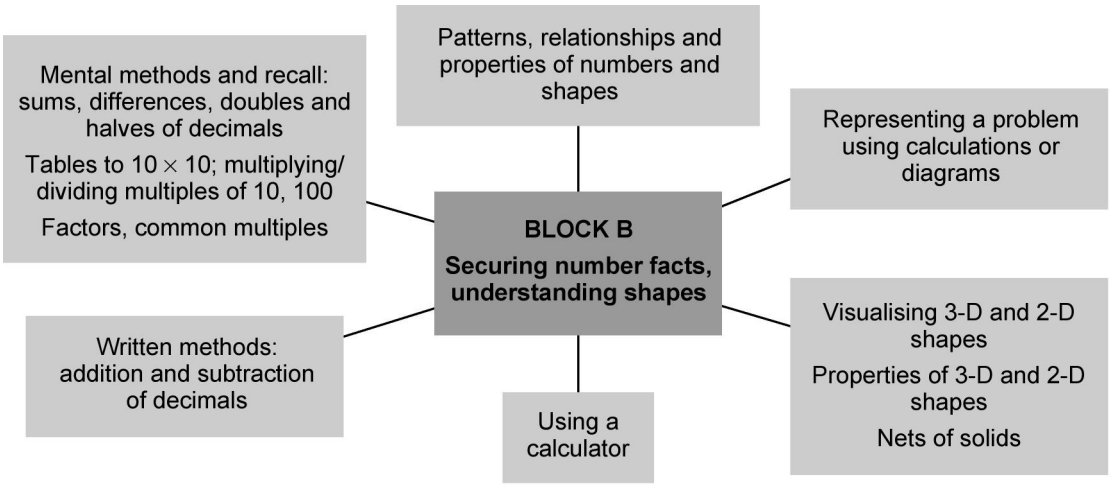
Year 5: Block B — Three 3-week units

Securing number facts, understanding shapes



Objectives End-of-year expectations (key objectives) are highlighted	Units 1	 2	 3
• Explore patterns, properties and relationships and propose a general statement involving numbers or shapes; identify examples for which the statement is true or false	✓	✓	✓
• Represent a puzzle or problem by identifying and recording the information or calculations needed to solve it; find possible solutions and confirm them in the context of the problem		✓	✓
• Use knowledge of place value and addition and subtraction of two-digit numbers to derive sums and differences and doubles and halves of decimals (e.g. 6.5 ± 2.7, half of 5.6, double 0.34)		✓	✓
• Recall quickly multiplication facts up to 10 × 10 and use them to multiply pairs of multiples of 10 and 100; derive quickly corresponding division facts	✓	✓	✓
• Identify pairs of factors of two-digit whole numbers and find common multiples (e.g. for 6 and 9)	✓		
• Use knowledge of rounding, place value, number facts and inverse operations to estimate and check calculations	✓	✓	✓
• Use efficient written methods to add and subtract whole numbers and decimals with up to two places	✓		✓
• Use a calculator to solve problems, including those involving decimals or fractions (e.g. to find $\frac{3}{4}$ of 150 g); interpret the display correctly in the context of measurement			✓
• Identify, visualise and describe properties of rectangles, triangles, regular polygons and 3-D solids; use knowledge of properties to draw 2-D shapes and identify and draw nets of 3-D shapes	✓	✓	✓
• Complete patterns with up to two lines of symmetry; draw the position of a shape after a reflection or translation		✓	

Speaking and listening objectives for the block

Objectives	Units		
	1	2	3
• Identify different question types and evaluate impact on audience	✓		✓
• Present a spoken argument, sequencing points logically, defending views with evidence and making use of persuasive language		✓	

Opportunities to apply mathematics in science

Activities		Units		
		1	2	3
5e	Earth, Sun and Moon: Use vocabulary related to shape and size when describing the Sun, Earth and Moon and their relative sizes.	✓	✓	✓

Key aspects of learning: focus for the block

Enquiry	**Problem solving**	Reasoning	**Creative thinking**
Information processing	Evaluation	**Self-awareness**	**Managing feeling**
Social skills	Communication	Motivation	**Empathy**

Vocabulary

problem, solution, calculate, calculation, equation, method, explain, reasoning, reason, predict, pattern, relationship, formula, rule, classify, property, criterion/criteria, generalise, general statement

integer, square number, multiple, factor, divisor, divisible by, decimal, decimal point, decimal place

operation, inverse, add, subtract, multiply, divide, sum, total, difference, plus, minus, product, quotient, remainder, double, halve, factor, multiple, divisor, round, estimate, approximate

3-D, three-dimensional, vertex, vertices, face, edge, 2-D, two-dimensional, regular, irregular, polygon, side, parallel, perpendicular, angle, degree (°), acute, obtuse, protractor, angle measurer, names of shapes, including equilateral triangle, isosceles triangle, scalene triangle, quadrilateral, octahedron

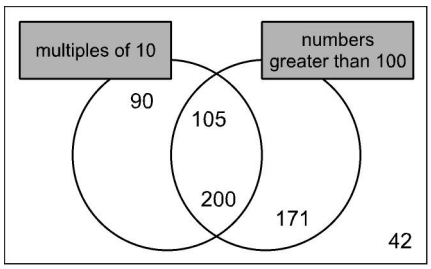
reflection, reflective symmetry, line of symmetry, mirror line, rotation, translation, origin, coordinates, x-coordinate, y-coordinate, x-axis, y-axis

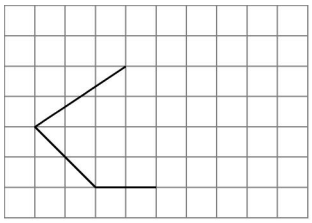
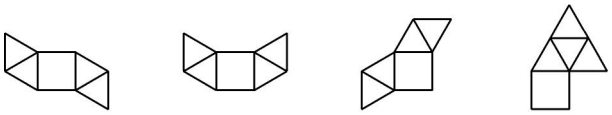
Building on previous learning

Check that children can already:

- derive and recall multiplication facts up to 10 × 10 and the corresponding division facts
- multiply and divide numbers to 1000 by 10 and 100, understanding the effect
- add or subtract mentally pairs of two-digit whole numbers, e.g. 47 + 58, 91 – 35
- use decimal notation for tenths and hundredths, and partition decimals
- use efficient written methods to add and subtract two- and three-digit whole numbers and £.p
- draw polygons and classify them by identifying their properties, including their line symmetry
- draw and complete shapes with reflective symmetry

Unit 5B1 3 weeks

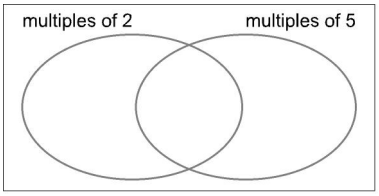
Objectives *Children's learning outcomes in italic*	**Assessment for learning**
• Explore patterns, properties and relationships and propose a general statement involving numbers or shapes; identify examples for which the statement is true or false *I can sort numbers or shapes according to their properties and explain how I sorted them*	What is the same about these two numbers (or shapes)? What is different? Look at this shape (or a shape that is drawn on a square grid). Tell me whether each of these statements is true or false. • The shape has exactly two right angles. • The shape has two pairs of parallel lines. • The shape has one line of symmetry. • The shape is a quadrilateral. Look at these four numbers (or shapes). Think of a property which is true for two of them and false for the other two. Now think of some different properties.
• Recall quickly multiplication facts up to 10 × 10 and use them to multiply pairs of multiples of 10 and 100; derive quickly corresponding division facts *I can use tables facts to multiply multiples of 10 and 100 and to find linked division facts*	The product is 400. At least one of the numbers is a multiple of 10. What two numbers could have been multiplied together? Are there any other possibilities? What tips would you give someone who had forgotten the 6 times-table to help them to work it out?
• Identify pairs of factors of two-digit whole numbers and find common multiples (e.g. for 6 and 9) *I can find pairs of factors that multiply to make a given number* *I can find a number that is a multiple of two different numbers*	Find all the factors of 30. Explain how you know you have found them all. The area of a rectangle is 32 cm^2. What are the lengths of the sides? Are there other possible answers? How did you work it out? Explain why 81 is a square number. One number is in the wrong place on the sorting diagram. Which one is it?  Choose from these digit cards each time: 7, 5, 2, 1. Make these two-digit numbers: • an even number • a multiple of 9 • a square number • a factor of 96 • a common multiple of 3 and 4
• Use knowledge of rounding, place value, number facts and inverse operations to estimate and check calculations *I can check whether a calculation is correct and explain how I did this*	Which is the best estimate for 2348 + 4965? A 6000 B 6300 C 7000 D 7300 Explain your decision.

Objectives *Children's learning outcomes in italic*	Assessment for learning
• Use efficient written methods to add and subtract whole numbers and decimals with up to two places *I can explain each step when I write addition and subtraction calculations in columns*	What tips would you give to someone to help them with column addition of decimals? What about subtraction? Which of these decimal additions/subtractions are correct? What has this person done wrong? How could you help them correct it? What are the missing digits in this calculation? 3□67 −192□ 1539 Explain your reasoning.
• Identify, visualise and describe properties of rectangles, triangles, regular polygons and 3-D solids; use knowledge of properties to draw 2-D shapes and identify and draw nets of 3-D shapes *I can describe the important features of shapes such as rectangles* *I know the important features of a cube. I can use these to draw its net*	I am thinking of a 3-D shape. It has a square base. It has four other faces which are triangles. What is the name of the 3-D shape? Use squared dotty paper. Use the dots to draw a shape that has four straight sides and no right angles. Here is part of a shape on a square grid. Draw two more lines to make a shape which has a line of symmetry. Use a ruler.  Look at these diagrams. Which of them are nets of a square-based pyramid? Explain how you know.  Is this a net for an open cube? Explain why not. 
• Identify different question types and evaluate impact on audience *I know that when my teacher asks certain mathematical questions there may be more than one answer. I try to think of all the possible answers*	What is the difference between these two questions? What is the sum of 1.2 and 0.8? Tell me two decimals with a sum of 2.

Learning overview

Children **rehearse multiplication facts** to 10 × 10 **and the related division facts**. They discuss the facts that they can recall rapidly and strategies to help them derive those they struggle to recall, for example doubling 4 times-table facts to work out 8 times-table facts. They respond to questions such as: *The product of two numbers is 24. What could the numbers be?* They record their answers systematically to derive all pairs of factors for the number 24. They use squared paper or peg boards to create all the different arrays possible using 10, 11, 12, … squares or pegs. They use this to **list all of the factors** of 10, 11, 12, … They investigate which numbers can create a square array and learn that these are called *square numbers*; for example, 16 is a square number because it is equal to 4 × 4.

Children **classify numbers according to their properties**, recording the classifications in Venn and Carroll diagrams. For example, they place the numbers 1 to 30 on a Venn diagram. They describe patterns in their diagram and respond to questions such as: *What do you notice about numbers that are multiples of both 2 and 5*?



They learn the vocabulary *common multiple* and **suggest general statements** based on similar relationships, for example: *All common multiples of 3 and 4 are multiples of 12*. They test these statements by finding examples that match them.

Children **use known multiplication facts and place value to find related facts**. For example, they use 8 × 4 = 32 to find the answer to 80 × 4, explaining that 80 is ten times as big as 8 so the answer will be ten times 32, or 320. They predict the answer to 80 × 40, explaining how they worked this out, then check their prediction using a calculator. They **find related division facts**, e.g. recognising that 3200 ÷ 400 = 8 because 8 × 400 = 3200. Children use similar strategies and their understanding of inverse operations to find the missing numbers in calculations such as:

20 × □ = 600

2800 ÷ 70 = □

□ ÷ 50 = 300

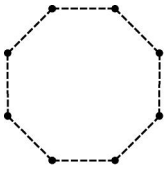
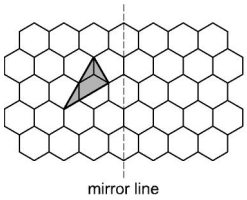
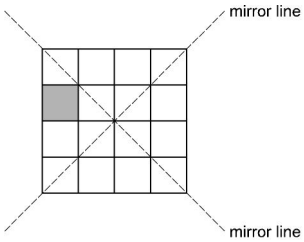
Children use **rounding** to suggest sensible estimates to addition and subtraction calculations. For example, they predict whether the answer to 3217 – 1682 is (a) 1635, (b) 1535 or (c) 1435. They use efficient written methods for addition and subtraction of whole numbers, estimating first. They use their **knowledge of number facts, rounding and inverses** to find the missing digits in calculations such as 3□67 – 192□ = 1539.

Children **visualise and describe 3-D shapes** according to a range of properties including: the shapes of faces, the number of faces, edges and vertices, and whether the number of edges meeting at each vertex is the same (as in a cube) or different (as in a square-based pyramid). They **solve problems** involving 3-D shapes, for example finding all of the possible nets for an open cube or sorting a set of 3-D shapes using an ICT 'binary tree' program.

Children **extend their knowledge of the properties of 2-D shapes**. For example, they investigate the properties of rectangles. They measure the length of the two diagonals, commenting on what they notice. They measure the distance from the point where the diagonals cross each other to each of the four vertices. Children predict and test which other shapes have diagonals of equal length or diagonals that bisect each other

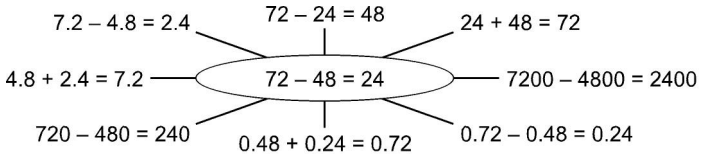
Unit 5B2 3 weeks

Objectives *Children's learning outcomes in italic*	Assessment for learning
• Explore patterns, properties and relationships and propose a general statement involving numbers or shapes; identify examples for which the statement is true or false *I can investigate a general statement and say whether examples are true or false*	Ella says: 'The sum of two even numbers is always a multiple of 4.' Is she correct? Give some examples to justify your answer.
• Represent a puzzle or problem by identifying and recording the information or calculations needed to solve it; find possible solutions and confirm them in the context of the problem *I can split a word problem into steps and work out what calculation to do for each step. I can explain what the answer to each step tells me*	Tanya has read the first 78 pages in a book that is 130 pages long. Which number sentence could Tanya use to find the number of pages she must read to finish the book? A 130 + 78 = ☐ B ☐ – 78 = 130 C 130 ÷ 78 = ☐ D 130 – 78 = ☐ Tilly's parcel cost 55p to post. She stuck on eight stamps. Each stamp was either 10p or 5p. How many of each stamp did Tilly stick on her parcel? Show how you worked out your answer. How did you decide which calculations to do? How did you know whether to add, subtract, multiply or divide? What clues did you look for? What does the answer to this step tell you?
• Use knowledge of place value and addition and subtraction of two-digit numbers to derive sums and differences and doubles and halves of decimals (e.g. 6.5 ± 2.7, half of 5.6, double 0.34) *I can add/subtract decimals in my head by using a related two-digit addition or subtraction* *I can find the double or half of a decimal by doubling or halving the related whole number*	Look at this number sentence: ☐ + ○ = 2. What could the missing numbers be? What strategies would you use to work out the answers to these calculations? Could you use a different method?
• Recall quickly multiplication facts up to 10 × 10 and use them to multiply pairs of multiples of 10 and 100; derive quickly corresponding division facts *I can use tables facts to multiply multiples of 10 and 100 and to find linked division facts*	How many multiplication and division facts can you make, using what you know about 48? How did you work out the division facts? Make up some division questions that have a remainder of 1. How did you do it? What tips would you give someone who had forgotten the 9 times-table to help them to work it out?
• Use knowledge of rounding, place value, number facts and inverse operations to estimate and check calculations *I can check whether a calculation is correct and explain how I did this*	How could you check that your answer is correct?

Objectives *Children's learning outcomes in italic*	**Assessment for learning**
• Identify, visualise and describe properties of rectangles, triangles, regular polygons and 3-D solids; use knowledge of properties to draw 2-D shapes and identify and draw nets of 3-D shapes *I can explain whether a shape has line symmetry and whether it has any parallel or perpendicular sides* *I can say whether a triangle is equilateral, isosceles or scalene and explain how I know*	How would you check if two lines are parallel? How would you check if two lines are perpendicular? Select two 'sorting' cards, such as: *has exactly two equal sides* and *has exactly two parallel sides*. Can you show me a polygon that fits both of these criteria? What do you look for? Here is an isosceles triangle. Show me some more isosceles triangles. How do you know? What do you look for? Here is a regular octagon. Join three of the dots to make an isosceles triangle. Use a ruler.  Join three dots to make a different isosceles triangle. Now join three dots to make a right-angled triangle. Join three dots to make a scalene triangle.
• Complete patterns with up to two lines of symmetry; draw the position of a shape after a reflection or translation *I can create a pattern that has two lines of symmetry or complete one that someone else has started*	Use these tiles to make a symmetrical shape. Can you take one tile away and keep your shape symmetrical? Can you change one or more tiles so that your shape is no longer symmetrical? This is half a symmetrical shape. Tell me how you would complete it to make it symmetrical. How do you use the line of symmetry to complete the shape? Show me where this shape would be if we reflected it in this mirror line. Where would it be if we translated it two units to the right parallel to the x-axis? This grid is made of hexagons. Draw the reflection of the shaded shape on the grid.  Here is a shaded square on a grid. Shade in three more squares so that the design is symmetrical in both mirror lines. 
• Present a spoken argument, sequencing points logically, defending views with evidence and making use of persuasive language *I can present my solution to a problem, explaining the steps that I took in a sensible order*	Explain to the class how you solved that problem.

Learning overview

Children use addition and subtraction and their understanding of place value in decimals to **derive sums and differences, doubles and halves of numbers with up to two decimal places**. For example, given the calculation 72 – 48 = 24, they generate a range of linked calculations, such as:



Children explain how they work out answers to calculations such as 3.8 × 2, 0.28 + 0.46, 9.7 – 3.9, demonstrating their understanding of the place value in the numbers.

Children recall multiplication and linked division facts to 10 × 10. They find, for example, the seventh multiple of 8, or a number that is a factor of both 12 and 20. They use these facts to **multiply and divide multiples of 10 and 100**, for example calculating 70 × 80, 3500 ÷ 5 and 600 × 40. They explain how they worked out the answers. They generate families of related calculations such as: 8 × 3 = 24, 80 × 3 = 240, 800 × 3 = 2400 and 8 × 0.3 = 2.4. They use division facts to find **factors** of numbers, determining, for example, that 56 has a factor pair of 7 and 8, so 560 has a factor pair of 70 and 8 or 7 and 80. They **solve problems** such as:

Find as many pairs of numbers as you can with a product of 160.

Children use their knowledge of number properties to **investigate general statements** such as: *The product of an odd number and an even number is always even*. They test examples and use reasoning to explain why they think that the statement is true. They suggest similar general statements such as: *The product of two odd numbers is odd* and test them.

Children **solve word problems**. They identify the calculations that they need to do and the best way to do them: mentally, on paper or using a calculator. They estimate the answer by rounding the numbers involved. They solve problems such as:

A rectangular play area is covered in concrete slabs. There are 20 slabs along the length of the play area and 14 slabs along the width of the play area. How many slabs cover the play area?

Samira has a 1 kg bag of flour. She uses 0.2 kg to make biscuits and 0.35 kg to bake a cake. How much flour is left in the bag?

How many jugs each holding 0.3 litres can be filled from a bottle containing 1.5 litres of juice?

Children make up 'number stories' to reflect statements like 300 ÷ 25 = 12 or 3.5 – 1.7 = 1.8.

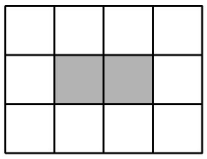
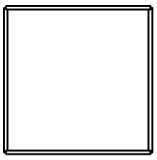
Children **complete patterns with two lines of symmetry**, using for example peg boards or a suitable computer program. They **solve problems** involving symmetry such as:

Place eight squares together (edge to edge) to make a shape with two lines of symmetry. How many different shapes can you make?

Children **investigate the line symmetry of regular polygons**, finding how many lines of symmetry there are in an equilateral triangle, square, regular pentagon, regular hexagon, and so on. They suggest a general statement based on their findings.

Children extend their knowledge of the **properties of 3-D and 2-D shapes,** including the tetrahedron and octahedron. They identify shapes that have pairs of **parallel or perpendicular sides or edges**. They learn about different types of triangles (equilateral, isosceles, scalene, right-angled). They draw or create right-angled and isosceles triangles, using pencil and paper, peg boards or ICT. They collaborate in groups to explore how many different shapes they can make from five squares touching edge to edge. They understand that if rotations and reflections of the shapes are not counted as different there are 12 shapes to be found. They investigate which of these shapes can be folded up to make an open cube.

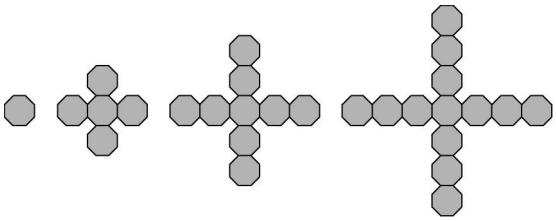
Unit 5B3 3 weeks

Objectives *Children's learning outcomes in italic*	Assessment for learning
• Explore patterns, properties and relationships and propose a general statement involving numbers or shapes; identify examples for which the statement is true or false *I can suggest a general statement and test whether it is true by investigating examples*	Two square tiles are placed side by side. How many tiles are needed to surround them completely?   What if three square tiles were laid side by side? Four tiles? Five tiles? How many tiles would be needed if 100 tiles were laid side by side? Explain your answer. 'A number that ends in the digits 52 is always divisible by 4.' Give me an example where the statement is true. Can you find an example where the statement is false? Why not?
• Represent a puzzle or problem by identifying and recording the information or calculations needed to solve it; find possible solutions and confirm them in the context of the problem *I can split a word problem into steps and work out what calculation to do for each step. I can explain what the answer to each step tells me* *I recognise when there may be more than one solution to a problem and try to find them all*	You need six drinking straws each the same length. Cut two of them in half. You now have eight straws, four long and four short. You can make two squares from the eight straws like this.   Arrange your eight straws to make three squares, all the same size. Draw a diagram to show your solution.
• Use knowledge of place value and addition and subtraction of two-digit numbers to derive sums and differences and doubles and halves of decimals (e.g. 6.5 ± 2.7, half of 5.6, double 0.34) *I can add/subtract decimals in my head by using a related two-digit addition or subtraction* *I can find the double or half of a decimal by doubling or halving the related whole number*	Which of these subtractions can you do without any jottings? How did you find the difference between these two numbers? Talk me through your method. Find half of 92. Use your answer to find half of 0.92. Explain the relationship between the two calculations. What number added to 0.72 gives 1? How do you know? What number lies exactly halfway between 0.48 and 0.74? How did you work this out? I think of a number, halve it, then add 0.6. I get the answer 5.2. What number did I start with? How did you work out your answer?
• Recall quickly multiplication facts up to 10 × 10 and use them to multiply pairs of multiples of 10 and 100; derive quickly corresponding division facts *I can use tables facts to multiply multiples of 10 and 100 and to find linked division facts*	What tips would you give someone who had forgotten the 7 times-table to help them to work it out? What other links between times-tables are useful? Find two numbers with a product of 1500. What other pairs can you find? Find different ways of completing this calculation: 240 ÷ ☐ = ☐.
• Use knowledge of rounding, place value, number facts and inverse operations to estimate and check calculations *Before I solve a word problem, I work out an estimate for the answer*	417 895 men and 176 243 women attended a football match. Roughly, how many people attended altogether? Suggest a multiplication problem that will have an answer close to 2000.

Objectives *Children's learning outcomes in italic*	Assessment for learning
• Use efficient written methods to add and subtract whole numbers and decimals with up to two places *I can explain each step when I write addition and subtraction calculations in columns*	How did you find the difference between these two numbers? Talk me through your method. Make up an example of an addition/subtraction involving decimals that you would do in your head and one you would do on paper. Explain why. What could the two missing digits be? □62 + □95 = 757
• Use a calculator to solve problems, including those involving decimals or fractions (e.g. to find ¾ of 150 g); interpret the display correctly in the context of measurement *I can use a calculator to find missing numbers in calculations. I use inverse operations and number facts to help me*	You have been using your calculator to find an answer. The answer in the display reads 5.6. What might this mean? You save £1.35 per week. How many weeks is it before you can buy a book costing £18.49? Explain how you used your calculator to work out the answer.
• Identify, visualise and describe properties of rectangles, triangles, regular polygons and 3-D solids; use knowledge of properties to draw 2-D shapes and identify and draw nets of 3-D shapes *I use mathematical vocabulary to describe the features of a 2-D shape. I always say whether any angles in the shape are equal* *I use the properties of 3-D shapes to draw their nets accurately*	Tell me some facts about rectangles. Give me some instructions to get me to draw a rectangle. What is the same about a square and a rectangle? What might be different? Is it possible for a quadrilateral to have exactly three right angles? Why not? Imagine you have a paper square and a pair of scissors. Imagine cutting off a corner of the square in one straight cut. Without saying anything, quickly draw the shape you cut off. Now draw the shape you have left. Compare your two shapes with the rest of your group. What are the names of your two shapes? Describe how you would draw a net for a tetrahedron.
• Identify different question types and evaluate impact on audience *I know that when my teacher asks certain mathematical questions there may be more than one answer. I try to think of all the possible answers*	What is the difference between these two questions? *What is the product of 12 and 7?* *Tell me all the factor pairs of 84.*

Learning overview

Children investigate **patterns and relationships** between numbers. They continue **sequences** involving diagrams and numbers such as:



They look for and describe relationships between the numbers in the sequence. They use this to predict the next two terms and the 10th term. They explain the rule of the sequence and relate this to the diagrams, explaining why, for example, the terms increase by 4 each time.

Children use the vocabulary *factor*, *multiple* and *product*. They identify all the **factors** of a given number; for example, the factors of 20 are 1, 2, 4, 5, 10 and 20. They answer questions such as:

Find some numbers that have a factor of 4 and a factor of 5. What do you notice?

My age is a multiple of 8. Next year my age will be a multiple of 7. How old am I?

Children investigate the statement: *Every whole number has an even number of factors.* They discover that square numbers have an odd number of factors. Because they have found a **counter-example** they know that the statement cannot be true.

Children recognise **multiples** of 2, 5, 10 or 100. They test the statement: *Any number that ends in the digits 52 is divisible by 4.* They test some three-digit numbers then use their calculators to identify examples of larger numbers with the same property.

Children use their **calculation skills** and **understanding of place value** to solve problems such as:

0.□ × □ = 2. Find all possible ways to complete the calculation by placing one digit in each box.

Find two numbers with a difference of 1.95.

I double a number then add 1.52. The answer is 1.88. What number did I start with?

What number lies exactly halfway between 0.79 and 1.43?

Find all the different totals you can using two numbers from the set of numbers: 3.75, 13.75, 1.82, 0.76, 3.93.

They choose how to record their working, using mental methods with jottings or written methods as appropriate. They appreciate that where they are asked to find all possible answers they need to work methodically. They **check answers** using **alternative calculations** or the **inverse operation**.

Children **round** the numbers involved in calculations in order to find an **approximate answer**. They use this to **check** that the answer is sensible when solving word problems such as:

I buy six first-class stamps at 37p each. How much change will I get from £5?

There are approximately 1.75 pints in 1 litre. How many pint bottles can I fill using 8 litres of milk?

They use estimation, inverse operations and properties of numbers to help them to use a calculator efficiently to solve problems such as:

□□ × 6□ = 6272

(□ ÷ 5) – 23 = 30

Children continue to **investigate properties of 3-D and 2-D shapes**. They measure angles in regular shapes and establish that all of the angles in a regular shape are the same. They measure the angles in assorted equilateral triangles to establish that they are always 60°. They discover that the opposite angles of a parallelogram are always equal. Children use their knowledge of properties of shapes. For example, they investigate the number of different shapes that can be made by placing four identical equilateral triangles edge to edge, or four identical cubes face to face. They draw accurate nets for a range of 3-D shapes, including the nets of prisms.