Year 3

Progression in mathematics

The learner

At the start of Year 3, children have a stronger understanding of the number system and of the four operations. They solve problems set in different contexts, recording the steps and information used, and checking solutions. They describe patterns that they observe, begin to make predictions and test them with examples. Children solve logical problems and, working with other children, follow a line of enquiry, making choices and decisions that they explain.

By the end of Key Stage 1, children have a range of counting skills using whole-number steps. They are becoming more confident in their understanding and use of all four number operations. They know all number pairs up to 10 and for 20 and the multiplication facts for the 2, 5 and 10 times-tables. They use signs and symbols to record and interpret number sentences, and find the values of unknown numbers. They partition two-digit numbers and mentally add and subtract one-digit numbers to and from two-digit numbers. Children continue to develop and use informal written methods of calculation, supported by practical methods, while drawing on more secure recall and mental skills. They visualise and recognise simple properties of shapes. They use standard units of measure, including units of time.

Year 3 children move into a new key stage. The end-of-key-stage assessment from Year 2 provides a clear benchmark of their attainment in mathematics. Using this assessment profile to help children to recognise their progress and to fill any gaps maintains their enthusiasm and motivation. A careful blend of support and increasing independence over the year promotes children's sense of responsibility as learners. The home–school link remains an important element in supporting their mathematical progress.

Effective daily mathematics teaching provides new learning, consolidation through practice and opportunity to use and apply mathematics to solve problems and pursue enquiries. Further opportunity to link mathematics to other curricular activities strengthens children's learning and emphasises the role mathematics plays in quantifying and explaining events.

Oral and mental work, and the use of models and images to support thinking, remain key features of Year 3 mathematics learning. Recording requires more precision as questions and problems become more complex and involve more steps. The activities children engage in should support them in developing many of the key aspects of learning identified in *Excellence and Enjoyment: learning and teaching in the primary years.*

Using and applying mathematics

Children solve one-step and two-step problems that involve numbers, money or measures, including time. They identify the information that they need, decide which method to use, and explain and record the calculations that they undertake to solve the problem. They use inverse operations to solve and check solutions to problems. They understand that a remainder after a division calculation may need rounding up or down depending on the context of the problem.

Children talk about their mathematics, describing solutions and explaining methods orally and in writing, using pictures and diagrams and, where appropriate, £.p notation. They use their mathematics to answer questions such as: 'How should we give points to teams on sports day?'. They decide how events should be organised and results measured, timed and collected. They use lists and tables to help manage their planning, and tally charts and frequency tables to collect and

sort data. They present their findings using pictograms and bar charts, making use of ICT to analyse and highlight results and place the teams in order.

Children solve a range of problems and puzzles. For example, they add and subtract different combinations of 2s, 5s and 6s to make the numbers 1 to 20, for example 6 – 5 + 2 = 3. They make and classify quadrilaterals on a 4 by 4 pinboard. They sift information from a table or list of statements to determine who owns what item. They explain their methods and solutions orally and in writing, using diagrams and picture to help them.

Children follow a line of enquiry and begin to justify their choices and explain their reasons. For example, they select six different digits to form three 2-digit numbers, e.g. 26, 51 and 43. They add two of their numbers and subtract the third, e.g. 26 + 51 – 43 to get the answer 34. They rearrange the six digits into three new 2-digit numbers and find combinations with answers that are multiples of 10. They explain their arrangement and say why some of their chosen sets of 2-digit numbers work and others do not.

Children generate shapes on a grid and identify right angles in the shapes. They record their shapes and organise them into groups, using properties such as symmetry, number of sides or number of right angles, explaining their choices and reasons. Children use software such as the ITP 'Area' to create shapes. For example, they use five squares to build shapes and then combine four of these shapes to form a 4 by 5 rectangle.

Children generate examples that satisfy statements about numbers, such as: 'In the 3 times-table, the multiples alternate between odd and even numbers' or: 'In the 4 times-table, the ones digits follow the pattern 4, 8, 2, 6, 0'. They also decide if a given statement is always, sometimes or never true, such as: 'A rectangle can be cut up to make a square and a smaller rectangle'; 'Joining a square and a triangle gives a pentagon'; 'Hexagons are made up of 4 triangles'.

Children identify rules for calculations that help them to simplify their methods. For example, they carry out the calculations 47 + 9 – 8 and 47 – 8 + 9 and similar pairs of calculations to establish that the answer is always one more than the first number and to explain why this is the case. They apply this to other pairs of calculations such as 53 + 7 – 5 and 53 – 5 + 7 to extend and generalise the rule that they have observed. Children discuss the patterns they find and begin to communicate any rules that can be applied to other calculations.

Counting and understanding number

Children consolidate and extend their knowledge and understanding of number. They build on their understanding of place value to read, write in words and figures and order numbers to at least 1000. They partition three-digit numbers into multiples of 100, 10 and 1, for example partitioning 724 into 700 + 20 + 4 or 600 + 110 + 14. They write, say, 387 as 300 + 80 + 7 and use this to show that 400 more than 387 is 787, 40 more than 387 is 427 and 4 more than 387 is 391. They carry out a similar process for subtraction. They position numbers on a number line and round two- and three-digit numbers to the nearest 10 or 100.

Children count from zero and back in steps of 2, 3, 4, 5, 6 and 10. They use the patterns and results to help them to derive and recall the associated facts in the corresponding times-tables. They use calculators, for example, to extend the tables beyond 10 and to explore patterns of the digits in the numbers generated. They count on from and back to zero using multiples of 10 and use this to give the number that is the multiple of 10 or 100 more or less than any three-digit number. Children's counting becomes more sophisticated. They count on in 9s by adding 10 and subtracting 1 and count on in 12s, from 7 say, adding the 10 and 2 independently and whispering the intermediate steps in the sequence saying: '7, (17), 19, (29), 31, (41), 43, …'

Children read and write proper fractions. They understand that in the fraction $\frac{1}{5}$ the denominator 5 identifies the number of parts the whole quantity has been divided into. It is also the divisor when

finding $\frac{1}{5}$ of, say, 20 kg. They understand that the 3 in the fraction $\frac{3}{5}$ indicates that the fraction represents three of these five parts or three fifths of the whole. They estimate and identify fractional parts of shapes. They use diagrams to compare fractions. For example, children use a rectangle of 4 rows and 3 columns to show the fractions $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{6}$, and identify which fraction is the largest. They use similar grids to begin to identify equivalent fractions such as: $\frac{4}{8}$, $\frac{2}{4}$ and $\frac{1}{2}$; and $\frac{1}{3}$ and $\frac{3}{9}$.

Knowing and using number facts

Children derive and recall addition and subtraction facts for numbers to at least 20, and number pairs that total 100. They apply these facts to identify sums and differences of multiples of 10; for example, 16 – 7 = 9 means that 160 – 70 = 90. Children generate equivalent sums and differences; for example, 100 = 40 + 60 = 41 + 59 = 42 + 58 and 15 – 8 = 16 – 9 = 17 – 10 = 7. They use inverse operations to derive facts; for example, 58 + 42 = 100 means that 100 – 48 = 52. They consolidate their knowledge of doubles of numbers to 20 and derive the associated halves. They use doubles that they know to find other doubles or near-doubles. For example, they use 45 + 45 = 90 to work out 43 + 45 and 46 + 46. They find halves of numbers such as 94 by partitioning 94 into 90 and 4, halving each part and finding the sum of the halves.

Children derive and learn by heart the 2, 3, 4, 5, 6 and 10 times-tables. They use this knowledge to derive the corresponding division facts. They generate tables such as the 6 times-table from the 3 times-table by doubling, and generate other tables, in this case the 12 times-table, by doubling again. They use facts in the 2 times-table to derive the 20 times-table by multiplying by 10. Children recognise multiples of 2, 5 and 10 up to 1000.

Calculating

Children extend their mental calculation skills to add and subtract combinations of one-digit and two-digit numbers such as: 14 – 8, 34 – 8, 34 – 18, 6 + 18, 6 + 58 and 16 + 58. In particular, they use their knowledge of addition and subtraction facts to 20 to add or subtract a one-digit number to or from any two-digit number, e.g. 63 + 8, 63 – 8. They recognise and use the fact that addition can be done in any order. Children develop strategies for dealing with special cases, for example, finding 57 – 29 by subtracting 30 from 57 and adding 1 or by representing the calculation as 58 – 30. Children continue to recognise and construct equivalent calculations that help them to carry out addition and subtraction calculations mentally. Children apply their understanding that the difference between two numbers will stay the same if both numbers are reduced or increased by the same amount. For example, finding the difference between 147 and 138 is the same as finding the difference between 47 and 38 or the difference between 49 and 40. They recognise that the sum of two numbers stays the same if one of the numbers is increased by an amount while the other is decreased by the same amount. For example, 27 + 68 has the same answer as 25 + 70 and 30 + 65. Children recognise that 172 – 46 can be represented as 172 – 40 – 6, and 547 + 25 as 547 + 20 + 5. They count up when the difference is small, as in 143 – 138.

Children develop and use written methods to add and subtract two-digit and three-digit numbers. They represent calculations such as 246 + 87 as steps on a number line, linking this to methods of recording where 87 is partitioned into 80 and 7.

246 + 87 = 246 + 80 + 7

$$\begin{array}{r} 246 \\ +\ 80 \\ \hline 326 \\ +\ 7 \\ \hline 333 \end{array}$$

For calculations involving subtraction, children use a number line, subtracting the number that they are taking away in convenient and partitioned steps. In other cases, they step up from the smaller number to the larger number. Children relate these number-line methods to expanded written methods of recording such as:

246 – 87 = 246 – 80 – 7

$$\begin{array}{r} 246 \\ -\ 80 \\ \hline 166 \\ -\ 7 \\ \hline 159 \end{array}$$

231 – 189

$$\begin{array}{rl} 231 & \\ -189 & \\ \hline 11 & \rightarrow 200 \\ +\ 31 & \rightarrow 231 \\ \hline 42 & \end{array}$$

Children begin to use their knowledge of place value and partitioning of three-digit numbers to develop their written methods for addition and subtraction of two- and three-digit numbers using expanded methods of recording:

375 + 67

$$\begin{array}{rrrrrrr} 300 & + & 70 & + & 5 & & \\ + & & 60 & + & 7 & & \\ \hline 300 & + & 130 & + & 12 & = & 442 \end{array}$$

325 – 58

$$\begin{array}{rrrrrrr} 200 & + & 110 & + & 15 & & \\ - & & 50 & + & 8 & & \\ \hline 200 & + & 60 & + & 7 & = & 267 \end{array}$$

Children understand and describe the effect on the digits when multiplying one- and two-digit numbers by 10 and 100. They use multiplication facts for the 2, 3, 4, 5, 6 and 10 times-tables, along with practical and informal written methods, to multiply by two-digit numbers. For example, for 14 × 4 or 3 × 16 they partition the two-digit number into its tens and ones and use a grid to help them to record and carry out the calculation.

×	10	4	
4	40	16	= 56

×	10	6	
3	30	18	= 48

Children understand that the problems: '30 children are organised in teams of 6. How many teams are there?' and: '30 pencils are shared equally into 6 pots. How many pencils are there in each pot?' each involve division and are represented by the calculation 30 ÷ 6. They use their knowledge of multiplication facts to derive division facts such as 30 ÷ 6 = 5. For calculations that they cannot recall, they use a practical approach or an informal method such as repeated steps on a number line. Children carry out calculations involving remainders, such as 28 ÷ 5, by identifying the multiple of 5 just below 28, in this case 25, and counting on 3 to find the remainder. Children use ICT such as the ITP 'Grouping' to support their understanding that the remainder is always less than the divisor.

Children find fractions of numbers and quantities, for example finding $\frac{1}{6}$ of £24 by dividing 24 by 6.

Children work out approximate answers to calculations involving two- and three-digit numbers by rounding numbers to the nearest 10 or 100. They use such approximations to check that their answers are reasonable. They identify that 38 + 215 is smaller than 40 + 220 = 260 and bigger than 30 + 210 = 240. They know that 19 × 12 is approximately 20 × 10 so will give an answer close to 200. Children check their calculations with a related calculation involving the inverse operation or, for addition and multiplication calculations, by changing the order of the numbers.

Children's use of mathematical vocabulary becomes more precise. They read calculations aloud to understand the structure. They read 16 + 4 = 20 as '16 plus 4 is equal to 20'. They understand that because 4 is added to 16, the inverse number sentence involves subtraction and is 20 – 4 = 16, or '20 minus 4 is equal to 16'. They read 6 × 3 = 18 as '6 multiplied by 3 is equal to 18' and establish that the inverse is 18 ÷ 3 = 6, since 3 is the multiplier in the initial calculation. Children apply this understanding to generate pairs of inverse statements and to find unknowns in number sentences. For example, for □ ÷ 3 = 8 they use the inverse to rewrite this as 8 × 3 = □ or □ = 8 × 3.

Understanding shape

Children draw and make 2-D shapes and 3-D solids. They use mathematical language to name shapes and describe their properties, for example: 'Cuboids have 6 rectangular faces, 8 corners or vertices and 12 edges. This shape is also a rectangular prism.'. They use the properties of shapes to sort them into groups, such as shapes with right angles and with line symmetry, and those without. They identify shapes from drawings and in the patterns they explore, such as a mosaic of tiles or a painting.

Children make shapes on grids and reflect these shapes in a mirror line along one side. They complete shapes with reflective symmetry and recognise that changing the orientation of the completed shape does not change its size or its symmetry. They identify the similarities and differences between shapes that are reflected, enlarged or stretched in one direction.

Children describe direction and movement about a grid using the four compass points, such as 'north two units' and 'west five units'. They identify position relative to a fixed point, for example '3 cm north and 5 cm east from the church on the map', or 'right six squares and up five squares from the bottom left square on a grid'.

Children use a set-square to draw a right angle. They identify right angles in shapes and compare other angles with right angles. For example, they use ICT to make a hexagon, and then move the corners to create new ones. In each case they identify which angles are bigger than or smaller than a right angle. They understand that two right angles represent half a turn and when put together form a straight line. Children draw an angle with two intersecting lines and estimate its size in relation to a right angle, for example: 'This angle is about $\frac{1}{3}$ of a right angle'. They test it by comparing it with a right angle.

Measuring

Children read scales and measure to the nearest division with increasing precision and accuracy. They use standard units to measure length, weight and capacity. They use a ruler to draw lines accurately and to measure length to the nearest half centimetre. They know the relationship between units, such as 1 kg being equivalent to 1000 g and 1 m to 100 cm. They understand the £.p notation for money and begin to use decimal notation for measurements, for example writing $1\frac{1}{2}$ kg as 1.5 kg.

Children read time on a 12-hour digital clock and to the nearest five minutes on an analogue clock. They use the units 'hours', 'minutes' and 'seconds' to describe time intervals. For example, they describe a school day as 6 hours, the walk home as 15 minutes, and the length of time that they can hold their breath as 28 seconds. Children calculate time intervals in practical contexts. They find start or end times when given an interval. For example, they use a clock face or time line to solve problems such as: 'It takes me 25 minutes to walk to school from home. I arrive at 8:50 in the morning. When did I leave home?'

Handling data

Children collect, organise and interpret data to find answers to questions such as: 'When is the best time of day for mathematics lessons?' or: 'How far will a paper plane fly?'. They discuss the question to identify factors that raise new questions and which might have an influence on their data. For example: 'What lesson might come before mathematics?' or: 'Does the type of paper and size of the sheet make a difference to how far the plane will fly?'.

Children decide on the data that they need to collect and plan and prepare for gathering the data. They organise the data using tally charts or frequency tables and present it as pictograms or bar charts. They understand how to interpret their tables and charts and analyse their results to identify,

say, that the best time for mathematics is the first lesson in the morning and that a mathematics lesson should never follow a PE lesson. They measure to the nearest half metre the distances travelled by paper planes of different sizes, and use a bar chart to show the distances travelled by a particular plane in 10 throws.

Children construct Venn and Carroll diagrams to help them to sort and organise data or objects. They use one criterion first and separate items into two groups; they then apply another criterion to each group. They begin to construct more complex diagrams to cope with two criteria at once, for example to decide whether numbers are in the 3 times-table, the 4 times-table, neither or both.

Embedding key aspects of learning

In Year 3 children develop more secure understanding and wider knowledge and skills to call on. These inform their thinking skills, communication skills and evaluative skills. Children contribute to questions and lines of enquiry that they develop when they use and apply their mathematics. They evaluate their own and other children's ideas and methods. They make increasing numbers of choices and decisions about what information is important and the resources and methods to use. Children begin to acquire the tools they can use to judge effectiveness and efficiency.

The introduction to informal written methods of calculation and their relation to more visual and kinaesthetic models helps children to see connections in mathematics and to other aspects of learning. Communication is developed as children talk about their mathematics, describing solutions and explaining methods orally and in writing, using pictures and diagrams. They learn new vocabulary to discuss topics such as fractions and early concepts of proportion. Working in pairs and groups helps to develop their social skills as well their mathematical thinking. They have opportunities for creative thinking when they identify relationships and make estimates and predictions they can check and test.

During Year 3, children extend their information processing skills. They learn more ways to organise and present information, drawing on ICT to help them. They begin to develop some understanding of how they learn and are increasingly able to consider their own learning goals. This self-awareness enables them to recognise what they can do well and what they need to improve, and what to set as a mathematics target.