Level4opaedia

'A level is a level'

Please note that Using and Applying assessment criteria are not included within the Levelopaedia

Numbers and the Number System

Recognise and describe number patterns	
Identify a pattern of numbers within a 1-100 grid and use this to describe how to continue the pattern beyond the grid Know simple tests for divisibility	Show me an example of a number greater than 500 that is (i) divisible by 3 (ii) divisible by 4 (iii) divisible by 6 (iv) divisible by 9. Show me an example of a number greater that 100 that is divisible by 5 and also by 3. True/Never/Sometimes: ▪ Numbers divisible by 3 are also divisible by 6 ▪ Numbers divisible by 8 are also divisible by 4 ▪ Numbers with a units digit of 2. 6 and are divisible by 4. ▪ Odd numbers are divisible by 3 ▪ Even numbers are divisible by 4 What is the same different about: 24, 30, 42, 56 and 128, 108, 178, 198 Convince me that: ▪ 744 is divisible by 6. ▪ numbers divisible by 8 are also divisible by 2.
Recognise and describe number relationships including multiple, factor and square	
Identify factors of two-digit numbers Identify square numbers up to 15 x 15	Show me a number less than 100 with 6 as a factor Show me a number less than 100 with i) exactly two factors ii) more than 5 factors ii) more than 8 factors Show me a square number greater than 50. True/Never/Sometimes: ▪ The sum of four even numbers is a multiple of four. ▪ A prime number can be a multiple of 4 What is the same different about 9, 16, 64, 100 and 5, 6, 10, 12 Convince me that: ▪ that 1 is a square number ▪ that 81 is a square number ▪ that 6 is a perfect number
Use place value to multiply and divide whole numbers by 10 or 100	
Calculate: ▪ 37×100 ▪ 105×10 ▪ $7900 \div 10$ ▪ $81000 \div 10$ Complete statements such as: ▪ 4 x 10 = ▪ 4 x ___ = 400 ▪ ___ ÷ 10 = 40 ▪ ___ x 1000 = 40 000 ▪ ___ x 10 = 400	Show me: ▪ a number when multiplied by 10 gives an answer greater than 350 ▪ a number when divided by 100 gives an answer less than 20 True / Never / Sometimes: ▪ To multiply by 100, you move the digits two places to the left ▪ To multiply by 100, you move the digits two places to the right ▪ To divide by 100, you move the digits two places to the left ▪ To divide by 100, you move the digits two places to the right ▪ To divide by 100, you move the decimal point two places to the left ▪ To divide by 100, you move the decimal point two places to the right What is the same/different about 46 × 10, 4600 ÷

	10, 46 × 100 and 4600 ÷ 100
	Convince me:
	▪ that 7900 ÷ 10 = 790
	▪ that 250 ÷ 10 and 2500 ÷ 100 give the same answer.
	▪ how to multiply a number by 10.
	▪ how to divide a number by 100.

Recognise approximate proportions of a whole and use simple fractions and percentages to describe these

Recognise simple equivalence between fractions, decimals and percentages e.g. 1/2, 1/4, 1/10, 3/4 Convert mixed numbers to improper fractions and vice versa	Show me ▪ a percentage you can you easily work out. ▪ a question with the answer 20% True/Never/Sometimes: To calculate 10% of a quantity, you divide it by 10. So to find 20%, you must divide by 20. Convince me 50% of the numbers on a 1-100 grid are even.

Order decimals to three decimal places

Place these numbers in order of size, starting with the greatest: 0.206, 0.026, 0.602, 0.620, 0.062 Place these decimals on a line from 6.9 to 7.1: 6.93, 6.91, 6.99, 7.01, 7.06 Put these in order, largest/smallest first: 1.5, 1.375, 1.4, 1.3, 1.35, 1.425 Put these in order, largest/smallest first: 7.765, 7.675, 6.765, 7.756, 6.776 Continue sequences involving decimals	Show me ▪ a number to three decimal places ▪ a number to three decimal places i) greater than 0.2 ii) less than 0.25 ▪ a number between 0.12 and 0.17. True/Never/Sometimes: If numbers have the same digit in the same place then you can't order the numbers What is the same different about: 0.206, 0.026, 0.602, 0.620, 0.062 and 7.765, 7.675, 6.765, 7.756, 6.776 Convince me: ▪ how to order decimals to three decimal places. ▪ that that 0.35 is greater than 0.035. ▪ that that 0.36 is greater than 0.351.

Begin to understand simple ratio

Given a selection of red and blue cubes, write the ratio of red cubes to blue cubes, and the ratio of blue cubes to red cubes	Show me a set of coloured pencils that are in the ratio 2:3 True/Never/Sometimes: ▪ The ratio 1:4 is the same as the ratio 4:1 ▪ The bigger number comes first in a ratio What is the same different about: The ratio 1:4 and the ratio 4:1

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Calculating

Use a range of mental methods of computation with all operations

Calculate mentally a difference such as 8006 - 2993 by 'counting up' or by considering the equivalent calculation of 8006 - 3000 + 7

Use their knowledge of tables and place value in calculations with multiples of 10 such as 180 ÷ 3

Calculate complements to 1000

Carry out simple calculations involving negative numbers in context

Understand 'balancing sums' including those using division, such as 20 +   = 100 x 4

Undo' two-step problems

Respond rapidly to oral and written questions like:
- Nine sevens
- How many eights in 48?
- 6 times 7
- 5 multiplied by 9
- Multiply 9 by 6
- 7 multiplied by 0

Respond quickly to questions like
- Divide 36 by 9
- What is 48 shared between 8?
- One seventh of 35

Know by heart or derive quickly
- Doubles of all numbers 1 to 100
- Doubles of multiples of 10 up to 1000
- Doubles of multiples of 100 up to 10 000
- And all the corresponding halves

Show me:
- a multiplication and related division fact for 56
- a subtraction you can do without a formal method
- a subtraction with the answers 2003
- a complement of 1000

True/Never/Sometimes:
- If 14 × 7 = 98 then 98 ÷ 7 = 14
- If 14 × 7 = 98 then 98 ÷ 14 = 7
- If 14 × 7 = 98 then 7 ÷ 98 = 14
- If 14 × 7 = 98 then 140 × 70 = 980
- A three digit number subtract another three digit number requires a formal method

Convince me:
- that 8006 – 2993 = 5013
- that if 20 +   = 100 × 4 then   = 380

Recall multiplication facts up to 10 × 10 and quickly derive corresponding division facts

Recall:
- 6 x 7
- 3 x 8
- 4 x 9

Find the 8th multiple of 9

Recall
- 56 ÷ 8
- 40 ÷ 5
- 27 ÷3
- 30 ÷ 6

Show me
- a pair of numbers with a product of i)40 ii) 60
- a pair of numbers with a quotient of 5.
- a multiple of i) 4 ii) 9

What is the same different about 24, 30, 42, 56 and 36, 54, 72, 90

Convince me that 8 × 6 = 48

Use efficient written methods of addition and subtraction and of short multiplication and division

Calculate 1202 + 45 + 367 or 1025 - 336

Work with numbers to two decimal places, including sums and differences with different numbers of digits, and totals of more than two numbers, e.g.
- 671.7 - 60.2
- 543.65 + 45.845.89 + 653.7
- 1040.6 - 89.09
- 764.78 - 56.4
- 76.56 + 312.2 + 5.07

Use the grid method for short multiplication

Show me
- a pair of numbers with a sum of 145.5
- a pair of numbers with a difference of 56.2
- a pair of numbers with a product greater than 160

True/Never/Sometimes:
- 12.3 + 9.8 = 21.11;
- 4.07 - 1.5 = 3.92;
- 3.2 - 1.18 = 2.18.

Convince me

Use partitioning for short multiplication Use efficient methods of repeated subtraction, by subtracting multiples of the divisor, before moving to short division	▪ that 1202 + 45 + 367 = 1614 ▪ that 1025 − 336 = 689 ▪ that 23 × 6 = 138

Multiply a simple decimal by a single digit

Calculate: ▪ 2.4 x 7 ▪ 4.6 x 8 ▪ 9.3 x 9	Convince me that ▪ 2.4 × 7 = 16.8 ▪ 4.6 × 8 = 36.8 ▪ 9.3 × 9 = 83.7

Solve problems with or without a calculator

Deal with two constraints simultaneously Interpret a calculator display of 4.5 as £4.50 in context of money Use a calculator and inverse operations to find missing numbers, including decimals Carry out simple calculations involving negative numbers in context	Convince me that £4.50 is the same as 4.5 on your calculator

Check the reasonableness of results with reference to the context or size of numbers

Check the reasonableness of results with reference to the context or size of numbers See page 110 of the KS3 Framework supplement of examples	Convince me how to estimate the answer to a calculation.

Algebra

Begin to use formulae expressed in words

Use worded formulae based on a standing charge and an amount per unit (e.g. phone bill)	Show me an example of a formula expressed in words
Use inverse operations to calculate unknowns in two- or three-step problems	What is the same/different about '£5 standing charge plus 5p for every minute' and ,Cost of phone bill = £5 standing charge plus 5p for every minute'
Recognise that a worded formula requires an equals symbol	How can you change 'Plumber's bill = £40 per hour' to include a £20 call-out fee
Appreciate the difference between 'I think of a number and double it', and 'I think of a number and double it. The answer is 12'.	True/Never/Sometimes: A formula should have an equals sign in it
	Convince me that there is only one solution to 'I think of a number and add 12. The answer is 17.'

Use and interpret coordinates in the first quadrant

Given the coordinates of three vertices of a rectangle, find the fourth	Show me:
	▪ a co-ordinate pair with the x value greater than 2
You might like to try 'x is a cross, wise up'!	▪ a co-ordinate pair with the y value greater than 2
	▪ four pairs of co-ordinates that when plotted would form a i) square ii) rectangle
	True/Never/Sometimes:
	▪ It doesn't matter which axes you use first
	▪ The first number is the x value
	▪ The first number is the y value
	▪ The x value has to be less than or equal to the y-value
	What is the same/different about (2, 1) , (2, 4), (2, 6), (2, 8) and (0,0) , (1, 2), (2, 2) , (3, 4)
	Convince me
	▪ how to use the scale on the axes to help you to read a co-ordinate that has been plotted
	▪ how to use the scale on the axes to help plot a co-ordinate accurately
	▪ that (2, 3) is closely to the origin than (1, 4)

Shape, Space and Measures

Use the properties of 2-D and 3-D shapes

Recognise and name most quadrilaterals e.g. trapezium, parallelogram, rhombus	Show me: ▪ a triangle that is i) isosceles ii) equilateral iii) right angled iv) scalene ▪ a i) trapezium, ii) parallelogram, iii) rhombus ▪ a pair of congruent shapes
Recognise right-angled, equilateral, isosceles and scalene triangles	
Recognise an oblique line of symmetry in a shape	True/Never/Sometimes: ▪ A square is a rectangle ▪ A rectangle is a square ▪ A rectangle is a trapezium
Use mathematical terms such as horizontal, vertical, congruent (same size, same shape)	▪ A rectangle is a parallelogram ▪ A square is a rhombus
Understand properties of shapes, e.g. why a square is a special rectangle	What is the same/different about: rectangle, trapezium, parallelogram, rhombus square, equilateral triangle, trapezium, scalene triangle
Visualise shapes and recognise them in different orientations	Convince me that: ▪ a triangle is i) isosceles ii) equilateral iii) right angled iv) scalene ▪ a square is a rectangle but a rectangle is not necessarily a square

Make 3-D models by linking given faces or edges and draw common 2-D shapes in different orientations on grids

Complete a rectangle which has 2 sides drawn at an oblique angle to the grid	Show me a net of a i) cube ii) cuboid iii) prism iv) pyramid True/Never/Sometimes: 3-D shapes have more than one net Convince me that: ▪ a cube has at least five different nets ▪ a cuboid has at least five different nets ▪ a triangular prism has at least two different nets

Reflect simple shapes in a mirror line, translate shapes horizontally or vertically and begin to rotate a simple shape or object about its centre or a vertex

Use a grid to plot the reflection in a mirror line presented at 45° where the shape touches the line or not	Show me: ▪ a reflection that is easy / hard to do. ▪ a rotation that is easy / hard to do.
Begin to use the distance of vertices from the mirror line to reflect shapes more accurately	True/Never/Sometimes: ▪ Reflected shapes are the same size and shape as the original shape. ▪ Rotated shapes are the same size and shape as the original shape.
Translate shapes horizontally or vertically	What is the same/different about: Horizontal reflection, vertical reflection, rotation
Also: begin to rotate a simple shape or object about its centre or a vertex	Convince me how to: ▪ reflect a shape into a horizontal mirror line. ▪ reflect a shape into a vertical mirror line. ▪ reflect a shape into a mirror line presented at 45°. ▪ reflect a shape into a mirror line where the shape touches the line. ▪ rotate a simple shape or object about its centre. ▪ rotate a simple shape or object about a vertex.

Choose and use appropriate units and instruments

Know metric conversions: mm/cm , cm/m , m/km, mg/g , g/kg, ml/l	Show me pairs of metric units that can complete the statements below:

Measure and draw lengths and angles accurately (±2mm ±5°) Read scales on a range of measuring instruments, including vertical scales, (e.g. thermometer, tape measure, ruler…) and scales around a circle or semi-circle, (e.g. for measuring time, mass, angle…)	i) 1 _____ = 1000 _____ ii) 1 _____ = 100 _____ iii) 1 _____ = 10 _____ What is the same/different about: ▪ mm, cm ,m,km ▪ mg, g, kg, ▪ km, kg, l Convince me how to read a scale on measuring equipment.

Interpret, with appropriate accuracy, numbers on a range of measuring instruments

Measure and draw lengths and angles accurately (±2mm ±5°) Interpret scales on a range of measuring instruments, including vertical scales, (e.g. thermometer, tape measure, ruler…) and scales around a circle or semi-circle, (e.g. for measuring time, mass, angle…)	Show me i) an acute angle ii) an obtuse angle What is the same/different about: Drawing a line, drawing an angle Convince me how you decide what each division on the scale represents.

Find perimeters of simple shapes and find areas by counting squares

Use the terms area and perimeter accurately and consistently Find areas by counting squares and part squares Begin to find the area of shapes that need to be divided into rectangles Use 'number of squares in a row times number of rows' to find the area of a rectangle *Ensure pupils can work with shapes other than rectangles. The focus is on having a feel for the area - not calculating the area.*	Show me a: ▪ 2-D shape/object that could be measured in cm². ▪ shape with an area of i) 10cm² ii) 7.5cm² ▪ rectangle that has an area of 24cm² ▪ rectangle that has a perimeter of 24cm ▪ rectangle that has an area > perimeter ▪ rectangle that has an area < perimeter True/Never/Sometimes: ▪ Area of a rectangle = Perimeter of a rectangle ▪ Area of a rectangle < Perimeter of a rectangle ▪ Area of a rectangle > Perimeter of a rectangle ▪ The area of a rectangle can be found by 'number of squares in a row times number of rows' What is the same/different about: Area, Perimeter Convince me that the area of a rectangle can be found by 'number of squares in a row times number of rows'

Handling Data

Collect and record discrete data.	
Record discrete data using a frequency table	Convince me what makes information easy or difficult to represent.
Group data, where appropriate, in equal class intervals	
Decide on a suitable class interval when collecting or representing data about pupils' hours per week spent watching television	Convince me what makes information easy or difficult to represent
Continue to use Venn and Carroll diagrams to record their sorting and classifying of information	
Using this Carroll diagram for numbers, write a number less than 100 in each space 		even	not even
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a square number		
not a square number		| Use a Venn diagram to sort by two criteria typical of level 3 and 4 mathematics, e.g. sorting numbers using the properties 'multiples of 8' and 'multiples of 6'	Show me a i) 2-sort Venn diagram ii) 2-sort Venn diagram that can be used to sort the numbers 1-50 Show me i) a 2-sort Carroll diagram ii) a 2-sort Carroll diagram – with four cells – that can be used to sort the numbers 1-50 What is the same/different about: Venn diagrams, Carroll diagrams Convince me that the numbers 81 and 100 would be placed in different regions of a Carroll diagram.
Construct and interpret frequency diagrams and simple line graphs	
Suggest an appropriate frequency diagram to represent particular data, for example decide whether a bar chart, Venn diagram or pictogram would be most appropriate and for pictograms use one symbol to represent, e.g. 2, 5, 10 or 100 Decide upon an appropriate scale for a graph e.g. labelled divisions representing 2, 5, 10, 100 Interpret simple pie charts Interpret the scale on bar graphs and line graphs, reading between the labelled divisions e.g. reading 17 on a scale labelled in fives Interpret the total amount of data represented compare data sets and respond to questions e.g. how does our data about favourite televisions programmes compare to the data from year 3 children?	Show me simple pie chart / line graph True/Never/Sometimes: ▪ You can read the frequency from a pie chart ▪ You can read the proportion from a pie chart ▪ You can read the frequency from a bar graph Convince me how to draw a simple pie chart / line graph
Understand and use the mode and range to describe sets of data	
Use mode and range to describe data relating to shoe sizes in their class and begin to compare their data with data from another class Respond effectively to problems such as: ▪ List a small set of data that has a mode of 5 ▪ List a small set of data that has a mode of 5 and a range of 10	Show me a small set of data that has a i) mode of 5 ii) range of 10 iii) a mode of 5 and a range of 10. What is wrong: ▪ The mode of the set of numbers 2, 3, 2, 7, 3 is 3. ▪ The range of the set of numbers is 2, 3, 2, 7, 3 is 1. True/Never/Sometimes: ▪ For a set of numbers, the mode = range. ▪ For a set of numbers, the mode < range. ▪ For a set of numbers, the mode > range. ▪ A set of numbers has one value for the mode. ▪ A set of numbers has one value for the range. ▪ The value for the range of a set of numbers is positive.

	Convince me that :
	• The mode of the set of numbers 2, 3, 2, 7, 3 is 2 and 3
	• The range of the set of numbers is 2, 3, 2, 7, 3 is 5.