The National Strategies
Secondary

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Assessing Pupils' Progress

Focused assessment materials: Level 5

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department for
children, schools and families

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Contents

Acknowledgement

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These materials are based on the APP assessment criteria and organised in the National Curriculum levels. There is a set for each of levels 4 to 8.

The focused assessment materials include for each assessment criterion:

- **Examples of what pupils should know and be able to do** so teachers have a feel for how difficult the mathematics is intended to be. These are not activities or examples that will enable an accurate assessment of work at this level. To do this, you need a broad range of evidence drawn from day-to-day teaching over a period of time; this is exemplified in the Standards files, which are provided as part of the overall APP resources.
- Some **probing questions** for teacher to use with pupils in lessons to initiate dialogue to help secure their assessment judgement.

Numbers and the number system

Examples of what pupils should know and be able to do	Probing questions
Use understanding of place value to multiply and divide whole numbers and decimals by 10, 100 and 1000 and explain the effect	
Know, e.g.: • in 5.239 the digit 9 represents nine thousandths, which is written as 0.009 • the number 5.239 in words is 'five point two three nine' not 'five point two hundred and thirty-nine' • the fraction $5\frac{239}{1000}$ is read as 'five and two hundred and thirty-nine thousandths'. Complete statements such as: $4 \div 10 = \square$ $4 \div \square = 0.04$ $0.4 \times 10 = \square$ $0.4 \times \square = 400$ $0.4 \div 10 = \square$ $0.4 \div \square = 0.004$ $\square \div 100 = 0.04$	How would you explain that 0.35 is greater than 0.035? Why do 25 ÷ 10 and 250 ÷ 100 give the same answer? My calculator display shows 0.001. Tell me what will happen when I multiply by 100. What will the display show? I divide a number by 10, and then again by 10. The answer is 0.3. What number did I start with? How do you know? How would you explain how to multiply a decimal by 10, and how to divide a decimal by 100?

Round decimals to the nearest decimal place and order negative numbers in context

Petrol costs 124.9p a litre. How much is this to the nearest penny? Round, e.g.: • 2.75 to one decimal place • 176.05 to one decimal place • 25.03 to one decimal place • 24.992 to two decimal places. Order the following places from coldest to warmest: Moscow, Russia: 4°C Oymyakon, Russia: –71°C Vostok, Antarctica: –89°C Rogers Pass, Montana, USA: –57°C Fort Selkirk, Yukon, Canada: –64°C North Ice, Greenland: –66°C Reykjavik, Iceland: 5°C.	Explain whether the following are true or false: • 2.399 rounds to 2.310 to two decimal places • –6 is less than –4 • 3.5 is closer to 4 than it is to 3 • –36 is greater than –34 • 8.4999 rounds to 8.5 to one decimal place How do you go about rounding a number to one decimal place? Why might it not be possible to identify the first three places in a long jump competition if measurements were taken in metres to one decimal place? Show me a length that rounds 4.3m to one decimal place. Are there other lengths? What is the same/different about these numbers: 72.344 and 72.346

Recognise and use number patterns and relationships

Find: • a prime number greater than 100 • the largest cube smaller than 1000 • two prime numbers that add up to 98. Give reasons why none of the following are prime numbers: 4094, 1235, 5121 Use factors, when appropriate, to calculate mentally, e.g.: $35 \times 12 = 35 \times 2 \times 6$ Continue these sequences: 8, 15, 22, 29, … 6, 2, –2, –6, … 1, ½, ¼, ⅛, … 1, –2, 4, –8, … 1, 0.5, 0.25, … 1, 1, 2, 3, 5, 8, …	Talk me through an easy way to do this multiplication/division mentally. Why is knowledge of factors important for this? How do you go about identifying the factors of a number greater than 100? What is the same/different about these sequences: 4.3, 4.6, 4.9, 5.2, … 16.8, 17.1, 17.4, 17.7, … 9.4, 9.1, 8.8, 8.5, … I've got a number sequence in my head. How many questions would you need to ask me to be sure you know my number sequence? What are the questions?

Use equivalence between fractions and order fractions and decimals

Find two fractions equivalent to $\frac{4}{5}$

Show that $\frac{12}{18}$ is equivalent to $\frac{6}{9}$, $\frac{4}{6}$ and $\frac{2}{3}$

Find the unknown numerator or denominator in:

$\frac{1}{4} = \frac{?}{48}$ $\frac{7}{12} = \frac{35}{?}$ $\frac{36}{24} = \frac{?}{16}$

Write the following set of fractions in order from smallest to largest:

$\frac{1}{4}$, $\frac{2}{3}$, $\frac{1}{6}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{1}{3}$

Convert fractions to decimals by using a known equivalent fraction and using division. E.g.:

- $\frac{2}{8} = \frac{1}{4} = 0.25$
- $\frac{3}{5} = \frac{6}{10} = 0.6$
- $\frac{3}{8} = 0.375$ using short division

Answer questions such as:

- Which is greater: 0.23 or $\frac{3}{16}$?

Give me two equivalent fractions. How do you know they are equivalent?

Give me some fractions that are equivalent to … How did you do it?

Can you draw a diagram to convince me that $\frac{1}{4}$ is the same as $\frac{3}{12}$? Can you show me on a number line?

Explain whether the following is true or false:

10 is greater than 9, so 0.10 is greater than 0.9

Explain how you could fill in the missing numbers so that each resulting set of fractions is in ascending order:

- $\frac{*}{3}$, $\frac{*}{2}$, $\frac{*}{4}$
- $\frac{3}{*}$, $\frac{2}{*}$, $\frac{4}{*}$

Now show how you could fill in the missing numbers in a different way, so that each set of fractions is in descending order.

What are the important steps when putting a set of fractions/decimals in order?

Reduce a fraction to its simplest form by cancelling common factors

Cancel these fractions to their simplest form by looking for highest common factors:

$\frac{9}{15}$ $\frac{12}{18}$ $\frac{42}{56}$

What clues do you look for when cancelling fractions to their simplest form?

How do you know when you have the simplest form of a fraction?

Understand simple ratio

Write 16:12 in its simplest form.

Solve problems such as:

28 pupils are going on a visit. They are in the ratio of three girls to four boys. How many boys are there?

How do you know when a ratio is in its simplest form?

Is the ratio 1:5 the same as the ratio 5:1? Explain your answer.

Convince me that 19:95 is the same ratio as 1:5

The instructions on a packet of cement say, 'mix cement and sand in the ratio 5:1'. A builder mixes 5 kg of cement with one bucketful of sand. Could this be correct? Explain your answer.

The ratio of boys to girls at a school club is 1:2. Could there be ten pupils at the club altogether? Explain your answer.

Calculating

Examples of what pupils should know and be able to do	Probing questions
Use known facts, place value, knowledge of operations and brackets to calculate including using all four operations with decimals to two places	
Given that 42 × 386 = 16 212, find the answers to: • 4.2 × 386 • 42 × 3.86 • 420 × 38.6 • 16 212 ÷ 0.42 Use factors to find the answers to: • 3.2 × 30 knowing 3.2 × 10 = 32 32 × 3 = 96 • 156 ÷ 6 knowing 156 ÷ 3 = 52, 52 ÷ 2 = 26 Use partitioning for multiplication; partition either part of the product: 7.3 × 11 = (7.3 × 10) + 7.3 = 80.3 Use $\frac{1}{5}$ = 0.2 to convert fractions to decimals mentally. E.g. $\frac{3}{5}$ = 0.2 × 3 = 0.6 Calculate: • 4.2 × (3.6 + 7.4) • 4.2 × 3.6 + 7.4 • 4.2 + 3.6 × 7.4 • (4.2 + 3.6) × 7.4 Extend doubling and halving methods to include decimals, e.g.: 8.12 × 2.5 = 4.06 × 5 = 20.3	Explain how you would do this multiplication by using factors, e.g. 5.8 × 40 What clues do you look for when deciding if you can do a multiplication mentally? E.g. 5.8 × 40. Give an example of how you could use partitioning to multiply a decimal by a two-digit whole number, e.g. 5.3 × 23. 37 × 64 = 2368. Explain how you can use this fact to devise calculations with answers 23.68, 2.368, 0.2368. 73.6 ÷ 3.2 = 23. Explain how you can use this to devise calculations with the same answer. Explain why the 'standard' compact method for subtraction (decomposition) may not be convenient for some calcuations, e.g. 10 008 – 59. Talk me through this calculation. What steps do you need to take to get the answer? How do you know what you have to do first? What are the important conventions for the order of operations when doing a calculation?

Use a calculator where appropriate to calculate fractions/percentages of quantities/ measurements	
Use mental strategies in simple cases, e.g.: • ⅛ of 20; find ¼ and halve the answer • 75% of 24; find 50% then 25% and add the results • 15% of 40; find 10% then 5% and add the results • 40% of 400kg; find 10% then multiply by 4. Calculate simple fractions or percentages of a number/quantity e.g.of ⅜ 400g or 20% of £300. Use a calculator for harder examples, e.g.: • $\frac{1}{18}$ of 207; 207 ÷ 18 = 11.5 • 43% of £1.36; 0.43 × 1.36 = 58p • 62% of 405m; 0.62 × 405 = 251.1m	What fractions/percentages of given quantities can you easily work out in your head? Talk me through a couple of examples. When calculating percentages of quantities, what percentages do you usually start from? How do you use this percentage to work out others? How do you decide when to use a calculator, rather than a mental or written method, when finding fractions or percentages of quantities? Give me some examples. Talk me through how you use a calculator to find a percentage of a quantity or a fraction of a quantity.
Understand and use an appropriate non-calculator method for solving problems that involve multiplying and dividing any three-digit number by any two-digit number	
Show how you could work these out without a calculator: • 348 × 27 • 309 × 44 • 19 × 423 Explain your choice of method for each calculation. Find the answer to each of the following, using a non-calculator method: • 207 ÷ 23 • 976 ÷ 61 • 872 ÷ 55 317 people are going on a school coach trip. Each coach will hold 28 passengers. How many coaches are needed? 611 is the product of two prime numbers. One of the numbers is 13. What is the other one?	Give pupils some examples of multiplications and divisions with mistakes in them. Ask them to identify the mistakes and talk through what is wrong and how they should be corrected. Ask pupils to carry out multiplications using the grid method and a compact standard method. Ask them to describe the advantages and disadvantages of each method. How do you go about estimating the answer to a division?

Solve simple problems involving ordering, adding, subtracting negative numbers in context	
Immediately before Sharon was paid, her bank balance was shown as –£104.38; the minus sign showed that her account was overdrawn. Immediately after she was paid, her balance was £1312.86. How much was she paid? The temperatures in three towns on 1 January were: Apton –5°C Barntown 2°C Camtown –1°C • Which town was the coldest? • Which town was the warmest? • What was the difference in temperature between the warmest and coldest towns? The lowest winter temperature in a city in Canada was –15°C. The highest summer temperature was 42°C higher. What was the highest summer temperature?	'Addition makes numbers bigger.' When is this statement true and when is it false? 'Subtraction makes numbers smaller.' When is this statement true and when is it false? The answer is –7. Can you make up some addition/subtraction calculations with the same answer? The answer on your calculator is –144. What keys could you have pressed to get this answer? How does a number line help when adding and subtracting positive and negative numbers? Talk me through how you found the answer to this question.

Solve simple problems involving ratio and direct proportion	
The ratio of yogurt to fruit purée used in a recipe is 5:2. If you have 200g of fruit purée, how much yogurt do you need? If you have 250g of yogurt, how much fruit purée do you need? A number of cubes are arranged in a pattern and the ratio of red cubes to green cubes is 2:7. If the pattern is continued until there are 28 green cubes, how many red cubes will there be? Three bars of chocolate cost 90p. How much would six bars cost? And 12 bars? Six stuffed peppers cost £9. What will nine stuffed peppers cost?	How do you decide how to link the numbers in the problem with a given ratio? How does this help you to solve the problem? The ratio of boys to girls in a class is 4:5. How many pupils could be in the class? How do you know? Give pupils several different simple problems and ask: Which of these problems are linked to, e.g. the ratio 2:3? How do you know?

Apply inverse operations and approximates to check answers to problems are of the correct magnitude	
Discuss questions such as: • Will the answer to 75 ÷ 0.9 be smaller or larger than 75? Check by doing the inverse operation, e.g.: Use a calculator to check : 43.2 × 26.5 = 1144.8 with 1144.8 ÷ 43.2 ⅗ of 320 = 192 with 192 × 5 ÷ 3 3 ÷ 7 = 0.4285714 with 7 × 0.4285714	Looking at a range of problems or calculations, ask: • Roughly what answer do you expect to get? • How did you come to that estimate? • Do you think your estimate is higher or lower than the real answer? • Explain your answers. How could you use inverse operations to check that a calculation is correct? Show me some examples.

Algebra

Examples of what pupils should know and be able to do	Probing questions
Construct, express in symbolic form, and use simple formulae involving one or two operations	
Use letter symbols to represent unknowns and variables. Understand that letter symbols used in algebra stand for unknown numbers or variables and not labels, e.g. ‘5*a*’ cannot mean ‘5 apples’. Know and use the order of operations and understand that algebraic operations follow the same conventions as arithmetic operations. Recognise that in the expression $2 + 5a$ the multiplication is to be performed first. Understand the difference between expressions such as: $2n$ and $n + 2$ $3(c + 5)$ and $3c + 5$ n^2 and $2n$ $2n^2$ and $(2n)^2$ Simplify or transform linear expressions by collecting like terms; multiply a single term over a bracket. Simplify these expressions: $3a + 2b + 2a - b$ $4x + 7 + 3x - 3 - x$ $3(x + 5)$ $12 - (n - 3)$ $m(n - p)$ $4(a + 2b) - 2(2a + b)$ Substitute integers into simple formulae, e.g.: Find the value of these expressions when $a = 4$. $3a^2 + 4$ $\quad$ $2a^3$ Find the value of y when $x = 3$ $y=\frac{2x+3}{x}$ $\quad$ $y=\frac{x-1}{x+1}$	How do you know if a letter symbol represents an unknown or a variable? What are the important steps when substituting values into this expression/formula? What would you do first? Why? How would you continue to find the answer? How are these two expressions different? Give pupils examples of multiplying out a bracket with errors. Ask them to identify and talk through the errors and how they should be corrected, e.g.: $4(b + 2) = 4b + 2$ $3(p - 4) = 3p - 7$ $-2(5 - b) = {}^{-}10 - 2b$ $12 - (n - 3) = 9 - n$ Similarly for simplifying an expression. Can you write an expression that would simplify to, e.g.: $6m - 3n$, $8(3x + 6)$? Are there others? Can you give me an expression that is equivalent to, e.g.: $4p + 3q - 2$? Are there others? What do you look for when you have an expression to simplify? What are the important stages? What hints and tips would you give to someone about simplifying expressions? And removing a bracket from an expression? When you substitute $a = 2$ and $b = 7$ into the formula $t = ab + 2a$ you get 18. Can you make up some more formulae that also give $t = 18$ when $a = 2$ and $b = 7$ are substituted?

Simplify $p = x + x + y + y$ Write $p = 2(x + y)$ as $p = 2x + 2y$ Give pupils three sets of cards: the first with formulae in words, the second with the same formulae but expressed algebraically, the third with a range of calculations that match the formulae (more than one for each). Ask them to sort the cards. Formulae should involve up to two operations, with some including brackets.	How do you go about linking a formula expressed in words to a formula expressed algebraically? Could this formula be expressed in a different way, but still be the same?
Use and interpret coordinates in all four quadrants	
Plot the graphs of simple linear functions. Generate and plot pairs of coordinates for $y = x + 1$, $y = 2x$ Plot graphs such as: $y = x$, $y = 2x$ Plot and interpret graphs such as y = x, $y = 2x$, $y = x + 1$, $y = x - 1$ Given the coordinates of three points on a straight line parallel to the y axis, find the equation of the line. Given the coordinates of three points on a straight line such as $y = 2x$, find three more points in a given quadrant.	If I wanted to plot the graph $y = 2x$ how should I start? How do you know the point (3, 6) is not on the line $y = x + 2$? Can you give me the equations of some graphs that pass through (0, 1)? What about…? How would you go about finding coordinates for this straight line graph that are in this quadrant?

Shape, space and measures

Examples of what pupils should know and be able to do	Probing questions
Use a wider range of properties of 2-D and 3-D shapes and identify all the symmetries of 2-D shapes	
Understand 'parallel' and 'perpendicular' in relation to edges and faces of 3-D shapes. Find lines of symmetry in 2-D shapes including oblique lines. Recognise the rotational symmetry of familiar shapes, such as parallelograms and regular polygons. Classify quadrilaterals, including trapeziums, using properties such as number of pairs of parallel sides.	Sketch me a quadrilateral that has one line of symmetry, two lines, three lines, no lines, etc. Can you give me any others? What is the order of rotational symmetry of each of the quadrilaterals you sketched? One of the lines of symmetry of a regular polygon goes through two vertices of the polygon. Convince me that the polygon must have an even number of sides. Sketch a shape to help convince me that: • a trapezium might not be a parallelogram • a trapezium might not have a line of symmetry • every parallelogram is also a trapezium.
Use language associated with angle and know and use the angle sum of a triangle and that of angles at a point	
Calculate 'missing angles' in triangles including isosceles triangles or right-angled triangles, when only one other angle is given. Calculate angles on a straight line or at a point, such as the angle between the hands of a clock, or intersecting diagonals at the centre of a regular hexagon. Understand 'parallel' and 'perpendicular' in relation to edges or faces of 2-D shapes.	Is it possible to draw a triangle with: i) one acute angle ii) two acute angles iii) one obtuse angle iv) two obtuse angles? Give an example of the three angles if it is possible. Explain why if it is impossible. Explain why a triangle cannot have two parallel sides. How can you use the fact that the sum of the angles on a straight line is 180° to explain why the angles at a point are 360°? An isosceles triangle has one angle of 30°. Is this enough information to know the other two angles? Why?

Reason about position and movement and transform shapes	
Construct the reflections of shapes in mirror lines placed at different angles relative to the shape: • reflect shapes in oblique (45°) mirror lines where the shape either does not touch the mirror line, or where the shape crosses the mirror line • reflect shapes not presented on grids, by measuring perpendicular distances to/from the mirror. Reflect shapes in two mirror lines, where the shape is not parallel or perpendicular to either mirror. Rotate shapes, through 90° or 180°, when the centre of rotation is a vertex of the shape, and recognise such rotations. Translate shapes along an oblique line. Reason about shapes, positions and movements, e.g.: • visualise a 3-D shape from its net and match vertices that will be joined • visualise where patterns drawn on a 3-D shape will occur on its net.	Make up a reflection/rotation that is easy to do. Make up a reflection/rotation that is hard to do. What makes it hard? What clues do you look for when deciding whether a shape has been reflected or rotated? What transformations can you find in patterns in flooring, tiling, wallpaper, wrapping paper, etc? What information is important when describing a reflection/rotation? Describe how rotating a rectangle about its centre looks different from rotating it about one of its vertices. How would you describe this translation precisely?
Measure and draw angles to the nearest degree, when constructing models and drawing or using shapes	
Measure and draw angles, including reflex angles, to the nearest degree, when neither edge is horizontal/vertical. Construct a triangle given the length of two sides and the angle between them (accurate to 1mm and 1°). Construct an accurate net for a model of a right prism whose cross section is a scalene triangle.	Why is it important to estimate the size of an angle before measuring it? What important tips would you give to a person about using a protractor? How would you draw a reflex angle with a 180° protractor? Why are 30° and 150° in the same position on a 180° protractor?
Read and interpret scales on a range of measuring instruments, explaining what each labelled division represents	
Read and interpret scales on a variety of real measuring instruments and illustrations; e.g. rulers and tape measures, spring balances and weighing scales, thermometers, car instruments and electrical meters. Explain what each labelled division represents on a scale.	When reading scales how do you decide what each division on the scale represents? What mistakes could somebody make when reading from a scale? How would you avoid these mistakes?

Solve problems involving the conversion of units and make sensible estimates of a range of measures in relation to everyday situations	
Change a larger unit into a smaller one. E.g.: • 36cl into millilitres • 0.89km into metres • 0.56l into millilitres. Change a smaller unit into a larger one. E.g.: • 750g into kilograms • 237ml into litres • 3cm into metres • 4mm into centimetres. Solve problems such as: How many 30g blocks of chocolate will weigh 1.5kg, using 1.5kg ÷ 30g ? Know rough metric equivalents of imperial measures in daily use (feet, miles, pounds, pints, gallons). Work out approximately how many kilometres are equivalent to 20 miles.	Which is longer: 200cm or 20 000mm? Explain how you worked it out. Give me another length that is the same as 3m. What clues do you look for when deciding which metric unit is bigger? Explain how you convert metres to centimetres. How do you change grams into kilograms, millilitres into litres, kilometres into metres, etc.? What rough metric equivalents of imperial measurements do you know? How would you change metres into feet, kilometres into miles, etc.? What do you need to know to be able to do this?

Understand and use the formula for the area of a rectangle and distinguish area from perimeter	
Find any one of the area, width and length of a rectangle, given the other two. Find any one of the perimeter, width and length of a rectangle, given the other two. Find the area or perimeter of simple compound shapes made from rectangles. The carpet in Walt's living room is square, and has an area of $4m^2$. The carpet in his hall has the same perimeter as the living room carpet, but only 75% of the area. What are the dimensions of the hall carpet?	For a given area (e.g. $24cm^2$) find as many possible rectangles with whole-number dimensions as you can. How did you do it? For compound shapes formed from rectangles: How do you go about finding the dimensions needed to calculate the area of this shape? Are there other ways to do it? How do you go about finding the perimeter? Is the following statement always, sometimes or never true? *If one rectangle has a larger perimeter than another one, then it will also have a larger area.*

Handling data

Examples of what pupils should know and be able to do	Probing questions
Ask questions, plan how to answer them and collect the data required	
Respond to given problems by asking related questions. E.g.: Problem A neighbour tells you that the local bus service is not as good as it used to be. How could you find out if this is true? Related questions How can 'good' be defined? Frequency of service, cost of journey, time taken, factors relating to comfort, access? How does the frequency of the bus service vary throughout the day/week? Decide which data would be relevant to the enquiry and possible sources. Relevant data might be obtained from: • a survey of a sample of people • an experiment involving observation, counting or measuring • secondary sources such as tables, charts or graphs, from reference books, newspapers, websites; and so on. Examples of questions that pupils might explore: • How do pupils travel to school? • Do different types of newspaper use words (or sentences) of different lengths?	What was important in the way that you chose to collect data? How do you know that you will not need to collect any more data? How will you make sense of the data you have collected? What options do you have in organising the data? What other questions could you ask of the data? How will you make use of the data you have collected?

In probability, select methods based on equally likely outcomes and experimental evidence, as appropriate	
Find and justify probabilities based on equally likely outcomes in simple contexts. E.g.: • The letters of the word 'reindeer' are written on eight cards, and a card is chosen at random. What is the probability that the chosen letter is an 'e'? • On a fair dice what is the probability of rolling a prime number? Estimate probabilities from experimental data. E.g.: • Test a dice or spinner and calculate probabilities based on the relative frequency of each score. Decide if a probability can be calculated or if it can only be estimated from the results of an experiment.	Can you give me an example of an event for which the probability can only be calculated through an experiment? Can you give me an example of what is meant by 'equally likely outcomes'?
Understand and use the probability scale from 0 to 1	
What words would you use to describe an event with a probability of 90%? What about a probability of 0.2? Sketch a probability scale, and mark these probabilities on it. See pages 278 and 280 of the *Framework supplement of examples*	What is the same/different with a probability scale marked with: • fractions • decimals • percentages • words? Give examples of probabilities (as percentages) for events that could be described using the following words: • impossible • almost (but not quite) certain • fairly likely • an even chance. Make up examples of any situation with equally likely outcomes with given probabilities of: 0.5, $\frac{1}{6}$, 0.2, etc. Justify your answers.

Understand and use the mean of discrete data and compare two simple distributions, using the range and one of mode, median or mean	
Describe and compare two sets of football results, by using the range and mode. In your class girls are taller than boys. True or false? Solve problems such as, 'Find five numbers where the mode is 6 and the range is 8'. *How long do pupils take to travel to school?* Compare the median and range of the times taken to travel to school for two groups of pupils such as those who travel by bus and those who travel by car. *Which newspaper is easiest to read?* In a newspaper survey of the numbers of letters in 100-word samples the mean and the range were compared: • tabloid: mean 4.3 and range 10 • broadsheet: mean 4.4 and range 14.	The mean height of a class is 150cm. What does this tell you about the tallest and shortest pupil? Tell me how you know. Find five numbers that have a mean of 6 and a range of 8. How did you do it? What if the median was 6 and the range 8? What if the mode was 6 and the range 8? Two distributions both have the same range but the first one has a median of 6 and the second has a mode of 6. Explain how these two distributions may differ.
Understand that different outcomes may result from repeating an experiment	
Understand that if an experiment is repeated there may be, and usually will be, different outcomes. E.g.: • Compare estimated probabilities obtained by testing a piece of apparatus (such as a dice, spinner or coin) with those obtained by other groups. Understand that increasing the number of times an experiment is repeated generally leads to better estimates of probability. E.g.: • Confirm that the experimental probabilities for the scores on an ordinary dice approach the theoretical values as the number of trials increase.	'When you spin a coin, the probability of getting a head is 0.5. So if you spin a coin ten times you would get exactly five heads.' Is this statement true or false? Why? You spin a coin 100 times and count the number of times you get a head. A robot is programmed to spin a coin 1000 times. Who is most likely to be closer to getting an equal number of heads and tails? Why?

Interpret graphs and diagrams, including pie charts, and draw conclusions	
Interpret data represented in two-way tables. Interpret bar charts with grouped data. Interpret and compare pie charts where it is not necessary to measure angles. Read between labelled divisions on a scale of a graph or chart, e.g. read 34 on a scale labelled in tens or 3.7 on a scale labelled in ones, and find differences to answer the question, 'How much more…?'. Recognise when information is presented in a misleading way, e.g. compare two pie charts representing data sets of different sizes. When drawing conclusions, identify further questions to ask.	Make up a statement or question for this chart/ graph using one or more of the following key words: • total, range, mode • fraction, percentage, proportion.

Create and interpret line graphs where the intermediate values have meaning	
Draw and use a conversion graph for pounds and euros. Answer questions based on a graph showing tide levels, e.g.: • between which times will the height of the tide be greater than 5m? Use a line graph showing average maximum monthly temperatures for two locations. E.g.: • What was the coldest month in Manchester? • During which months would you expect the maximum temperatures in Manchester and Sydney to be about the same?	Do the intermediate values have any meaning on these graphs? How do you know? • Show graphs where there is no meaning – e.g. a line graph showing the trend in midday temperatures over a week. • Also show examples where interpolation makes sense – e.g. the temperature in a classroom, measured every 30 minutes for six hours. Convince me that you can use this graph (conversion graph between litres and gallons – up as far as 20 gallons) to find out how many litres are roughly equivalent to 75 gallons.

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