Mathematics: Level 10

Number

- [no content at Level 10]

Algebra

- Understand that the gradient is the rate of change at that point and use to solve problems with real-life graphs, such as the velocity at any given time on a distance-time graph or the acceleration at any given time on a speed-time graph

Geometry

- Know how to use a diagram to represent the sum (resultant) and difference of two vectors and the scalar multiple of a vector
- Solve problems and prove geometric results using vectors, including using midpoints or ratios (Level 11)

Data

- [no content at Level 10]

Mathematics: Level 9

Number

- Understand and use the fact that a unitary fractional index means a root. Eg: $4^{\frac{1}{2}} = \sqrt{4} = 2$; $8^{\frac{1}{3}} = \sqrt[3]{8} = 2$
- Understand that the inverse of raising something to the power of n is raising it to the power of 1/n
- Understand the concept of some square roots being irrational numbers and the need to leave answers to problems in surd form
- Know which square roots are surds
- Know how to use surds and pi in exact calculations, without a calculator (making links with Pythagoras questions, for example)
- Given a number rounded to significant figures or decimal places, know how to find the bounds of its accuracy. Use inequality notation to specify the error intervals. For example, if x = 3.4 (rounded to 1 dp), $3.35 \leq x < 3.45$
- Be able to write the upper bound and the lower bound of a number (or measurement). Know that the upper bound ends with a '5' and not a recurring decimal
- Recognise a graph showing exponential growth or decay

Algebra

- Solve quadratic equations by factorising eg $x^2-7x+12=0$
- Draw the graph of a quadratic function, showing the y- and x-intercepts and the coordinates of the turning point.
- Identify the intercepts and turning point of quadratic functions from their graph.
- Be able to combine inequalities graphically to find a region that satisfies all of them and state the coordinates of points within that region (with integer values)

- Find the equation of a line perpendicular to one given
- Draw a tangent to a curve

Geometry

- Recall or work out the exact values of the trigonometric ratios for angles 0°, 30°, 45°, 60° and 90°
- Calculate the volume of a cone, pyramid or a sphere
- Calculate the surface area of a cone or a sphere
- Calculate the sum (resultant) and difference of two column vectors and the scalar multiple of a vector and know how to use a diagram to represent vectors
- Show that a vector is parallel to another vector if they are multiples of each other

Data

- Describe different sampling methods and their pros and cons, including stratified sampling
- Use a two way table in calculations for stratified sampling
- Draw a Venn diagram and use it to find the probability of different outcomes or combinations of outcomes.
- Use the notation $A \cap B$ to represent the intersection of the sets A and B
- Use the notation $A \cup B$ to represent the union of the sets A and B.
- Use the notation A' to represent the complement of Set A.

Mathematics: Level 8

Number

- Use given calculations to work out related calculations using powers of 10
- Understand and use negative indices in number work and in algebra
- State the reciprocal of any given number
- Read and write numbers in standard form, on paper and on a calculator
- Convert between ordinary and standard form
- Do calculations with standard form without a calculator
- Do calculations with standard form with a calculator
- Solve problems in standard form
- Check calculations using estimation, working backwards or sensible size
- Work out exact answers including π, fractions and square roots
- Convert recurring decimals to fractions
- Understand and calculate simple and compound interest
- Calculate repeated percentage changes eg interest rates or depreciation using the power key on a calculator

Algebra

- Show inequalities on a graph, with correct lines and shading
- Factorise quadratic expressions eg x2-7x+12
- Recognise the difference of two squares and perfect squares
- Rearrange and change the subject of formulae involving fractions
- Solve simultaneous equations using substitution
- Find the midpoint of a line (2D and 3D)

Geometry

- Use trigonometic ratios sin, cos and tan to calculate lengths in right-angled triangles
- Use inverse trigonometric ratios to calculate angles in right-angled triangles
- Solve problems involving trigonometry and Pythagoras
- Solve bearings problems using trigonometry and Pythagoras
- Calculate the area of a sector of a circle
- Calculate the arc length and the perimeter of a sector
- Find the radius or the angle of a sector if I know the area or arc length
- Calculate the volume and surface area of a prism or cylinder
- Convert between metric units of area and volume
- Carry out and describe enlargements using a positive or negative, integer or fractional scale factor

Data

- Describe different sampling methods and their pros and cons, including systematic sampling.
- Find the lower quartile and upper quartile, then calculate the interquartile range, from data presented in a list or stem and leaf diagram
- Draw a tree diagram to show the results from two or more events and use it to calculate the probability of combined events
- Know that P(A) + P(B) 'OR' rule can be used when A and B are mutually exclusive
- Know that P(A) × P(B) 'AND' rule can be used when A and B are independent

Mathematics: Level 7

Number

- Multiply and divide decimals by negative powers of 10, for example: 0.1, 0.01
- Recognise powers of 2, 3, 4, 5 and 10
- Understand what it means to raise something to the power of 0
- Understand what it means to raise something to the power of 1
- Know how to multiply and divide powers of a number; $10^4 \times 10^3 = 10^{4+3} = 10^7$
- $10^4 \div 10^3 = 10^{4-3} = 10^1$
- Find a power of a power Eg: $(10^4)^3 = 10^{4 \times 3} = 10^{12}$
- Use the index rules in algebra
- Find the Lowest Common denominator (LCM) and highest common factor (HCF) from prime factors
- Explain why not to round off an answer until the end, and use an appropriate degree of accuracy.
- Multiply a fraction by a fraction
- Understand and use reciprocals
- Divide a whole number or a fraction by a fraction
- Increase or decrease by a percentage by using one multiplication
- Find the percentage change
- Work out the original if I am told the increased or decreased amount
- Convert fractions to decimals

Algebra

- Understand how to use function notation, e.g. f(x) and substitute numbers into a function
- Multiply two brackets to form a quadratic expression eg (x+3)(x+3)
- Solve linear equations with brackets and negatives. For example: 9(3x+1) + 4(3x-2) = 7x;
- Solve equations involving fractions. For example:
  - eg: $\frac{2x+1}{3} = \frac{7x-2}{7}$ or $\frac{x}{2} - \frac{x}{5} = \frac{3}{4}$
- Solve simultaneous equations by finding the point of intercept on a graph
- Solve simultaneous equations using elimination
- Write and solve simultaneous equations from practical situations
- Show inequalities on a number line
- Solve inequalities algebraically
- Give integer solutions to inequalities
- Recognise and solve problems involving triangle numbers
- Know the Fibonacci sequence
- Use a flowchart to generate a sequence
- Recognise the links between a rule for a sequence expressed in words, symbols, in a table of values or on a graph.
- Find a rule from an investigation, using algebra correctly
- Understand the difference between a specific example and a proof
- Find the equation of a straight line using the gradient and y intercept
- Find the equation of a line parallel to one given
- Find the gradient of a line between two points
- Use 3D coordinates
- By identifying two points on the tangent, calculate the gradient

Mathematics: Level 7

Geometry

- show a proof for the sum of the angles of a triangle being 180°, and the sum of the angles in a quadrilateral being 360o
- work out if different polygons will tessellate
- Understand and use Pythagoras' theorem to find missing lengths in a right-angled triangle
- Construct an angle bisector
- Construct the perpendicular bisector of a line, the perpendicular from a point to a line, and the perpendicular from a point on a line
- Understand the meaning of locus
- Solve problems on loci
- Understand when shapes are congruent or similar
- Use SAS, ASA, SSS, and RHS to construct triangles and to demonstrate that two triangles are congruent
- Solve problems involving similar and congruent shapes, finding lengths and angles
- Use Pythagoras' theorem to help work out the perimeter of a right-angled or isosceles triangle or a compound shape
- Calculate the volume of prisms including cylinders
- Work out missing sides of a prism if I know the volume
- Given two of: density, mass, volume be able to calculate the missing one and give the correct units
- Understand and calculate density of a prism
- Enlarge a shape using a centre of enlargement and positive integer or fractional scale factor
- Describe fully the single transformation which maps the object to the image

Data

- Make a sensible decision about class intervals when grouping data
- Compare data in a back-to-back stem and leaf diagram
- Find the mode (or modal group), median (or median group) and mean (or estimated mean) from data presented in a list, stem and leaf diagram, frequency table, pie chart, bar chart or frequency diagram
- Estimate probability from relative frequency
- Understand that repeating an experiment more times is likely to give a more accurate estimate of probability
- Use a two way-table, frequency tree, or Venn diagram to organise results and calculate the probability for combined events
- Use two way tables to sort out information presented in long word problems to find missing information or solve a ratio, proportion, fraction, percentage or probability question
- Understand why we use samples and why they must be as representative of the population as possible
- Consider what a suitable sample size would be for a given population or data set
- Describe different sampling methods and their pros and cons, including: convenience sampling and random sampling

Mathematics: Level 6

Number

- Add, subtract, multiply and divide negative numbers
- Multiply or divide a decimal by a decimal
- BIDMAS to include decimals, negatives and extend to include squaring and cubing
- Be able to carry out prime factor decomposition, using factor trees
- Know the squares of integers from 1x1 up to 15x15 and the corresponding square roots
- Know the cubes of 2, 3, 4, 5 and 10 and the related cube roots
- Recognise numbers that have particular properties, such as square numbers, triangular numbers, cube numbers, multiples of 3 etc, factors of 20 etc
- Use a calculator to do multi-stage problems, eg
- Read tables, bills and timetables to solve problems
- Add and subtract fractions with different denominators
- Convert between per cent and fractions
- Find a percentage increase/decrease
- Compare ratios (unitary method)
- Solve ratio problems (unitary method)

Algebra

- understand the meaning of the words: equation, formula, identity, expression, unknown and variable.
- Write an expression in algebra for perimeter or area
- Multiply a bracket by a number or a letter eg a(3a+5), b(2a-3b), 2c(4c-5), -4(3x+2)
- Simplify expressions with brackets Eg: 3-2(4x-1); 5(2x+3)-(7x-1)
- Factorise an expression into a number x a bracket or a letter x a bracket   For example: $3a2 + ab = a(3a + b)$
- Work out algebraic expressions in the right order (BIDMAS)
- Simplify expressions that have powers in them eg 3abc x 2bc2
- Understand how to simplify algebraic expressions by collecting like terms where x2 is involved
- Eg: simplify x2+4x+5x+20 to give x2+9x+20
- use formulae to substitute positive and negative integer or decimal variables. eg: given that a=4, b=-2, c=1, work out m=2(a+b)-c
- Solve equations with x on both sides eg 4x-2=3x-1
- Solve equations with brackets
  - Eg: 2(2x + 1) = 3(x + 7)
  - 2(3x-4) = 5(8-2x)
- Write and solve an equation from an I think of a number problem
- Write and solve equations from practical situations and diagrams
- draw and interpret graphs of real life or physical situations
- use a graph to work out speed, given speed, finish an incomplete graph
- match up tables of values, equations, graphs and descriptions
- Explain what a gradient and an intercept is and how they connect to y=mx+c
- Match straight line graphs with their equations
- Draw graphs of the form ax+by=c
- Rearrange an equation of the form ax+by=c into y=mx+c

Mathematics: Level 6

Geometry

- Understand why some shapes tessellate whilst others don't by using the "angles around a point add up to 360°" fact
- Explain why any triangle will always tessellate
- Explain why any quadrilateral will always tessellate
- Use the rules that, on parallel lines, Alternate angles are equal and Corresponding angles are equal as well
- Use the sum of the interior angles of a polygon to work out the size of each angle in a regular polygon, with particular emphasis on polygons with 5,6,8,9,10 & 12 sides
- state the properties of common 2D shapes, with a focus on special quadrilaterals
- use, draw and find bearings
- Work out the area of a parallelogram
- Work out the area of a triangle
- Work out the area of a trapezium
- Work out the area of compound shapes (made up of rectangles, triangles, parallelograms and trapeziums)
- Solve problems involving area and circumference of a circle
- Find the area or perimeter of a semi-circle or quarter-circle
- Illustrate and name parts of a circle: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
- Sketch the net for any 3-D shape
- create or sketch a 3D shape from a net
- Find the surface area of prisms including cylinders
- draw the plan, front and side elevation for a 3-D shape,
- make a 3D shape from the plan, front and side elevations
- know that shapes are congruent if they have a scale factor of 1
- know what changes and what stays the same when objects are enlarged
- understand that ratios can be simplified and know how to use the unitary method
- create scale drawings
- Know how to use scale drawings to answer questions ranging from interpreting distances to showing the simple locus of a point drawn to scale.

Data

- Recall the data handling cycle : understanding what is involved at each stage
- By considering a specific research question or hypothesis, decide which type of graph would be most useful. Include: pictograms, tally charts, different types of bar charts and pie charts.
- construct a pie chart from a frequency table;
- compare data represented in a pie chart and a bar chart
- Draw and interpret stem and leaf diagrams, including the key
- Use the shape frequency and stem and leaf diagrams to describe data
- Write a hypothesis to compare two variables
- Draw and interpret a scatter graph
- Explain positive, negative, strong, weak and no correlation
- Draw and use a line of best fit
- Group discrete and continuous data in a table
- Find the modal group from a grouped frequency table
- Find the median for grouped data
- Decide which average is most suitable for a set of data
- Compare data using averages, range and different kinds of graphs
- List all the outcomes from two events systematically
- Show the outcomes from two combined events in a sample space diagram
- Calculate probabilities from sample space diagrams
- Explain the meaning of mutually exclusive
- Work out the probability of something not happening, if I know the probability of it happening
- Understand and be able to use two-way tables, including filling the gaps in incomplete two way tables

Mathematics: Level 5

Number

- Use the symbols =, ≠, <, and >
- Multiply and divide any number by 10, 100 or 1000
- Order any decimals and put them on a number line
- Do calculations in the right order, and use brackets (BIDMAS)
- Order negative numbers and put them on a number line
- Add and subtract negative numbers
- Recognise prime numbers up to 100
- Explain and work out the Lowest Common Multiple (LCM) and Highest Common Factor (HCF) of a pair of numbers
- Multiply a 3 digit by a 2 digit number
- Multiply a decimal by a whole number in my head
- Divide a 3 digit by a 2 digit number
- Divide a short decimal by a whole number in my head
- Round a number to the nearest 10, 100, 1000, million...
- Round a number to 1 or 2 decimal places
- Round to any number of significant figures
- Truncate a number to any number of decimal digits
- Use rounding to work out a rough answer
- Find equivalent fractions
- Cancel fractions to their lowest terms
- Change between improper fractions and mixed numbers
- Order fractions and place them on a number line
- Write decimals as fractions eg 0.23, 0.05
- Work out a fraction of an amount (unitary method)
- Understand the difference between ratio (part-to-part) and proportion (part-to-whole)
- Use and convert between metric measures: length (mm,cm,m,km), mass/weight (mg, g, kg, tonne) capacity (ml, cl, l)
- Work with imperial units including miles, feet, pounds, pints, gallons when given the conversion

Algebra

- Explain the meaning of term, expression, algebraic
- Write an expression that uses letters to represent numbers I don't know
- Write I think of a number expressions as number machines and algebra
- Work out an expression if I'm told what the numbers represent eg if a=2 and b=4, what is 2a+3b?
- Simplify expressions by collecting like terms eg a+a+a=3a, a+2b+3a=4a+2b, 3a-2b+4a-6b=7a-8b
- Make equivalent equations
- Explain the idea of balancing equations
- Solve equations with two operations eg 2x+5=11
- Write the 10th, 100th term of a sequence if I'm given the rule
- Write a rule using algebra
- Recognise the variable and constant parts of a physical sequence
- Plot coordinates including negatives
- Draw and label axes correctly
- Plot points on a coordinate grid that fit a rule y=x+3
- Plot the lines y=x, y=-x, x=-1, y=3
- Draw tables and graphs for equations of the form y=mx+c

Mathematics: Level 5

Geometry

- Use a protractor to accurately draw or measure acute, obtuse angles and reflex angles within 1°
- Use these rules for angles:
    - Angles at a point add to 360o
    - Angles in a triangle add to 180o
    - Vertically opposite angles are equal
- Given a shape, show if the shape tessellates or not by creating a tiling pattern
- Construct a triangle given two sides and the angle between (SAS)
- Construct a triangle given two angles and the side between (ASA)
- Use a ruler and protractor to construct any polygon
- Identify and describe all the properties of isosceles, equilateral and scalene triangles
- Identify and describe all the properties of special quadrilaterals (square, rectangle, parallelogram, trapezium, kite, rhombus and arrow-head)
- Work out missing lengths on shapes made up of rectangles
- Work out the area and perimeter of shapes made up of rectangles
- know the vocabulary of 3D shapes (face, vertex, vertices, edges)
- understand the meaning of similarity

Data

- Draw and interpret line graphs
- Draw and interpret bar graphs, including with dual bars
- Find the mean, median, mode and range from a bar chart or pie chart
- Describe a set of data using the mode, median and range
- Use the averages and range to compare two sets of data
- Decide which average is most useful
- Work out the data values if I'm told the mode, median, mean and range
- Say which situations have equally likely outcomes
- Use the probability scale from 0 to 1 and place events on it
- Write the probability of an event as a fraction
- Estimate probability from an experiment
- Compare expected results with an experiment

Mathematics: Level 4

Number

- Read and write any numbers up to one million in words and figures, taking care to spell words correctly
- Recall my times tables up to 12x12
- Explain how to tell if a number is divisible by 2 or 5
- Find factors and multiples of numbers
- Order numbers with two decimal places and put them on a number line
- Read and write amounts of money, and do money calculations
- Explain when to add, subtract, multiply or divide to solve a problem
- Work out complements to 100, 1000, 360
- Use tables to do mental division
- Use a written method to add and subtract decimals
- Multiply a 2 digit number by a 1 digit number eg 14x5
- Round numbers to the nearest 1, 10 or 100
- Understand that a percentage is a fraction out of 100
- Find 10%, 25%, 50% of an amount
- Say what fraction has been shaded on a diagram
- Shade in a diagram to show a given fraction
- Put simple fractions on a number line
- Add fractions with the same denominator
- Work out fractions of an amount (1/2, 1/3, 1/4)
- Understand ratio. Use the : symbol and use the correct language
- Find equivalent ratios
- Split an amount in a ratio

Algebra

- Use a formula written in words
- Use letters to represent numbers I don't know
- Work out an expression if I'm told what number the letter stands for Eg if a=5, then a+3=8
- Use number machines with two steps
- Use a number machine backwards
- Explain what inverse means
- Solve equations with letters on only one side
- Describe patterns in sequences, and how to get the next term in the sequence
- Fill in the gaps in a sequence, both ascending (getting bigger) and descending (getting smaller)
- Write a sequence if I'm told the first term and the pattern
- Recognise sequences of odd numbers, even numbers, and times tables
- Recognise which times table a sequence comes from
- Make and draw sequence patterns
- Explain how the coordinate grid works, labelling the axes correctly
- Use coordinates to draw pictures by following instructions
- Identify the coordinates of a point and write them correctly

Mathematics: Level 4

Geometry

- Estimate the size of any angle to the nearest 10°
- Sketch an estimate of an angle to within 10°
- Use the fact that angles on a straight line sum to 180° to find missing angles
- Recognise and name a: scalene triangle, isosceles triangle, equilateral triangle, square, rectangle, rhombus, parallelogram, trapezium, pentagon
- Recognise, and be able to create, which nets make cubes and which do not.
- Make a 3D shape by using its net (Eg: prism or cuboid)
- Construct shapes (including nets) using a pencil, ruler and protractor
- Find an area by counting squares
- Find the area of an unusual shape by counting squares and estimating
- Find an area of a rectangle by working out length x width
- Find the perimeter by measuring sides
- Find the perimeter when I'm told the lengths of the sides
- Use the correct units for area and perimeter
- Draw all the lines of symmetry on a regular polygon
- Draw all the lines of symmetry on other shapes
- Explain and use the words axis, object, image
- Recognise the order of rotational symmetry of a shape

Data

- Ask questions, plan how to answer them and how to collect the data required
- Write a hypothesis
- Know the difference between quantitative and qualitative data
- Make and complete a tally chart and frequency table
- Explain what a frequency table shows
- Draw a bar chart and label the axes
- Find the mode and modal group from a list of raw data
- Find the median from a list of raw data
- Find the mean from a list of raw data
- Find the range from a list of raw data
- Put events onto a probability scale labelled impossible, unlikely, equally likely, likely, certain
- Use the spaces in between the words to place events
- Understand evens or 50-50

Mathematics: Level 3

Number

- Read 12 and 24 hour clock times, and tell the time exactly
- Add and subtract 2 digit numbers in my head
- Use a written method to add and subtract 3 digit numbers
- Read and write any numbers up to ten thousand in words and figures
- Order numbers with one decimal place
- Tell the time using ¼ and ½ hours, and find how long between times
- Know when to add, subtract, multiply or divide
- Know other words for add, subtract, multiply and divide
- Work out complements to 100
- Add and subtract whole numbers on a number line
- Work out what fraction of a shape is shaded
- Explain which is the numerator and denominator

Algebra

- Explain what the = sign means
- Fill gaps in number sentences
- $◊ + 3 = 8$, $4+7 = ⌂$, $12=20 - □$
- Use letters to stand for numbers

Geometry

- Complete a shape with a horizontal or vertical or diagonal mirror line
- Use acute, obtuse, reflex and right angle to describe angles
- Use a pair of compasses to draw a circle of a given radius
- Recognise reflection symmetry in simple shapes
- Colour/shade a diagram to give it reflection symmetry

Data

- Use a tally table and tally marks
- Draw a pictogram
- Explain what a pictogram shows
- Put shapes or numbers onto a Venn diagram or a two way table
- Put data in order
- Find the biggest and smallest values
- Describe a set of data using the most common value or what most numbers are close to

Mathematics: Level 2

Number

- count, read, write, order and compare
- numbers up to 100
- add and subtract two-digit whole numbers up to 100
- multiply using single digit whole numbers
- use and interpret +, −, ×, and = in practical situations for solving problems
- understand odd and even numbers
- approximate by rounding to the nearest 10
- read, write, and compare halves and quarters of quantities
- find halves and quarters of small numbers of items or shapes
- recognise and appreciate the value of all coins
- convert from pence to pounds and vice versa
- make amounts of money up to £ 1 in different ways using 1 p, 2 p, 5 p, 10 p, 20 p and 50 p coins
- total money (up to 100) and give change
- solve real life problems involving what to buy and how to pay
- "understand and use in context language
- associated with calendars and time"
- know that: 1 week = 7 days; 1 day = 24 hours; 1 hour = 60 minutes; 1 minute = 60 seconds
- understand time displayed on analogue and 12-hour digital clocks in hours, half hours and quarter hours
- find the difference between two times in problems
- extract specified information from a given simplified
- timetable, such as a bus timetable or school timetable

Algebra

- create and describe number patterns

Geometry

- recognise and name 2-D shapes including triangles, hexagons, pentagons, quadrilaterals and right-angled triangles
- recognise and name 3-D shapes including cylinders, pyramids, cones and spheres
- describe the properties of common 2-D shapes, for example the number of corners and edges, straight or curved sides
- describe the properties of common 3-D shapes
- understand angle as a measure of turn
- choose appropriate standard units of length, capacity and mass
- measure using standard units eg cm, mm, m, g, kg, l, miles
- measure using non-standard units eg paces, handspans
- estimate the mass and length of given items, for example select the heavier of two objects
- understand and use positional vocabulary, for example giving simple directions "How do I get to the bus stop?"

Data

- sort and classify objects using more than one criterion
- collect information, e.g. ask 10 people what their favourite subject is
- record results in simple lists, tables and diagrams, including block graphs and pictograms where one symbol represents one unit
- communicate their findings
- extract information from lists, tables, simple diagrams and block graphs

Mathematics: Level 1

Number

- count reliably up to 10 items
- read, write, order and compare numbers up to 10, including zero
- add single digit numbers with totals to 10, and subtract single digit numbers up to 10
- understand the language associated with number, for example: more, less, the same, first, last, smaller, larger, how many, after, next, between, subtract, add, total, altogether, take away, sum etc
- Use the = sign to represent equality
- recognise coins and notes of different values up to £50
- exchange money up to 10p for an equivalent value in smaller denominations
- total coins (up to 10) and give change
- understand and use in context basic language associated with calendars and time
- read the time to the hour or half hour on an analogue clock
- order familiar events in a day or week, or in a story

Algebra

- [no content at Level 3]

Geometry

- recognise and name common 2-D and 3-D shapes including rectangle, square, circle and cube
- describe sizes of different shapes
- order a group of shapes
- understand everyday language associated with measuring
- describe lengths, weights and capacities, for example "Which line is longest?"
- understand and use everyday positional vocabulary, for example draw a circle above the square

Data

- sort and classify objects using a single criterion
- select statistical information from a list or group of objects, eg "How many blue cars are there?"
- construct simple line diagrams, including block graphs