Level4opaedia

'A level is a level'

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Numbers and the Number System

Recognise and describe number patterns	
Know simple tests for divisibility	Can you give me an example of a number greater than 500 that is divisible by 3? How do you know if a number is divisible by 6? etc Can you give me an example of a number greater that 100 that is divisible by 5 and also by 3? Is there a quick way to check if a number is divisible by 25?
Recognise and describe number relationships including multiple, factor and square	
Identify factors of two-digit numbers	Which numbers less than 100 have exactly three factors? What number up to 100 has the most factors? The sum of four even numbers is a multiple of four. When is this statement true? When is it false? Can a prime number be a multiple of 4? Why?
Use place value to multiply and divide whole numbers by 10 or 100	
Calculate: ▪ 37× 100 ▪ 105 × 10 ▪ 7900 ÷ 10 ▪ 81000 ÷ 10 Complete statements such as: ▪ 4 x 10 = ☐ ▪ 4 x ☐ = 400 ▪ ☐ ÷ 10 = 40 ▪ ☐ x 1000 = 40 000 ▪ ☐ x 10 = 400	Why do 25 ÷ 10 and 250 ÷ 100 give the same answer?
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	What percentages can you easily work out in your head? Talk me through a couple of examples. When calculating percentages of quantities, what percentage do you usually start from? How do you use this percentage to work out others? To calculate 10% of a quantity, you divide it by 10. So to find 20%, you must divide by 20. What is wrong with this statement? Using a 1 - 100 grid, 50% of the numbers are even. How would you check? Give me a question with the answer 20% (or other percentages)
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	What do you look for first when you are ordering numbers with decimals? Which part of each number do you look at to help you? Which numbers are the hardest to put in order? Why? What do you do when numbers have the same digit in the same place? Give me a number between 0.12 and 0.17. Which of the two numbers is it closer to? How do you know?

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

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	If someone has forgotten the 8 times table, what tips would you give them to work it out? What other links between tables are useful? If you know that 4 x 7 = 28, what else do you know? Start from a two-digit number with at least 6 factors, e.g. 56. How many different multiplication and division facts can you make using what you know about 56? How have you identified the divisions? Which of these subtractions can you do without writing anything down? Why is it possible to work this out mentally? What clues did you look for? How did you find the difference? Talk me through your method. If 2003 is the answer to a similar question, what could the question be?
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	If I know that 3 x 4 = 12, what other facts do I know / can I derive? The product is 40. What could the two numbers be? Convince me. The quotient is 5. What could the two numbers be? Convince me.

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 Use partitioning for short multiplication Use efficient methods of repeated subtraction, by subtracting multiples of the divisor, before moving to short division	Give pupils some completed questions to mark. Questions should be written horizontally as well as in column form. Include incorrect answers like ▪ 12.3 + 9.8 = 21.11; ▪ 4.07 - 1.5 = 3.92; ▪ 3.2 - 1.18 = 2.18. Which are correct/incorrect? How do you know? Explain what has been done wrong and correct the answers. Talk me through your method. What two numbers have you multiplied together to get this part of the answer?
Multiply a simple decimal by a single digit	
Calculate: ▪ 2.4 x 7 ▪ 4.6 x 8 ▪ 9.3 x 9	Use the digits 4, 5 and 7 to generate U.t x U calculations (each digit can only be used <u>once</u> for each calculation). What combination gives the largest / smallest product? Convince me. How many different integer / whole number answers are possible? Convince me that you have found them all.
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	Roughly what answer do you expect to get? How did you come to that estimate? Do you expect your answer to be less than or greater than your estimate? Why?

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) Use inverse operations to calculate unknowns in two- or three-step problems Recognise that a worded formula requires an equals symbol 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'.	Show me an example of a formula expressed in words 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' How can you change 'Plumber's bill = £40 per hour' to include a £20 call-out fee 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 You might like to try 'x is a cross, wise up'!	What are the important conventions when describing a point using a coordinate? I'm thinking of a co-ordinate that I want you to plot. I can only answer 'yes' and 'no'. Ask me some questions to find out the co-ordinate so you can plot it. How do you use the scale on the axes to help you to read a co-ordinate that has been plotted? How do you use the scale on the axes to help you to plot a co-ordinate accurately?

Shape, Space and Measures

Use the properties of 2-D and 3-D shapes	
Recognise and name most quadrilaterals e.g. trapezium, parallelogram, rhombus Recognise right-angled, equilateral, isosceles and scalene triangles Recognise an oblique line of symmetry in a shape Use mathematical terms such as horizontal, vertical, congruent (same size, same shape) Understand properties of shapes, e.g. why a square is a special rectangle Visualise shapes and recognise them in different orientations	What properties do you need to know about a triangle to be sure it is isosceles; equilateral; scalene? Can you convince me that 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	When presented with a net: ▪ Which edge will meet this edge ▪ Which vertices will meet this one
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 Begin to use the distance of vertices from the mirror line to reflect shapes more accurately Translate shapes horizontally or vertically Also: begin to rotate a simple shape or object about its centre or a vertex	Give me instructions to reflect this shape into this mirror line. What would you suggest I do first? Make up a reflection that is easy to do. Make up a reflection that is hard to do. What makes it hard?
Choose and use appropriate units and instruments	
Know metric conversions: mm/cm , cm/m , m/km, mg/g , g/kg, ml/l Measure and draw lengths and angles accurately (±2mm ±5º) 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…)	What is the first thing you look for when you are reading a scale on measuring equipment? Which pairs of metric units can complete the statements below: 1 _____ = 1000 _____ 1 _____ = 100 _____ 1 _____ = 10 _____
Interpret, with appropriate accuracy, numbers on a range of measuring instruments	
Measure and draw lengths and angles accurately (±2mm ±5º) 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…)	How do 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.*	Would you expect the area of a paperback book cover to be: 200cm², 600cm², or 6000cm²? Explain why. Would you expect the area of a digit card to be: 5 cm², 50cm² or 100cm²? Explain why. Suggest areas of 2-D shapes/objects that could be measured in cm². Area = Perimeter. Is this always true, sometimes true or never true.

Handling Data

<table>
<tr><th colspan="2">Collect and record discrete data.</th></tr>
<tr><td>Record discrete data using a frequency table</td><td>What makes the information easy or difficult to represent?</td></tr>
<tr><th colspan="2">Group data, where appropriate, in equal class intervals</th></tr>
<tr><td>Decide on a suitable class interval when collecting or representing data about pupils' hours per week spent watching television</td><td>What makes the information easy or difficult to represent?</td></tr>
<tr><th colspan="2">Continue to use Venn and Carroll diagrams to record their sorting and classifying of information</th></tr>
<tr><td>Using this Carroll diagram for numbers, write a number less than 100 in each space

<table><tr><th></th><th>even</th><th>not even</th></tr><tr><th>a square number</th><td></td><td></td></tr><tr><th>not a square number</th><td></td><td></td></tr></table>
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'</td><td>Show me a 2-sort Venn diagram that can be used to sort the numbers 1-50

Show me a 2-sort Carroll diagram – with four cells – that can be used to sort the numbers 1-50

Given the above task, remove the headings and give to a friend to investigate:
▪ what can / can't the headings be?
▪ where would the numbers 81 / 100 / 149 'live'? Convince me.

Given the above task, complete the diagrams with deliberate errors and give to a friend to investigate / amend</td></tr>
<tr><th colspan="2">Construct and interpret frequency diagrams and simple line graphs</th></tr>
<tr><td>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?</td><td>For a given graph/table/chart, make up three questions that can be answered using the information represented.</td></tr>
<tr><th colspan="2">Understand and use the mode and range to describe sets of data</th></tr>
<tr><td>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</td><td>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. How did you work this out?</td></tr>
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