the boxes to make these correct, □ + □ < 2000, 3000 > □ – □

Identify, represent and estimate numbers using different representations

Children should be able to:

- Answer questions such as, which of these numbers is closest to the answer of 342 – 119: 200 220 230 250 300
- Identify what the digit 7 represents in each of these amounts: £2.70, 7.35m, £0.37, 7.07m

Read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value

This is new content for the primary national curriculum in England. Suggestions for what children should be able to do include;

- Know what each letter represents in Roman numerals and be able to convert from Roman numeral to our current system (Arabic) and from Arabic to Roman e.g. 76 = _ *in Roman numerals, CLXIX =* _ Arabic numerals.
- Know that the current western numeral system is the modified version of the Hindu numeral system developed in India to include the concept of zero and place value.

identify, represent and estimate numbers using different representations

Children should be able to:

- Answer questions such as, which of these numbers is closest to the answer of 342 – 119: 200 220 230 250 300
- Identify what the digit 7 represents in each of these amounts: £2.70, 7.35m, £0.37, 7.07m

round any number to the nearest 10, 100 or 1000

Children should be able to:

- Explain tips to give someone who is learning how to round numbers to the nearest 10, or 1000.
- Answer questions such as, I rounded a number to the nearest 10. The answer is 340. What number could I have started with? Know what to look for first when you order a set of numbers and know which part of each number to look at to help you.

round decimals with one decimal place to the nearest whole number

- Round these to the nearest whole number. For example:
  9.7, 25.6, 148.3
- Round these lengths to the nearest metre:
  1.5m, 6.7m, 4.1m, 8.9m
- Round these costs to the nearest £:
  £3.27, £12.60, £14.05, £6.50

compare numbers with the same number of decimal places up to two decimal places

- Place these decimals on a line from 0 to 2:
  0.3, 0.1, 0.9, 0.5, 1.2, 1.9

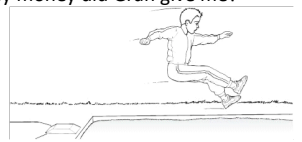
- Which is lighter: 3.5kg or 5.5kg? 3.72kg or 3.27kg? Which is less: £4.50 or £4.05?
- Put in order, largest/smallest first:
  6.2, 5.7, 4.5, 7.6, 5.2, 99, 1.99, 1.2, 2.1
- Convert pounds to pence and vice versa. For example: Write 578p in £.
- How many pence is £5.98, £5.60, £7.06, £4.00? Write the total of ten £1 coins and seven 1p coins (£10.07)
- Write centimetres in metres. For example, write: 125 cm in metres (1.25 metres)

solve simple measure and money problems involving fractions and decimals to two decimal places.

- These are the prices in a shoe shop. How much more do the boots cost than the trainers? Rosie buys a pair of trainers and a pair of sandals. How much change does she get from £50?

- A box of four balls costs £2.96. How much does each ball cost? Dean and Alex buy 3 boxes of balls between them. Dean pays £4.50. How much must Alex pay? KS2 Paper B level 3

- A full bucket holds 5½ litres. A full jug holds ½ a litre. How many jugs full of water will fill the bucket?
- Harry spent one quarter of his savings on a book. What did the book cost if he saved: £8…£10…£2.40…?
- Gran gave me £8 of my £10 birthday money. What fraction of my birthday money did Gran give me?
- Max jumped **2.25 metres** on his **second** try at the long jump.
  This was **75 centimetres** longer than on his **first** try.
  How far in **metres** did he jump on his **first** try?



Reasoning opportunities and probing questions	Mathematical Language	Possible misconceptions
• Show me a four-digit number with a tens unit of '6'. And another. And another … • Kenny writes the number 99 in Roman numerals as IC. Jenny thinks is should be LXXXXVIIII. Do you agree with Kenny or Jenny? • Benny writes the number two thousand and thirty six as '20036'. Do you agree with Benny? • What's the same and what's different: Roman numerals and Base 10 (Denary) number system? • Convince me that 15 rounds to 20 to the nearest 10 • What is the same and what is different: 595, 649, 534 and 634 • Kenny thinks that 4.6 rounds to 4 to the nearest whole number. Do you agree? Explain your answer. • NCETM: Place Value Reasoning	Place value Digit Thousands Hundreds Tens Ones Zero Roman Numeral Estimate Number line Scale	• Some pupils may think that zero is positive as it does not have a negative symbol • Some pupils may use 'base 10 thinking' to write Roman numerals, for example 49 as 'IL' as it is 'one less than fifty' • Some pupils may write four digits numbers literally, for example, four thousand and twenty six as '400026' • Some pupils may ignore place value and simply write the digits mentioned in a number, for example, four thousand and twenty six as '426' • Some pupils may truncate instead of round • Some pupils may misunderstand the rounding process as one that works from the end of the number; for example 347 to the nearest 100 is worked out as 347 → 350 → 400. • Some pupils may round down at the half way point, rather than round up.

Addition and Subtraction

Key concepts (National Curriculum statements)
Pupils should be taught to:

- add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.

Notes and guidance (non-statutory)

- Pupils continue to practise both mental methods and columnar addition and subtraction with increasingly large numbers to aid fluency

Possible Themes	Key learning points
• Develop mental methods of addition and subtraction • Extend written methods of addition and subtraction • Solve problems involving addition and subtraction	• Find 1000 more than a given number • Find 1000 less than a given number • Use columnar addition for numbers with up to four digits with no carrying required • Use columnar addition for four-digit and two-digit numbers with carrying required • Use columnar addition for four-digit and three-digit numbers with carrying required • Use columnar addition for four-digit numbers with carrying required • Use columnar subtraction for numbers with up to four digits with no exchanging required • Use columnar subtraction for four-digit and two-digit numbers with exchanging required • Use columnar subtraction for four-digit and three-digit numbers with exchanging required • Use columnar subtraction for four-digit and four-digit numbers with exchanging required • Solve two-step problems involving addition and/or subtraction
Prerequisite	NCETM – Ready to Progress

- ✓ Find 100 more or less than a given number
- ✓ Use column addition and subtraction for numbers up to three digits

add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate

7 8 9 + 6 4 2 1 4 3 1 1 1	8 7 4 − 5 2 3 3 5 1	8 12 1 9 3 2 − 4 5 7 4 7 5	1 1 9 3 2 − 4 5 7 4 7 5
Answer: 1431	Answer: 351	Answer: 475	Answer: 475

estimate and use inverse operations to check answers to a calculation

- Tina has read the first 85 pages in a book that is 150 pages long. Which number sentence could Tina use to find the number of pages she must read to finish the book?

  A 150 + 85 = ☐
  B ☐ – 85 = 150
  C 150 ÷85 = ☐
  D 150 – 85 = ☐

solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why

Children should be able to carry out practical tasks such as that represented here in an Australian classroom.

- Children were asked to individually run the class market stall. They were told they could use mental strategies or the whiteboard provided to assist them in their calculations. The customer (their teacher) would come to purchase some items. Each child was asked to solve a transaction problem involving a single item (calculating change – subtraction) and then a transaction involving two items (adding together values and then calculating change or two subsequent subtractions). They were also asked to explain their thinking and asked how to give the change in a different way (representing money values in various ways).

Children should be able to solve problems such as:

- I have read 134 of the 512 pages of my book. How many more pages must I read to reach the middle?
- There are 8 shelves of books. 6 of the shelves hold 25 books each. 2 of the shelves have 35 books each. How many books altogether are on the shelves?
- I think of a number, subtract 17, and divide by 6. The answer is 20. What was my number?
- You start to read a book on Thursday. On Friday you read 10 more pages than on Thursday. You reach page 60. How many pages did you read on Thursday?

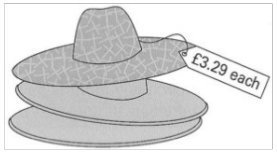
Amir and Lara buy some fruit.

grapes	pineapples	peaches
£2.50 for 1 kg	£1.40 each	£1.99 for a box

Amir buys 2 pineapples and a box of peaches.
How much does he pay?

Lara buys half a kilogram of grapes and one pineapple.
How much change does she get from £5?

A shop sells sun hats.



Ryan buys some sunglasses for £4.69 and a sun hat. How much change does he get from £10?

Reasoning opportunities and probing questions	Mathematical Language	Possible misconceptions
• Provide examples of column addition and subtraction with hidden digits. Challenge pupils to find these digits and explain their reasoning. • Show me an example of a column addition (that includes carrying) with the answer 2106 • Convince me that 6095 – 3622 = 2473 • NCETM: Addition and Subtraction Reasoning	Addition Subtraction Sum, Total Difference, Minus, Less Column addition Column subtraction Exchange Operation Estimate	• Some pupils incorrectly assume and use commutativity within column subtraction; for example: 4 1 2 6 – 3 7 3 4 1 6 1 2 • Some pupils may not use place value settings correctly (especially when the numbers have a different number of digits)

Multiplication and Division

Key concepts (National Curriculum statements)
Pupils should be taught to:

- recall multiplication and division facts for multiplication tables up to 12 × 12
- use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers
- recognise and use factor pairs and commutativity in mental calculations
- multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

Notes and guidance (non-statutory)

- Pupils continue to practise recalling and using multiplication tables and related division facts to aid fluency.
- Pupils practise mental methods and extend this to three-digit numbers to derive facts, (for example 600 ÷ 3 = 200 can be derived from 2 x 3 = 6).
- Pupils write statements about the equality of expressions (for example, use the distributive law 39 × 7 = 30 × 7 + 9 × 7 and associative law (2 × 3) × 4 = 2 × (3 × 4)).
- They combine their knowledge of number facts and rules of arithmetic to solve mental and written calculations for example, 2 x 6 x 5 = 10 x 6 = 60.
- Pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as the numbers of choices of a meal on a menu, or three cakes shared equally between 10 children

Possible Themes	Key learning points
• Develop mental arithmetic skills • Develop knowledge of multiplication tables • Explore place value • Develop written methods of multiplication • Solve problems involving multiplication and division	• Recall and use multiplication facts for the 6 times table • Recall and use multiplication facts for the 7 times table • Recall and use multiplication facts for the 9 times table • Recall and use multiplication facts for the 11 times table • Recall and use multiplication facts for the 12 times table • Recall and use division facts for the 6 times table • Recall and use division facts for the 7 times table • Recall and use division facts for the 9 times table • Recall and use division facts for the 11 times table • Recall and use division facts for the 12 times table • Use knowledge of factor pairs (commutativity) when multiplying and dividing mentally including multiplying three numbers together • Know the effect of multiplying by 0 and 1 and dividing by 1 • Use the distributive law to multiply a two-digit number by a one-digit number • Use short multiplication to multiply a two-digit number by a one-digit number • Use short multiplication to multiply a three-digit number by a one-digit number • Identify when a scaling or correspondence problem can be solved using multiplication or division
Prerequisite	NCETM – Ready to Progress

✓ Recall multiplication and division facts for 2, 3, 4, 5, 8 and 10 multiplication tables ✓ Understand that multiplication and division are inverse operations	recall multiplication and division facts for multiplication tables up to 12 × 12 Children should be able to: ➢ Pupils continue to practise recalling and using multiplication tables and related division facts to aid fluency. ➢ *e.g. One orange costs nineteen pence. How much will three oranges cost?* ➢ *What is twenty-one multiplied by nine?* ➢ *How many twos are there in four hundred and forty?* use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers Children should be able to: ➢ Pupils practise mental methods and extend this to three-digit numbers to derive facts, for example 200 × 3 = 600 into 600 ÷ 3 = 200. ➢ *e.g. Divide thirty-one point five by ten.* ➢ *Ten times a number is eighty-six. What is the number?* recognise and use factor pairs and commutativity in mental calculations Children should be able to: ➢ Pupils write statements about the equality of expressions (e.g. use the distributive law 39 × 7 = 30 × 7 + 9 × 7 and associative law (2 × 3) × 4 = 2 × (3 × 4)). They combine their knowledge of number facts and rules of arithmetic to solve mental and written calculations e.g. 2 x 6 x 5 = 10 x 6. ➢ *e.g. Understand and use when appropriate the principles (but not the names) of the commutative, associative and distributive laws as they apply to multiplication:* ➢ *Example of commutative law 8 × 15 = 15 × 8* ➢ *Example of associative law 6 × 15 = 6 × (5 × 3) = (6 × 5) × 3 = 30 × 3 = 90* ➢ *Example of distributive law 18 × 5 = (10 + 8) × 5 = (10 × 5) + (8 × 5) = 50 + 40 = 90* solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects Children should be able to: ➢ Pupils solve two-step problems in contexts, choosing the appropriate operation, working with increasingly harder numbers. This should include correspondence questions such as the numbers of choices of a meal on a menu, or three cakes shared equally between 10 children. ➢ *e.g. 185 people go to the school concert. They pay £l.35 each. How much ticket money is collected?* ➢ *Programmes cost 15p each. Selling programmes raises £12.30. How many programmes are sold?*

Reasoning opportunities and probing questions	Mathematical Language	Possible misconceptions
• Provide examples of multiplication of two-digit and three-digit numbers by a one-digit number using formal written layout with missing digits. Challenge pupils to find these digits and explain their reasoning. • A × B × C = 120. Show me possible values for A, B and C. And another triple. And another triple. • Always/Sometimes/Never: *'When you multiply two number together, the answer is greater than both of the two numbers'.* • NCETM: Multiplication and Division Reasoning	Mental arithmetic Place value Multiply, Multiplication, Times, Product Commutative Divide, Division Tenth, Hundredth Factor, Factor pairs Short multiplication Operation Estimate	• Some pupils may write statements such as 2 ÷ 8 = 4 • Some pupils may carry the wrong digit when using short multiplication; for example: 3 4 5 × 3 1 5

Fractions including decimals

Key concepts (National Curriculum statements)
Pupils should be taught to:

- recognise and show, using diagrams, families of common equivalent fractions
- count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten.
- solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number
- add and subtract fractions with the same denominator
- recognise and write decimal equivalents of any number of tenths or hundredths
- recognise and write decimal equivalents to 1/4, ½, ¾
- find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths
- round decimals with one decimal place to the nearest whole number
- compare numbers with the same number of decimal places up to two decimal places
- solve simple measure and money problems involving fractions and decimals to two decimal places.

Notes and guidance (non-statutory)

- Pupils should connect hundredths to tenths and place value and decimal measure. They extend the use of the number line to connect fractions, numbers and measures.
- Pupils understand the relation between non-unit fractions and multiplication and division of quantities, with particular emphasis on tenths and hundredths.
- Pupils make connections between fractions of a length, of a shape and as a representation of one whole or set of quantities. Pupils use factors and multiples to recognise equivalent fractions and simplify where appropriate
- Pupils continue to practise adding and subtracting fractions with the same denominator, to become fluent through a variety of increasingly complex problems beyond one whole.
- Pupils are taught throughout that decimals and fractions are different ways of expressing numbers and proportions.
- Pupils' understanding of the number system and decimal place value is extended at this stage to tenths and then hundredths. This includes relating the decimal notation to division of whole number by 10 and later 100.
- They practise counting using simple fractions and decimals, both forwards and backwards.
- Pupils learn decimal notation and the language associated with it, including in the context of measurements. They make comparisons and order decimal amounts and quantities that are expressed to the same number of decimal places. They should be able to represent numbers with one or two decimal places in several ways, such as on number lines.

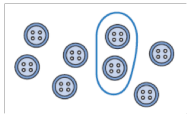
Possible Themes	Key learning points
• Develop knowledge of place value • Explore decimals • Investigate fractions and decimals • Calculate with fractions • Investigate equivalent fractions	• Recognise that hundredths arise from dividing a number or object into one hundred equal parts • Write hundredths as a fraction and as a decimal • Write decimal equivalents of any number of tenths and hundredths • Count up in hundredths • Count down in hundredths • Divide a one-digit number by 10 • Divide a one-digit number by 100 • Divide a two-digit number by 10 • Divide a two-digit number by 100 • Know and use the decimal equivalents to 1/4, 1/2, ¾ • Add fractions with the same denominator within and beyond one whole • Subtract fractions with the same denominator within and beyond one whole • Calculate a unit fraction of an amount when the answer is a whole number • Calculate a non-unit fraction of an amount when the answer is a whole number • Identify equivalent fractions from diagrams • Find families of equivalent fractions • Create diagrams to show families of equivalent fractions • Solve problems with increasingly harder fractions to calculate quantities
Prerequisite	NCETM – Ready to Progress

- ✓ Recognise and use tenths
- ✓ Divide one digit numbers by 10
- ✓ Add and subtract fractions with the same denominator within one whole
- ✓ Calculate fractions such as $^1/_2$ of 6 = 3
- ✓ Understand the concept of equivalent fractions
- ✓ Recognise equivalent fractions from diagrams
- ✓ Complete diagrams to show equivalent fractions

recognise and show, using diagrams, families of common equivalent fractions

- Recognise that five tenths (5⁄10) or one half is shaded.

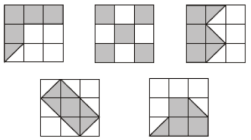
- Recognise that two eighths (2⁄8) or one quarter (¼) of the set of buttons is ringed



- Recognise that one whole is equivalent to two halves, three thirds, four quarters… a fraction 'wall' using a computer program and then estimate parts.
- Recognise patterns in equivalent patterns, such as:
- ½ = 2⁄4 = 3⁄6 = 4⁄8 = 5⁄10 = 6⁄12 = 7⁄14 And similar patterns for ⅓, ¼, ⅕, ⅙, 1⁄10.
- Here is a square. What fraction of the square is shaded?
- Here are five diagrams. Look at each one. diagram is exactly ½ of it is shaded. Put a cross

For example, build

Put a tick (✓) on the (✗) if it is not.



count up and down in hundredths; recognise that hundredths arise when dividing an object by a hundred and dividing tenths by ten

Respond to questions such as:

- What does the digit 6 in 3.64 represent? The 4? What is the 4 worth in the number 7.45? The 5?
- Write the decimal fraction equivalent to:
- two tenths and five hundredths; twenty-nine hundredths; fifteen and nine hundredths.
- Continue the count 1.91, 1.92, 1.93, 1.94 ...
- Suggest a decimal fraction between 4.1 and 4.2
- Know how many 10 pence pieces equal a pound, how many 1 pence pieces equal a pound, how many centimetres make a metre.

recognise and write decimal equivalents of any number of tenths or hundredths

Recognise that, for example:

- 0.07 is equivalent to 7⁄100 6.35 is equivalent to 6 35⁄100
- Particularly in the contexts of money and measurement
- Respond to questions such as:
- Which of these decimals is equal to 19⁄100? 1.9 10.19 0.19 19.1 Write each of these as a decimal fraction: 27⁄100 3⁄100 2 33⁄100

recognise and write decimal equivalents to ¼; ½; ¾

Know that, for example

- 0.5 is equivalent to ½, 0.25 is equivalent to ¼, 0.75 is equivalent to ¾, 0.1 is equivalent to 1⁄10
- Particularly in the context of money and measurement.

find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as units, tenths and hundredths

Understand that:

- When you divide a number by 1⁄100, the digits move one/two places to the right.
- Write a two-digit number on the board. Keep dividing by 10 and record the answer.

26
2.6
0.26
0.026

Describe the pattern.

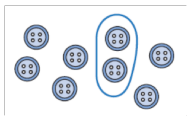
- Respond to oral or written questions such as:
- How many times larger is 2600 than 26?
- How many £1 notes are in £120, £1200?
- Divide three hundred and ninety by ten.

Write in the missing number

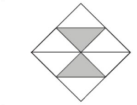
recognise and show, using diagrams, families of common equivalent fractions

- Recognise that five tenths (5⁄10) or one half is shaded.

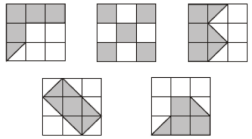
- Recognise that two eighths (2⁄8) or one quarter (¼) of the set of buttons is ringed



- Recognise that one whole is equivalent to two halves, three thirds, four quarters… For example, build a fraction 'wall' using a computer program and then estimate parts.
- Recognise patterns in equivalent patterns, such as:
- ½ = 2⁄4 = 3⁄6 = 4⁄8 = 5⁄10 = 6⁄12 = 7⁄14 And similar patterns for ⅓, ¼, ⅕, ⅙, 1⁄10.
- Here is a square. What fraction of the square is shaded?

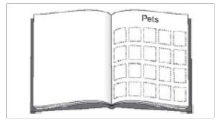


- Here are five diagrams. Look at each one.

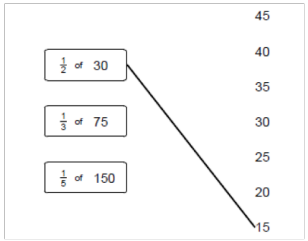


solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number

- What is one-fifth of twenty-five?
- Write the missing number to make this correct. $\frac{1}{4}$ of 24 = $\frac{1}{2}$ of $\square$
- Mary has 20 pet stickers to go on this page.
  ¼ of them are dog stickers. ½ of them are cat stickers. The rest are rabbit stickers. How many rabbit stickers does she have?



- Match each box to the correct number. One has been done for you.



Reasoning opportunities and probing questions	Mathematical Language	Possible misconceptions
• Jenny is counting in hundredths '…. 2.07, 2.08, 2.09, 2.010, 2.011 …'. Do you agree with Jenny? Explain your answer. • Convince me 0.17 = $\frac{17}{100}$ • Kenny thinks the decimal 0.8 can be written as $\frac{80}{100}$. Lenny thinks the decimal 0.8 can be written as $\frac{8}{10}$. Who do you agree with? Explain your thinking. • Always/Sometimes/Never: To divide a number by 10, remove the zero. • Convince me $\frac{1}{4}$ = 0.25 • NCETM: Fractions Reasoning • Show me a fraction equivalent to $\frac{3}{4}$ that no one else will think of. And another. And another • Show me two fractions that add together to make a whole. And another pair. And another pair. • Show me one improper and one proper fraction such that the difference is less than one whole. And another pair. And another pair. • Kenny thinks that ¾ of 24 is 2 because 24 ÷ 4 = 6 and 6 ÷ 3 = 2. Do you agree with Kenny? Explain your answer. • Jenny think that $\frac{16}{64} = \frac{1}{4}$ because your can simply cancel the '6' in the numerator and denominator. Do you agree with Jenny's method for finding equivalent fractions? Explain your answer	Place value Tenth, hundredth Decimal Divide Fraction Numerator Denominator Tenth Hundredth Decimal Fraction Unit fraction, non-unit fraction Improper fraction Top-heavy fraction Numerator, denominator Add, subtract Equivalent (fraction) Family	• Some pupils may think that the first place value heading after the decimal point is 'one-ths' /'unit-ths' and the second place value heading is 'tenths'. • Some pupils may read 0.25 as 'nought point twenty five' • Some pupils may think that $^1/_4$ = 1.4 • Some pupils may think that you simply add/subtract the numerators and add/subtract the denominators when adding fractions. • Some pupils may think that you find the non-unit fraction of an amount by dividing by the denominator (as with unit fractions) and then dividing by the numerator. They do not make the connection that ¾ = 3 x ¼. • Some pupils may think that diagrams to show fractions must always be circular.

Measurement

Key concepts (National Curriculum statements)
Pupils should be taught to:

- Convert between different units of measure [for example, kilometre to metre; hour to minute]
- measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres
- find the area of rectilinear shapes by counting squares
- estimate, compare and calculate different measures, including money in pounds and pence

Notes and guidance (non-statutory)

- read, write and convert time between analogue and digital 12- and 24-hour clocks
- solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days.

Possible Themes	Key learning points
• Solve problems involving time • Solve problems involving money • Estimate measures • Convert between measures • Solve problems involving measurement • Solve problems involving money • Calculate perimeter • Investigate area	• Read digital 24-hour clocks • Write times using digital 24-hour clock • Write times using analogue 12-hour clock • Convert between 12-hour time and 24-hour notation • Solve problems involving converting from hours to minutes and minutes to seconds; • Solve problems involving converting from weeks to days • Solve problems involving converting from years to months • Solve problems involving decimal notation to record money • Convert between kilometres and metres • Convert between centimetres and millimetres • Convert between kilograms and grams • Convert between litres and millilitres • Solve measurement problems involving fractions • Solve money problems involving fractions • Solve measurement problems involving decimals to two decimal places • Solve money problems involving decimals to two decimal places • Measure and calculate the perimeter of 2D shapes when dimensions are unknown • Calculate the perimeter of rectangles (including squares) when dimensions are known • Calculate the perimeter of other rectilinear shapes when dimensions are known • Find the area of rectangles (including squares) by counting squares • Find the area of other rectilinear shapes by counting squares • Solve problems involving perimeter • Solve problems involving area
Prerequisite	NCETM – Ready to Progress

✓ Use analogue and digital 12-hour clocks ✓ Know the number of seconds in a minute, minutes in an hour, hours in a day, and the number of days in each week, month, year and leap year ✓ Know the value of all British coins and notes ✓ Know the number of pence in a pound ✓ Calculate the duration of time for a given event or task ✓ Use a ruler to measure lengths to the nearest millimetre ✓ Use digital and mechanical scales to measure mass ✓ Use measuring vessels to measure a volume of liquid ✓ Choose appropriate units to state the result of a measurement ✓ Compare the length (mass, volume, capacity) of two or more objects ✓ Solve measurement problems involving addition or subtraction ✓ Find the perimeter of a simple 2D shape by measuring	estimate, compare and calculate different measures, including money in pounds and pence ➢ Draw on their calculation strategies to solve one- and two-step word problems, including those involving money and measures. They use rounding to estimate the solution, choose an appropriate method of calculation (mental, mental with jottings, written method) and then check to see whether their answer seems sensible. They throw a beanbag three times and find the difference between their longest and shortest throws. After measuring their height, they work out how much taller they would have to grow to be the same height as their teacher. They solve problems such as: o Dad bought three tins of paint at £5.68 each. How much change does he get from £20? o A family sets off to drive 524 miles. After 267 miles, how much further do they still have to go? o Tins of dog food cost 42p. They are put into packs of 10. How much does one pack of dog food cost? 10 packs? o A can of soup holds 400 ml. How much do 5 cans hold? Each serving is 200 ml. How many cans would I need for servings for 15 people? o I spent £4.63, £3.72 and 86p. How much did I spend altogether? o A string is 6.5 metres long. I cut off 70 cm pieces to tie up some balloons. How many pieces can I cut from the string? o A jug holds 2 litres. A glass holds 250 ml. How many glasses will the jug fill? o Dean saves the same amount of money each month. He saves £149.40 in a year. How much money does he save each month? read, write and convert time between analogue and digital 12- and 24-hour clocks solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days. ➢ Solve problems involving units of time, explaining and recording how the problem was solved. For example: Raiza got into the pool at 2:26 pm. She swam until 3 o'clock. How long did she swim? They count on to find the difference between two given times, using a number line or time line where appropriate and use the 24-hour clock to measure time. Convert between different units of measure [for example, kilometre to metre; hour to minute] ➢ Learn the relationships between familiar units of measurement. They learn that kilo means one thousand to help them remember that there are 1000 grams in 1 kilogram and 1000 metres in 1 kilometre. They respond to questions such as: A bag of flour weighs 2 kg. How many grams is this? They suggest suitable units to measure length, weight and capacity; for example, they suggest a metric unit to measure the length of their book, the weight of a baby, the capacity of a mug. They suggest things that you would measure in kilometres, metres, litres, kilograms, etc. ➢ Record lengths using decimal notation, for example recording 5 m 62 cm as 5.62 m, or 1 m 60 cm as 1.6 m. They identify the whole-number, tenths and hundredths parts of numbers presented in decimal notation and relate the whole number, tenths and hundredths parts to metres and centimetres in length. estimate, compare and calculate different measures, including money in pounds and pence ➢ Draw on their calculation strategies to solve one- and two-step word problems, including those involving money and measures. They use rounding to estimate the solution, choose an appropriate method of calculation (mental, mental with jottings, written method) and then check to see whether their answer seems sensible. They throw a beanbag three times and find the difference between their longest and shortest throws. After measuring their height, they work out how much taller they would have to grow to be the same height as their teacher. They solve problems such as: o Dad bought three tins of paint at £5.68 each. How much change does he get from £20? o A family sets off to drive 524 miles. 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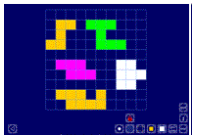
They suggest suitable units to measure length, weight and capacity; for example, they suggest a metric unit to measure the length of their book, the weight of a baby, the capacity of a mug. They suggest things that you would measure in kilometres, metres, litres, kilograms, etc.

- Record lengths using decimal notation, for example recording 5 m 62 cm as 5.62 m, or 1 m 60 cm as 1.6 m. They identify the whole-number, tenths and hundredths parts of numbers presented in decimal notation and relate the whole number, tenths and hundredths parts to metres and centimetres in length.
- Measure the edges of a rectangle and then combine these measurements. They realise they are calculating its perimeter. Given the perimeter of a rectangle they investigate its sides could be. They work out the perimeter of irregular shapes drawn on a centimetre using the ITP 'Area'.



that by doing this what the lengths of square grid, e.g.

- For example, they draw irregular shapes on centimetre square grids, and compare their areas and perimeters.
- They use rounding to estimate the solution, choose an appropriate method of calculation (mental, mental with jottings, written method) and then check to see whether their answer seems sensible. They throw a beanbag three times and find the difference between their longest and shortest throws. After measuring their height, they work out how much taller they would have to grow to be the same height as their teacher.

They solve problems such as:

- A family sets off to drive 524 miles. After 267 miles, how much further do they still have to go?
- A can of soup holds 400 ml. How much do 5 cans hold? Each serving is 200 ml. How many cans would I need for servings for 15 people?
- A string is 6.5 metres long. I cut off 70 cm pieces to tie up some balloons. How many pieces can I cut from the string?

A jug holds 2 litres. A glass holds 250 ml. How many glasses will the jug fill?

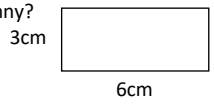
Reasoning opportunities and probing questions

- Compare quantities by estimation
- Ask students to tell the time of using images of the Greenwich Observatory Clock or 24 Hour watches. How does a 24-hour watch need to operate differently to a 12-hour watch?
- Convince me that 18:40 is the same as 6:40 pm.
- Convince me that 'two pounds and five pence' is not written as '£2.5p'

- NCETM: Measurement Reasoning

- Show me a length in cm that is between 25mm and 0.5m. And another. And another.
- Which is greater, 4.5 litres or 460 ml? Explain your answer.
- Kenny thinks that 120 minutes is the same as 1 hour and 20 minutes. Do you agree with Kenny? Explain your answer.
- Convince me that 15:00 = 3 p.m.

- Always / Sometimes / Never: perimeter is given by multiplying the shortest side by 2, the longest side by 2, and then adding the results
- Jenny thinks that the perimeter of this rectangle is 9cm. Do you agree with Jenny?



- Create a shape with a perimeter greater then 30 m

Mathematical Language

Analogue
Digital
12-hour
24-hour
Second, Minute, Hour
Day, Week, Month, Year
Pound (£)
Pence (p)
Length
Mass
Volume
Length, distance
Mass
Volume
Capacity
Metre, centimetre, millimetre
Kilogram, gram
Litre, millilitre
Hour, minute, second
Decimal
Perimeter
Area
Dimensions
Square
Rectangle
Rectilinear
Polygon
Millimetre, Centimetre, Metre, Kilometre

Possible misconceptions

- Some pupils do not write 24-hour times as four digits, for example 1:50 rather than 01:50 for 1.50 a.m.
- Some pupils may write 'one pound and eight pence' as '£1.8'
- Some pupils may use both '£' and 'p' symbols, for example '£4.56p'
- Some pupils may write 'four pounds and fifty six pence' as '4.56p' or '£456'
- Some pupils may write amounts of money incorrectly; e.g. £3.5 for £3.50, especially if a calculator is used at any point
- Some pupils may apply an incorrect understanding that there are 100 minutes in a hour when solving problems
- Some pupils may struggle when converting between 12- and 24-hour clock notation; e.g. thinking that 15:00 is 5 o' clock
- Some pupils may find perimeters by counting the squares that are around the outside of the shape, rather than the associated lengths. This will result in an answer four less than the correct answer if working with rectangles.
- Some pupils may confuse the concepts of area and perimeter
- Some pupils may think that perimeter is always given by 2(a + b) or 2a + 2b, but this is only the case for certain 2D shapes
- Some pupils may think that you multiply the numbers to find the perimeter of a shape.
- Some pupils may think that you cannot find the perimeter of a shape unless all the dimensions are given.
- Some pupils may just add the given dimensions, rather than consider any unlabelled dimensions

Geometry

Key concepts (National Curriculum statements)
Pupils should be taught to:

- compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes
- identify acute and obtuse angles and compare and order angles up to two right angles by size
- identify lines of symmetry in 2-D shapes presented in different orientations
- complete a simple symmetric figure with respect to a specific line of symmetry.
- describe positions on a 2-D grid as coordinates in the first quadrant
- describe movements between positions as translations of a given unit to the left/right and up/down
- plot specified points and draw sides to complete a given polygon.

Notes and guidance (non-statutory)

- Pupils continue to classify shapes using geometrical properties, extending to classifying different triangles (for example, isosceles, equilateral, scalene) and quadrilaterals (for example, parallelogram, rhombus, trapezium).
- Pupils compare and order angles in preparation for using a protractor and compare lengths and angles to decide if a polygon is regular or irregular.
- Pupils draw symmetric patterns using a variety of media to become familiar with different orientations of lines of symmetry; and recognise line symmetry in a variety of diagrams, including where the line of symmetry does not dissect the original shape.
- Pupils draw a pair of axes in one quadrant, with equal scales and integer labels. They read, write and use pairs of coordinates, for example (2, 5), including using coordinateplotting ICT tools.

Possible Themes	Key learning points
• Explore symmetry • Explore symmetrical patterns • Investigate 2D shapes • Develop knowledge of angles • Compare angles • Understand and use Cartesian coordinates • Use transformations to move shapes	• Identify and describe an equilateral triangle • Identify and describe an isosceles triangle • Identify and describe a scalene triangle • Identify and describe a parallelogram • Identify and describe a rhombus • Identify and describe a trapezium • Identify and describe a kite • Classify 2D shapes • Identify lines of symmetry of a 2D shape • Identify a line of symmetry of a pattern and for a diagram of a reflection • Use a line of symmetry to produce a symmetrical pattern • Use a line of symmetry to complete a symmetrical shape • Identify acute angles • Identify obtuse angles • Identify acute angles in shapes • Identify obtuse angles in shapes • Identify right angles in shapes • Compare angles up to two right angles in size • Order angles up to two right angles in size • Use coordinates to describe the position of a point in the first quadrant • Plot points in the first quadrant using co-ordinates • Use coordinates to plot a set of points to construct a polygon • Solve problems involving coordinates • Describe movements between positions as translations of a given unit to the left/right • Describe movements between positions as translations of a given unit to the up/down • Describe movements between positions as translations of a given unit to the left/right and up/down • Solve problems involving translation

Prerequisite	NCETM – Ready to Progress

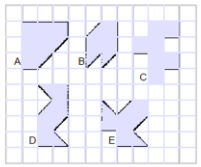
- ✓ Reflect a shape in a vertical line of symmetry
- ✓ Use a ruler to construct a straight line joining two points
- ✓ Know the names of special quadrilaterals
- ✓ Understand angles as a measure of turn
- ✓ Recognise angles in shapes
- ✓ Identify right angles as a quarter turn
- ✓ Know names and basic properties of polygons
- ✓ Know the language of movement; left, right, up and down

compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes

- ➢ Pupils should be able to complete this sentence:
  All equilateral triangles have …

identify lines of symmetry in 2-D shapes presented in different orientations

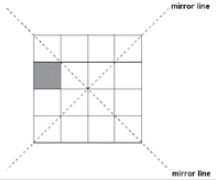
Here are five shapes on a square grid.



- ➢ Write the letters of the two shapes which have a line of symmetry.

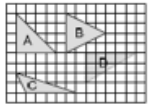
complete a simple symmetric figure with respect to a specific line of symmetry

Here is a shaded square on a grid. Shade in 3 more squares so that the design is symmetrical in both mirror lines.



identify acute and obtuse angles and compare and order angles up to two right angles by size

Here are four triangles drawn on a square grid.

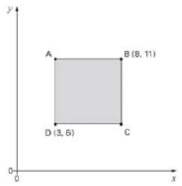


Write the letter for each triangle in the correct region of the sorting diagram. One has been done for you.

	has a right angle	has an obtuse angle	has an acute angle
is isosceles	A		
is not isosceles			

describe positions on a 2-D grid as coordinates in the first quadrant

Here is a shaded square.

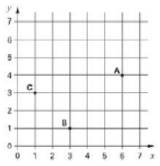


Write the coordinates for point A.

describe movements between positions as translations of a given unit to the left/right and up/down

I can describe where a shape will be after translation	This triangle is translated two squares to the left and one square down. Give the coordinates of its vertices in the new position.	

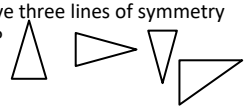
plot specified points and draw sides to complete a given polygon



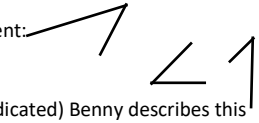
A, B and C are three corners of a rectangle. What are the coordinates of the fourth corner?

Reasoning opportunities and probing questions

- Show me a shape with one line of symmetry, two lines of symmetry. And Another …
- Always/Sometimes/Never: Triangles have three lines of symmetry
- What is the same and what is different ?



- Convince me that a rectangle does not have four lines of symmetry.
- Always/Sometimes/Never: Hexagons have six lines of symmetry
- NCETM: Geometry - Properties of Shapes Reasoning
- Show me an acute (obtuse) angle. And another. And another.
- (With your arms), show me an angle greater (less) than a quarter turn. And another. And another.
- Kenny thinks that a quarter turn is an acute angle. Jenny thinks that a quarter turn is an obtuse angle. Who is correct? Explain your answer.
- What is the same and what is different:



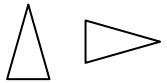
- (Given a grid with the point (2, 3) indicated) Benny describes this point as (2, 3). Jenny describes the point as (3, 2). Who do you agree with? Why?
- Convince me that the coordinates of the origin are (0, 0)
- Always / Sometimes / Never: A translation moves a shape further away from the origin.

Mathematical Language

Symmetry
Line of symmetry, Mirror line
Reflect, Reflection
Congruent
Perpendicular, Parallel
Vertex (Vertices)
Side, Edge
Quadrilateral
Square, Rectangle, Parallelogram, (Isosceles) Trapezium, Kite, Rhombus
Triangle
Scalene, Right-angled, Isosceles, Equilateral
Polygon, Hexagon, Pentagon, Octagon, Decagon
Circle
Turn
Angle
Right angle
Acute angle
Obtuse angle
Greater than, less than
2-D
Grid
Axis, axes, x-axis, y-axis
Origin
(First) quadrant
(Cartesian) coordinates
Point
Translation
Transformation
Left, right, up, down

Possible misconceptions

- Some pupils may think a rectangle has four lines of symmetry
- Some pupil may think that a triangle always has to have a horizontal base:



- Some pupils think that all hexagons, pentagons, octagons and decagons are regular.
- Some pupils think that a rhombus is a square 'standing' on one of its edges.
- Some pupils think that a quarter turn is an acute angle; some may think it's an obtuse angle.
- Some pupils may think that one part of a drawn angle must be horizontal
- Some pupils may think that all turns have to be in a clockwise direction
- Some pupils may think that a drawn angle must use two lines of equal length
- When describing or carrying out a translation, some pupils may count the squares between the two shapes rather than the squares that describe the movement between the two shapes.
- Some pupils may muddle left and right
- Some pupils will confuse the order of x-coordinates and y-coordinates
- When constructing axes, some pupils may not realise the importance of equal divisions on the axes

Statistics

Key concepts (National Curriculum statements)
Pupils should be taught to:

- interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs.
- solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs.

Notes and guidance (non-statutory)

- Pupils understand and use a greater range of scales in their representations.
- Pupils begin to relate the graphical representation of data to recording change over time.

Possible Themes

- Explore ways of presenting data
- Solve problems involving charts and graphs

Key learning points

- Interpret a pictogram where the symbol represents multiple items
- Interpret a bar chart
- Interpret bar charts with different scales on the frequency axis
- Create a bar chart with different scales on the frequency axis
- Interpret a time graph
- Create a time graph
- Solve problems involving the data in charts and graphs
- Solve problems involving the data in tables

Prerequisite

- ✓ Interpret and construct a pictogram where the symbol represents multiple items
- ✓ Interpret and construct a simple bar chart where one centimetre represents 2, 5 or 10 items
- ✓ Interpret and construct tables of data

NCETM – Ready to Progress

interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs

- Collect data, measuring where necessary. They work with a range of data, such as shoe size and width of shoe across the widest part of the foot, the number of letters in children's names, the width of their hand spans, the distance around their neck and wrist, data from nutrition panels on cereal packets, and so on.
- They decide on a suitable question or hypothesis to explore for each data set they work on. For example, 'We think that…boys have larger shoes than girls', '…our neck measurements are twice as long as our wrist measurements', '…girls' names have more letters than boys' names' or '…children in our class would prefer to come to school by car but they usually have to walk'.
- Children consider what data to collect and how to collect it. They collect their data and organise it in a table. They choose a Venn or Carroll diagram, or a horizontal or vertical pictogram or bar chart to represent the data. Where appropriate, they use the support of an ICT package. They justify their choice within the group so that they can present it.
- They understand that they can join the tops of the bars on the bar-line chart to create a line graph because all the points along the line have meaning.

solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs

- Undertake one or more of three enquiries:
  - What vehicles are very likely to pass the school gate between 10:00 am and 11:00 am? Why? What vehicles would definitely not pass by? Why not? What vehicles would be possible but not very likely? Why? What if it were a different time of day? What if the weather were different?
  - Does practice improve estimation skills? Children estimate the lengths of five given lines and record the estimate, measured length and difference. They repeat the activity with five more lines to see whether their estimation skills have improved after feedback.
  - What would children in our class most like to change in the school? Children carry out a survey after preliminary research to whittle down the number of options to a sensible number, e.g. no more than five.
- Children identify a hypothesis and decide what data to collect to investigate their hypothesis. They collect the data they need and decide on a suitable representation. In groups, they consider different possibilities for their representation and explain why they have made their choice.

In the first enquiry, children use tallies and bar charts. In the second, they use tables and bar charts to compare the two sets of measurements. In the third, they use a range of tables and charts to show their results, including Venn and Carroll diagrams. They use ICT where appropriate.

Reasoning opportunities and probing questions	Mathematical Language	Possible misconceptions
• Show me a time graph of your day and tell me a story about it. And another. And another. • Penny draws a bar chart with horizontal bars. Benny says the bars must be vertical. Who is correct? Explain your answer. • Always/Sometimes/Never**:** One centimetre on the frequency axis of a bar chart represents one unit. • NCETM: Statistics Reasoning	Data Pictogram Symbol Key Tally Bar chart Time graph Scale Axis Graph Frequency	• Some pupils may interpret bar charts as one unit of frequency for each one square on the paper used. • Some pupils may not leave gaps between the bars in a bar chart • Some pupils may think that one centimetre on the frequency axis of a bar chart always represents one unit in a bar chart. • Some pupils may think that a symbol always represents one unit in a pictogram. • Some pupils may think that the bars of a bar chart must be vertical.