Understanding progress in mathematics:
a guide for parents

department for
children, schools and families

qcda
Qualifications
and Curriculum
Development
Agency

Useful websites

National curriculum

qcda.gov.uk/curriculum

Information and services for parents

www.dcsf.gov.uk/familyinformationdirect

www.parentchannel.tv

www.parentlineplus.org.uk

Homework and enrichment

www.bbc.co.uk/schools

www.bbc.co.uk/learning

www.channel4learning.com/apps/homeworkhigh

www.direct.gov.uk/en/EducationAndLearning

www.gridclub.com

www.homeworkelephant.co.uk

www.rigb.org

www.learnthings.co.uk

www.schoolzone.co.uk

www.nrich.maths.org

www.s-cool.co.uk

www.nextgenerationlearning.org.uk/At-home

www.bbc.co.uk/radio4/science

Why this guide?

This guide helps parents[1] and carers understand how children progress in maths at each National Curriculum level. Also included are ideas for what you can do with your child to support their development in maths at home and help them make progress.

You will find this guide helpful when discussing your child's progress with their teachers.

At the back of this guide is information on the National Curriculum, the key stages of your child's primary and secondary education and the assessments they will be involved in.

Also available is *Understanding progress in English: a guide for parents* downloadable from **www.standards.dcsf.gov.uk/ nationalstrategies.**

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1 Reference to parents in this guide includes carers.

What is progress in maths about?

At all levels learning maths is about solving problems using key processes such as:

→ looking for patterns and relationships between numbers

→ making sense of and checking information

→ communicating and presenting maths using words and diagrams, for example, graphs and symbols

→ reasoning and developing mathematical arguments.

Progression in maths involves using and applying these processes and skills in mathematics lessons across the whole school curriculum and in everyday life. To do this children need to understand key elements such as number, geometry, measures and statistics.

As a mathematical problem-solver, your child should learn and use skills such as:

→ sorting

→ ordering

→ grouping

→ measuring

→ calculating

→ comparing

→ manipulating, organising and interpreting information.

Maths is an imaginative, creative way of thinking which is part of everyday living. Learning maths is also about knowing where it has come from, why it is necessary and how different cultures have contributed to the way it has developed over time.

Children learn maths best through tasks where they have to make choices in order to solve a problem or a puzzle. It helps them to practise skills, ideally in an enjoyable and engaging way, supporting the development of understanding as well as their confidence and their competence.

How can I help my child's mathematical development?

For younger children playing and talking about games together will really encourage their mathematical development and support their learning in school. All activities you do which are seen as a puzzle, a game or as a 'finding out' process will enhance your child's confidence to play with numbers and help them be more competent puzzlers and problem-solvers. Encouraging them to play with numbers and develop a range of mental calculation strategies will also help build their confidence and competence.

As well as playing and discussing games, older children need to practise and consolidate skills such as mental arithmetic, solving equations, working out angles and calculating an average. These skills are necessary for solving the 'bigger' problems they will encounter as their mathematics develops. You can also encourage your child to engage with maths in the media, looking at how numbers and graphs are used to support arguments and encouraging them to question the reasonableness of

what they are presented with. They may want to investigate further by searching on the internet, for example.

Many parents will find that the way maths is taught is different from their own experience. If there are aspects of maths you would like to know more about, talk to your child's teacher.

You can support your child in maths using the suggestions in this guide without a great deal of specialist knowledge.

Working at level 1 in maths

Children will be able to do many of the following:

- ➜ use objects or make drawings to explain what they have been doing
- ➜ see simple patterns and connections using pictures and numbers
- ➜ play counting games and put numbers in order
- ➜ identify numbers in different contexts, for example, recognising the same number on a clock, on a remote control or on the front door of a house or flat
- ➜ increase and decrease quantities in real life contexts, for example, understanding what happens if they have ten sweets and eat three
- ➜ use the mathematical names for common 2D and 3D shapes such as circles, squares, cubes and spheres
- ➜ sort objects such as buttons, leaves, or shells, and explain how they have chosen to sort them.

What you can do at home
to help your child make progress

- ➜ play simple counting games such as:
  - – snakes and ladders
  - – counting buttons
  - – choose two dominoes and count the total number of spots
- ➜ play simple ordering games such as:
  - – choose ten buttons and order them by size from smallest to largest
  - – from a pack of cards take out the Jacks, the Queens and the Kings and shuffle up the numbered cards. Choose any ten of them and put them in order

- ➜ play simple pattern-making games such as:
  - – with a collection of tiddlywinks make patterns such as 2 red, 1 blue, 2 red 1 blue…
  - – make patterns out of ten tiddlywinks such as:
- ➜ play simple sorting games such as sorting a collection of buttons, shells or leaves by colour or by size
- ➜ lay the table for a meal – selecting the correct number of items and matching them.

Working at level 2 in maths

Children will be able to do many of the following:

- explain why they think something is correct
- count up to 100 and put numbers up to 100 in the correct order
- know number bonds to 10, for example, $4 + 6 = 10$, $10 = 9 + 1$
- complete addition and subtraction calculations, and appreciate that addition and subtraction 'undo one another'
- understand the equals sign, for example, $8 - 1 = 5 + 2$
- recognise odd and even numbers
- name 2D and 3D shapes and identify faces, edges and vertices (the point where edges meet) on these shapes

- begin to understand angles, for example, they can recognise that when you change direction, the amount you turn through at a point is an angle
- measure the lengths of objects (for example, a pencil or a table) and weigh things to the nearest mark on the scale
- put events in the correct order, for example, giving instructions for a familiar journey
- collect information (data) to find out the answer to questions, for example, how many people have school dinners? How do people travel to school?

What you can do at home
to help your child make progress

- play with wooden blocks building towers and other structures. Is it possible to build two towers of the same height, whatever number of blocks you start with?
- from a pack of cards (without the tens, the Jacks, the Queens and the Kings) play a game of pairs where you try to turn over two cards that add up to 10
- with a pack of dominoes play the game of 'pairs' where you turn over two dominoes so the total number of spots is 12
- talk about shapes that can be found in the house
- play a game of estimating then measuring the lengths of objects in the house
- play a game of ordering everyday objects according to their weight, and then weigh them

- when someone opens a door, talk about the angle the door has turned through
- draw your child's attention to the clock so they learn to match times with events
- talk about what whole numbers mean when they appear in everyday situations such as car number plates, road signs, on a clock face, a flat or a house number. For example, counting out odd and even house numbers on a street
- play a game of 'find the number' somewhere in the house or on the way to school.
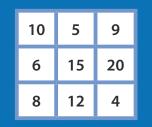
Working at level 3 in maths

Children will be able to do many of the following:

→ try different approaches when solving problems

→ test if a general statement is 'always true', 'sometimes true' or 'never true'. For instance, they can use examples to test if 'all numbers that end in 4 can be divided by 4'

→ understand what each digit in a number represents, for example, understanding that in the number 325, the digit 2 represents 20

→ deal confidently with whole numbers up to 1000 and can add and subtract them

→ begin to understand about numbers which contain a decimal point

→ know multiplication tables for 2, 3, 4, 5 and 10 and use them to solve practical problems. For example, if 20 cakes are needed for a party and cakes are sold in packs of four, how many packs of cakes should I buy?

→ talk about simple fractions in everyday life

→ recognise mirror/reflection symmetry in everyday objects, for example, they can make paper aeroplanes and explain the symmetry of the folding

→ find out the perimeter by working out the distance around simple shapes

→ use metric measures for length (centimetres and metres), capacity (litres and millilitres) and mass (kilograms and grams)

→ read commonly used times, for example, half past and quarter to the hour

→ use and interpret diagrams that represent information, such as bar charts.

What you can do at home
to help your child make progress

→ make a calculation:
  – from a pack of cards (without the tens, the Jacks, the Queens and the Kings) play a game where each player is dealt four cards and everyone has 1 minute to make up a calculation using cards they have in their hand so the answer is the value of the next card turned over
  – a scoring system can be used such as 1 point for using two cards, 2 points for using three cards and 3 points for using all four cards

→ dice bingo:
  – throw 2 dice and multiply the numbers together
  – cross off the numbers on a 'Bingo' card, such as:

10	5	9
6	15	20
8	12	4

→ talk about numbers that you see on packets or tins of food. This could include talking about how healthy different foods are

→ identify symmetrical objects, for example, look for symmetrical wheel trims on cars

→ find out how many millilitres different containers hold, such as a cup, perhaps estimating answers first then using a measuring jug to check the estimates

→ use a real clock to talk about the times certain events happen at home, for example, getting up in the morning, meal times, when the post arrives. Also, you could talk about times when certain television or radio programmes begin and end, and how long they last for

→ help when cooking by measuring ingredients and using the timer.

Working at level 4 in maths

Children will be able to do many of the following:

→ develop their own approaches for solving problems

→ select appropriate strategies for addition, subtraction, multiplication and division

→ decide when and if to use ICT, for example, they might recognise that it's easiest to do division and multiplication calculations up to 10 by 10 mentally, but estimating the family travel costs for a week could be done with a calculator or spreadsheet

→ use a computer to produce numerical and geometric patterns, such as tiling designs

→ understand simple fractions that emerge in everyday contexts. For example, they know that
$$\frac{1}{3} \text{ and } \frac{2}{6}$$
of a pizza are the same

→ identify and explain patterns, for example, in a sequence of numbers give the next number in the sequence or explain how they created a geometric design

→ find out the area of simple shapes by measuring the space enclosed by the shape's perimeter

→ apply knowledge in practical situations, for example, measuring and making diagrams, maps and 3D models

→ know how to order decimals, and record and interpret measures written as decimals. For example, they will recognise that 1.64m is the same as 1m 64cm and 1.056kg is the same as 1kg 56g

→ select the most appropriate average (mean, median or mode) when reporting findings from data.

What you can do at home
to help your child make progress

→ discuss how you might work out the cost of a week's food for the family. Encourage your child to estimate the shopping bill by keeping a running total while you shop

→ try to find examples of numbers that contain fractions or decimals in a daily newspaper, a magazine or on food containers

→ make a list of calculations where the answer is the same. What is the hardest calculation that can be made?

→ use pieces of card to make a three dimensional model of a room to a sensible scale

→ work out how much time, on average, different people spend doing different things at home, for example, eating, tidying up, cooking, playing, watching television, using a computer, sleeping

→ measure ingredients when cooking

→ take opportunities to discuss weights written on packets of food and what they mean in terms of grams and kilograms

→ look at maps of different scales of your local area, for example, a road atlas and a web map, and discuss how far it is from your home city, town or village to other nearby places.

Working at level 5 in maths

Children will be able to do many of the following:

- → identify and obtain information and select the mathematical tools needed to tackle a problem
- → use mathematical language, symbols and diagrams accurately
- → understand connections between fractions, decimals and percentages
- → solve ratio problems, for example, adapting a recipe for 4 to feed 6
- → understand how percentages can be used to compare different proportions and find simple percentages mentally. For example, they could work out 20% of £16 by finding 10% (£1.60) and doubling it
- → construct and use simple formulae to find the answer to problems, such as working out how many texts and minutes you would get for a £10 top-up with different mobile phone network providers
- → know facts about angles, such as the sum of the angles of a triangle (180°) and the sum of angles around a point (360°)
- → construct diagrams using mathematical approaches and

equipment, for example, they can create scale drawings or plot graphs of data

- → convert between different metric measures, for example, understand that 1.04kg is 1040g
- → understand probability, for example they understand that when throwing a six-sided dice, all numbers are equally likely – but that doesn't mean that if you roll the dice six times you'll get each of these numbers
- → use data to assess likelihood and risk in simple situations, for example, if a newspaper headline reports '50% more people likely to die from flu' but the chance of dying from flu is 1 in 5000 each year.

What you can do at home
to help your child make progress

- → look at the weather page in a local newspaper or website and find out what all the different sets of numbers/pieces of information mean
- → look for and discuss the use of percentages in articles in a newspaper or on the television or discuss the per cent (%) interest on a savings account
- → talk about supermarket offers, for example, "3 for the price of 2", "Buy 1 get 1 free", "Two for £2", "Buy one get one half price". Work out together which is the cheapest or best value
- → calculate percentage sales discounts
- → adapt recipe amounts for different numbers of people
- → play the 'estimate the size of the shopping bill' game, that is, round every item to the nearest 50p and see how the estimated bill compares to the actual cost

- → consider the probabilities of certain events happening when playing simple games with dice, for example, the chance of gaining a particular total when two dice are thrown
- → read timetables and maps when planning a journey
- → look at local ordnance survey maps and talk about how bearings are measured from your city, town or village to other nearby places.

Working at level 6 in maths

Children will be able to do many of the following:

- devise their own strategies for working on mathematical tasks and problems, for example, break down complex problems into smaller, manageable tasks

- construct an argument using mathematical symbols, diagrams and language correctly

- convert between fractions, decimals and percentages

- add and subtract fractions

- investigate and explain number patterns by drawing graphs and using algebra to represent them, for example, by using algebra to explain the pattern 3, 7, 11, 15 as $4n - 1$ ($4 \times 1 - 1 = 3$, $4 \times 2 - 1 = 7$ etc.)

- know about different quadrilaterals (four-sided closed shapes) and their properties

- understand formulae for calculating the circumference and the area of a circle

- work out the volume of a cuboid, for example, the volume of water needed to fill a rectangular water tank

- use ICT to explore transformations of shapes (reflection, rotation, translation, enlargement)

- understand how to construct a pie chart

- calculate the probability of different outcomes, for example, getting a head and a tail when tossing two coins.

> At level 6 and beyond, mathematical activity becomes more abstract and uses more algebra. Some of the best ways that parents can support their child's progress at this level are by looking for opportunities to extend their experience of maths in the wider world. For ideas see page 17.

> If your child is in Key Stage 2 working at level 6, they are likely to be supported by gifted and talented provision in school or elsewhere. Talk to your child's teachers to find out more.

Working at level 7 in maths

Children working at level 7 and beyond are likely to achieve GCSE grade C or above. At this level, mathematics lays the foundations for progression to AS Level or A Level. Children at level 7 will be able to do many of the following:

- justify their solutions to problems and look for connections with other problems

- they begin to appreciate the power of proof, such as justifying 'the square of all odd numbers is odd'

- explore problems by controlling and changing variables, for example, in science when investigating pressure, volume and temperature of gases, they keep one variable fixed and collect data about two others

- calculate percentage increase or decrease using multiplication only, for example, an increase of 20% can be found by multiplying by 1.2

- understand what a quadratic sequence is and how to describe the nth term, for example 1, 4, 9, 16, 25, …, n^2 ($1 \times 1 = 1$, $2 \times 2 = 4$, $3 \times 3 = 9$ therefore this sequence can be expressed as n^2)

- solve simultaneous linear equations using graphs and algebraic methods, for example, 'Two coffees and a cake cost £2.50, one coffee and cake cost £1.75. How much does each cake and each coffee cost?'

- apply Pythagoras' theorem to a range of problems

- find the locus of a point moving according to a given rule

- use ICT to draw graphs, solve equations and create geometric patterns

- understand and use compound measures such as speed (distance travelled in a particular time interval) and density (mass of a particular volume)

- understand that all measurements are approximate

- design experiments and gather data to test hypotheses, such as 'if you are good at English, you are also good at history'.

Working at level 8 and Exceptional Performance in maths

Children will be able to do many of the following:

→ tackle problems in unfamiliar contexts by selecting from a range of techniques such as algebra and graphs, often exploring alternative strategies, for example, investigating the path of a basketball when shot at the net

→ use mathematical symbols consistently to communicate precise meanings

→ apply mathematical reasoning and logic and construct simple proofs

→ calculate with powers, roots and numbers in standard form

→ solve problems involving proportional change, for example, if you have a credit card with a monthly interest rate of 2% you can calculate the amount owed at the end of three months by multiplying by 1.02^3

→ evaluate and manipulate formulae, equations and expressions

→ solve inequalities in two variables

→ use and interpret linear, quadratic, cubic and reciprocal graphs

→ understand and use congruence and similarity when solving problems

→ use trigonometric functions (sine, cosine and tangent) to solve problems in two dimensions

→ understand cumulative frequency, and use the interquartile range to compare sets of data

→ solve probability problems involving compound events, for example, in a box of 35 chocolates there are five toffees, the probability of getting a toffee changes each time a chocolate is taken from the box.

What you can do at home to help your child make progress beyond level 6

At level 6 and above the nature of maths becomes more algebraic and abstract. This involves making and using formulae and developing knowledge of sequences and graphs. You could ask your child to explain their understanding of some of the maths problems they are working on and solving at school. This will help reinforce and consolidate what they know.

You could also encourage your child to:

→ attend a maths event at school with you

→ work out the best value for money when shopping

→ watch documentaries and discuss the maths involved in climate change or other environmental concerns

→ talk about their work with reference to a textbook or online resource such as BBC Bitesize or MyMaths

→ watch the Royal Institution (RI) Christmas Mathematics Lectures, designed for children and young people, that offer exciting ways of looking at maths problems

→ listen to maths programmes such as 5 numbers, Pi, Golden Ratio, Imaginary number, Infinity.

Higher attaining children could be encouraged to:

→ consider the maths involved in modelling real-life situations, such as building a bridge or the arc a ball makes when thrown

→ find out why gambling is likely to cost you money

→ explore the interest earned on a range of savings accounts, the cost of obtaining money for a mortgage or the cost involved in using credit, for example, children can be encouraged to use an ICT spreadsheet to calculate and compare interest rates

→ join a maths club (at school or online, for example, NRICH), or take part in master classes (for example, RI) and other enrichment activities.

How do I know my child is progressing?

The programmes of study show progress within each subject for Key Stages 1, 2 and 3. In most subjects these are split into eight levels, plus a description of exceptional performance.

Children develop at different rates, but National Curriculum levels can give you an idea of how your child's progress compares to what is typical for their age. Children are expected to make two levels of progress as they move through each key stage, for example:

→ by the end of Key Stage 1 (Year 2), most children will be working at level 2

→ by the end of Key Stage 2 (Year 6), most will be working at level 4

→ by the end of Key Stage 3 (Year 9), most will be working at level 5 or level 6.

Level judgements can be broken down into three sub-levels which can help discussion about progress. For example:

→ high 2 or 2a means that the pupil is working at the top of level 2 and is almost into level 3

→ secure 2 or 2b means that the pupil is working securely in level 2

→ low 2 or 2c means that the pupil's work is just into level 2, but aspects of their knowledge and understanding may not be secure.

What is the National Curriculum?

The National Curriculum defines an entitlement for all children by setting out the stages and subjects your child will be taught during their time at school. Children aged five to 16 in maintained or state schools must be taught the National Curriculum.

What does it set out?

The National Curriculum is used by all maintained schools to ensure that teaching and learning is balanced and consistent. It sets out:

→ the subjects taught

→ the knowledge, skills and understanding required in each subject

→ standards or attainment targets in each subject – teachers can use these to assess your child's progress and plan the next steps in their learning

→ how your child's progress is assessed and reported.

Within the framework of the National Curriculum, schools are free to plan and organise teaching and learning in the way that best meets the needs of their pupils.

What are Programmes of Study?

For each National Curriculum subject, there is a programme of study. These describe the subject knowledge, skills and understanding pupils are expected to develop during each key stage.

For more information go to qcda.gov.uk/curriculum

What are key stages?

The National Curriculum is organised into blocks of years called key stages. There are four key stages as well as an Early Years Foundation Stage. The 'Early Years Foundation Stage' covers provision for children from birth to five.

This diagram shows how the key stages are organised and where formal assessments (see page 21) of your child's progress are made. Your child's teacher will be able to tell you more about how the school assesses progress between these key points.

Age	Stage	Year	Assessment
birth-5	Early Years Foundation Stage		
4-5		Reception	Early Years Foundation Stage Profile teacher assessment
5-6	Key Stage 1	Year 1	
6-7		Year 2	Formal teacher assessments in English, mathematics and science
7-8	Key Stage 2	Year 3	
8-9		Year 4	
9-10		Year 5	
10-11		Year 6	National tests and formal teacher assessments in English and mathematics and teacher assessment in science
11-12	Key Stage 3	Year 7	
12-13		Year 8	
13-14		Year 9	Formal teacher assessments in English, mathematics and science and the other foundation subjects
14-15	Key Stage 4	Year 10	
15-16		Year 11	Most children take GCSEs or other national qualifications

What is teacher assessment?

Teacher assessment is an important part of everyday teaching and learning in the classroom. Your child's teacher will be able to explain the range of formal and informal ways they use assessment to support your child's progress.

To find out more about the range of assessment approaches schools use and examples of conversations about learning go to: **www.standards.dcsf.gov.uk/ nationalstrategies.**

What are national tests?

The National Curriculum tests won't give you a complete picture of how your child is doing at school – they provide a snapshot, showing how they performed in selected parts of a subject on a particular day. But schools can use the test results as an independent measure of how they, and their pupils, are doing compared to standards across the country.

At the end of Key Stage 1, the teacher's assessment of your child's progress will take account of their performance in English and mathematics, supported by tasks and tests that are administered informally.

At the end of Key Stage 2, your child will take national tests in English and mathematics.

At the end of Key Stage 3 performance in all subjects is judged by teacher assessment.

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