

GCSE Mathematics Revision Cards

(2) Introducing Angles FIH



- (a) Types of Angles.
- (b) Measuring Angles.
- (c) Drawing Angles.
- (d) Calculating Angles.
- (e) Angles in Triangles.



Acute Angle: Between 0° and 90° . Right Angle: 90° . Obtuse Angle: Between 90° and 180° . Straight Line: 180° . Reflex Angle: Between 180° and 360° . Full Turn: 360° . We name angles using 3 letters, e.g. \widehat{ABC} . You need to know how to draw any angle between 0° and 360° using a protractor, **and how to draw the angles 60° , 30° , 90° , 45° using a compass**. The angles around any point sum to 360° . The angles on a straight line sum to 180° . The angles in a triangle sum to 180° . Vertically opposite angles are equal. **The exterior angle of a triangle is equal to the sum of the two opposite interior angles.** Types of triangle: equilateral; isosceles; scalene; right angle.

(4) Introducing Percentages FIH



- (a) Preparation: Place Value, Working with Decimals.
- (b) Calculating Percentages.
- (c) Using Percentages.



In words, the number 4,708,200 is four million, seven hundred and eight thousand, two hundred. $34 \times 10 = 340$, $8,700 \div 10 = 870$, $0.026 \times 100 = 2.6$, $8 \div 1,000 = 0.008$. You need to be able to calculate sums such as 75.82×6 , $24.52 + 384.287$ and $34.8 - 1.46$ without a calculator. Calculating simple percentages: 50%: divide by 2. 25%: divide by 4. 10%: divide by 10. Example: Calculate 37% of £85. 10% of £85 is $\pounds 8.50$. 30% of £85 is $\pounds 8.50 \times 3 = \pounds 25.50$. 1% of £8.50 is $\pounds 8.50 \div 10 = \pounds 0.85$. 7% of £85 is $\pounds 0.85 \times 7 = \pounds 5.95$. 37% of £85 is $\pounds 25.50 + \pounds 5.95 = \pounds 31.45$. With a calculator, type $85 \times 37\%$. Using percentages: Profit and loss; simple interest; wages; VAT; percentage in a test.

(1) Welcome to Ysgol y Creuddyn FIH



- (a) The Library: Multiples.
- (b) The Hall: Polygons, Special Lines.
- (c) The Sports Hall: Odd and Even Numbers, Square Numbers, Cube Numbers.
- (d) The School Timetable: The Clock, the Calendar, Timetables.
- (e) The Refectory: **Symmetry**.
- (f) The Eisteddfod: **Rotational Symmetry, Translation using a Column Vector**.



Names of polygons with 3–10 sides: triangle; quadrilateral; pentagon; hexagon; heptagon; octagon; nonagon; decagon. Regular polygon: equal sides and also equal angles. $4^2 = 4 \times 4 = 16$. $2^3 = 2 \times 2 \times 2 = 8$. **A shape has rotational symmetry if it comes to fit onto itself more than once during a complete rotation. The translation $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ moves a shape 3 units to the right and 5 units down.**

(3) Data Handling and Statistics I FIH



- (a) The Mean.
- (b) The Range.
- (c) Bar Charts.
- (d) Mean of Grouped Data.
- (e) Pie Charts.



The mean is an average. To calculate it, (1) Find the total of all the data items; (2) Divide by the number of data items. The range is a measure of spread. To calculate it, subtract the least value from the greatest value. Qualitative data deals with descriptions. Quantitative data deals with numbers – data that can be measured. There are two types of quantitative data: discrete and continuous. A gap is needed between the bars in a bar chart. There are no gaps in a frequency diagram. *Given grouped data, we must use the mid-points to estimate the mean or range.* Use a protractor to draw a pie chart.

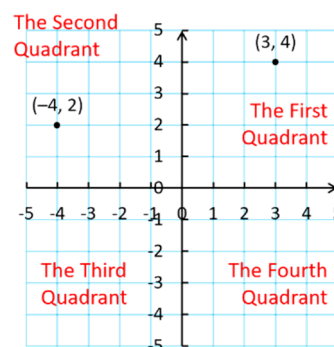
(5) Co-ordinates in the Four Quadrants FIH



- (a) The First Quadrant.
- (b) The Four Quadrants.
- (c) Mid-point of a Line.
- (d) Using Co-ordinates.



The origin is the co-ordinate (0, 0). For the co-ordinate (3, 4), 3 is the x -coordinate and 4 is the y -coordinate. **The mid-point of the co-ordinates $(-4, 2)$ and $(3, 4)$: $-4 + 3 = -1$, $-1 \div 2 = -0.5$; $2 + 4 = 6$, $6 \div 2 = 3$. Answer: $(-0.5, 3)$.** Adding a negative number is the same as subtracting, e.g. $5 + -2 = 5 - 2 = 3$.





(1) Is 3,891 a multiple of (a) 2; (b) 3; (c) 5; (d) 7; (e) 9? (2) What is the name of a 7-sided shape? (3) Draw a regular pentagon. (4) Draw (a) a horizontal line; (b) a vertical line; (c) a pair of parallel lines; (d) a pair of perpendicular lines. (5) Is 23 an odd number or an even number? (6) Complete the following using 'odd' or 'even': (a) odd + odd = _____; (b) even × odd = _____; (c) even – odd = _____. (7) Evaluate (a) 7^2 ; (b) 4^3 ; (c) $4^2 + 3^3$; (d) $6^3 \div 2^2$. (8) Change 2:54 pm to be in the 24-hour clock. (9) How many days are there in November? (10) Was the year 1842 a leap year? (11) How many minutes pass between the times 1:24 pm and 4:30 pm? (12) How many minutes are in 2 hours and a half? (13) Draw a shape with (a) 2 symmetry lines; (b) 4 symmetry lines; (c) no symmetry lines. (14) Draw a shape with (a) order of rotational symmetry 2; (b) no rotational symmetry. (15) How would the column vector $\begin{pmatrix} -4 \\ 2 \end{pmatrix}$ move a shape?

FIH Welcome to Ysgol y Creuddyn (1)



Contents of the workbook.



Important facts to remember. The ones highlighted in green appear on page 2 of the examination paper.



Revision questions. Answers are available on www.mathemateg.com (Year 11).

F = Foundation Tier (normal type);
I = Intermediate Tier (italic type);
H = Higher Tier (bold type).

Examination Dates Summer 2020

Numeracy Unit 1: Tuesday May 5th (AM)
Numeracy Unit 2: Thursday May 7th (AM)
Mathematics Unit 1: Tuesday May 19th (AM)
Mathematics Unit 2: Thursday June 4th (AM)



(1) What is the mean of 1, 3, 2, 5, 4, 8, 2, 9? (2) What is the range of the values in question (1)? (3) What is the (a) mean; (b) range of the data on the right? (4) What type of data is shown in the shoe size table? (5) Draw a bar chart for the shoe size data. (6) Calculate an estimate for the (a) mean; (b) range of the book weight data in the above table. (7) What type of data is shown in the book weight table? (8) Draw a frequency diagram for the book weight data. (9) Draw a pie chart for the book weight data.

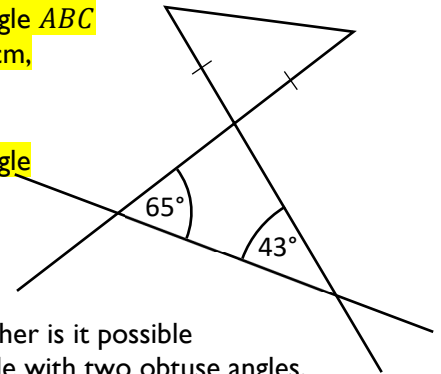
Shoe Size	Number of children
3	4
4	5
5	10
6	9
7	2

Weight of a book (w grams)	Frequency
$0 < w \leq 100$	8
$100 < w \leq 200$	12
$200 < w \leq 300$	5
$300 < w \leq 400$	7

FIH Data Handling and Statistics 1 (3)



(1) What type of angle is (a) 73° ; (b) 261° ; (c) 180° ; (d) 103° ; (e) 90° ; (f) 92° ; (g) 360° ? (2) Draw the following angles using a protractor. (a) 37° ; (b) 75° ; (c) 97° ; (d) 173° ; (e) 248° ; (f) 301° . (3) Draw the following angles using only a ruler and compass. (a) 60° ; (b) 30° ; (c) 90° ; (d) 45° . (4) Calculate the size of each missing angle in the diagram below. (5) Sketch (a) an equilateral triangle; (b) a scalene triangle. (6) Draw a triangle ABC where $AB = 5$ cm, $\hat{BAC} = 40^\circ$, $\hat{ABC} = 60^\circ$. (7) Draw a triangle ABC where $AB = 3.5$ cm, $AC = 6$ cm, $BC = 8$ cm. (8) Explain whether it is possible to draw a triangle with two obtuse angles.



FIH Introducing Angles (2)



(1) What is the x-coordinate of the co-ordinate (4, 6)? (2) What is the y-coordinate of the co-ordinate (4, 6)? (3) Draw a set of axes where the x and y axes go from -10 to 10. On these axes: (a) Plot the co-ordinate (2, 8); (b) Plot the co-ordinate (-4, 3); (c) Plot the co-ordinate (6, -4); (d) Plot the co-ordinate (-5, -7). (4) In which quadrant do the following co-ordinates appear? (a) (7, 3); (b) (-3, -7); (c) (6, -2); (d) (-8, 1); (e) (9, 0); (f) (0, 0). (5) What is the mid-point of the co-ordinates (4, 8) and (10, 12)? (6) Calculate the following without using a calculator. (a) $6 + -2$; (b) $-5 + 8$; (c) $-2 + -3$. (7) What is the mid-point of the co-ordinates (8, 2) and (-2, -6)? (8) Connect, in order, the co-ordinates from question (3) to form a quadrilateral. Translate this quadrilateral using the column vector $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$. (9) What is the co-ordinate of the origin?

FIH Co-ordinates in the Four Quadrants (5)



(1) Write the number 87,040,392 in words. (2) Without a calculator, calculate (a) 23×10 ; (b) 82.8×100 ; (c) $0.82 \times 1,000$; (d) $65 \div 10$; (e) $23.4 \div 100$; (f) $2.8 \div 1,000$; (g) 75.82×6 ; (h) $24.52 + 384.287$; (i) $34.8 - 1.46$; (j) 50% of £80; (k) 25% of £48; (l) 10% of £72; (m) 20% of 60 cm; (n) 15% of \$90; (o) 73% of £28. (3) Check your answers to question (2) using a calculator. (4) Megan changes £400 into Euros. The bank claim 2% commission. How much is the commission? (5) Rheinallt borrows £12,000 from Barclays bank at a simple interest rate of 3% a year. Rheinallt wants to pay back all the money after four years. How much money will Rheinallt have to pay back after four years? (6) Elin receives a gross salary of £450 a week. Elin must pay 26% of her salary as income tax, national insurance and pension. What is Elin's net salary, per week? (7) The price of a TV before VAT is £250. If the VAT rate is 20%, what is the price of the TV after adding VAT?

FIH Introducing Percentages (4)

An important part of revision work is to complete past examination papers. These are available (in Welsh) at www.mathemateg.com under the heading TGAU. Make sure to mark your work using the answers that are available. Go and see your mathematics teacher if you do not understand how to answer a particular question.

It is a good idea to try to complete any examination paper at the rate of a *mark a minute*. This way, you will have spare time at the end to check answers.

Numeracy and Mathematics Examinations

Unit 1: **Without** a calculator.

Unit 2: **With** a calculator.

Foundation Tier: 1 hour 30 minutes (65 marks).

Intermediate Tier: 1 hour 45 minutes (80 marks).

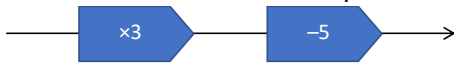
Higher Tier: 1 hour 45 minutes (80 marks).



- (a) Sequences. (b) Forming Expressions.
- (c) Substitution. (d) Collecting Like Terms.
- (e) Solving Equations.



A sequence is a number pattern. E.g. in the sequence 7, 13, 19, 25, 31, ... we need to add six to continue the pattern. The input goes into a number machine, and the output comes out. E.g. if 8 goes into the blue machine, then 19 comes out. Forming an expression means writing a piece of algebra to represent a situation. When substituting, we write a number instead of a variable, e.g. 5 instead of x . A formula tells us how to calculate something. Collecting like terms: e.g. $4x + 5y + 2x - 7y = 6x - 2y$. To solve an equation you must find the value of the variable. For example: $4x - 1 = 19$. To begin add 1 to each side to obtain $4x = 20$. Then divide by 4 to obtain $x = 5$.



- (a) The Mode.
- (b) Pictograms.
- (c) Vertical Line Diagrams.
- (d) Line Graphs.
- (e) Probability in Words.



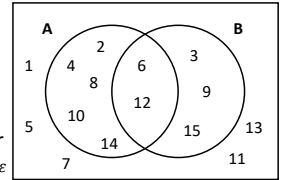
The mode is the data item that appears most often. It is possible that a data set has more than one mode, or no mode at all if the data items are all different. Grouped data has a modal class/modal classes. A pictogram displays data using a symbol to represent the data, e.g. $\text{♣} = 4$ people. A vertical line diagram is similar to a bar chart, but the bars have been narrowed to be vertical lines. In a line graph, straight lines connect the data points. It is possible to use words such as impossible; unlikely; even chance; very likely; certain to describe the probability of an event. A probability scale goes from 0 (impossible) to 1 (certain).



- (a) Square Root and Cube Root.
- (b) Factors and Prime Numbers.
- (c) Venn Diagrams. (d) Index Form.
- (e) Highest Common Factor, Lowest Common Multiple.



$\sqrt{36} = 6$. $\sqrt[3]{64} = 4$. A factor is a number that divides into another number. E.g. the factors of 20 are 1, 2, 4, 5, 10, 20. A number is a prime number if it has exactly 2 factors, 1 and itself. The Venn diagram below represents $\varepsilon = \{1, 2, 3, \dots, 15\}$, A = even numbers, B = multiples of 3. You need to know how to draw $A \cap B$ (intersection), $A \cup B$ (union), A' (complement). The index form for 144 is $2^4 \times 3^2$. It is a square number as the powers are all even. $\sqrt{144} = 2^2 \times 3^1 = 12$ (halve the powers). Use a Venn diagram to find the Highest Common Factor and the Lowest Common Multiple.



- (a) Measures. (b) Quadrilaterals.
- (c) Perimeter and Area.
- (d) Solids.



You need to remember facts about length, mass and volume measures, e.g. 1 m = 100 cm. A conversion graph changes one measure into another. You need to know the properties of a square; rectangle; parallelogram; kite; rhombus; arrowhead; trapezium; isosceles trapezium. The perimeter is the distance around a shape. The area is the size of the surface of the shape. Area of a rectangle = length \times width. Area of a triangle = $\frac{\text{base} \times \text{height}}{2}$. Area of a parallelogram = base \times height. Area of a trapezium = $\frac{1}{2}(a + b) \times \text{height}$. You need to know the properties of a cube; cuboid; square based pyramid; tetrahedron; sphere; triangular prism; cylinder. A net folds to make a three-dimensional shape. Volume of a cuboid = length \times width \times height.



- (a) Directed Numbers.
- (b) Decimals. (c) Angles 2.
- (d) Transformations: Rotation.



The symbol $<$ means 'less than'. The symbol $>$ means 'greater than'. Subtracting a negative number is the same as adding, e.g. $5 - -2 = 5 + 2 = 7$. Multiplying directed numbers: pos \times pos = pos; pos \times neg = neg; neg \times pos = neg; neg \times neg = pos. (The same rules work for division.) To change a percentage into a decimal, divide the percentage by 100, e.g. $62\% = 0.62$. To change a decimal to a percentage, multiply the decimal by 100, e.g. $0.3 = 30\%$. 43.625 rounds off to 43.6 (one decimal place) and 43.63 (two decimal places). If a line crosses a pair of parallel lines, it is possible to recognise corresponding angles (F shape); alternate angles (Z shape); and internal angles (C shape). To rotate a shape, you need to know the centre of rotation (e.g. (2, 5)) and how to rotate (e.g. 90° clockwise).



(1) Evaluate (a) $\sqrt{25}$; (b) $\sqrt[3]{27}$; (c) $\sqrt{121}$. (2) List all the factors of (a) 24; (b) 80. (3) Are the following numbers prime numbers? (a) 31; (b) 32; (c) 33; (d) 34; (e) 35. (4) Draw a Venn diagram for $\varepsilon = \{1,2,3, \dots, 10\}$, A = the odd numbers, B = multiples of 5. (5) Draw a Venn diagram for $\varepsilon = \{1,2,3, \dots, 12\}$, A = the even numbers, B = multiples of 4, C = numbers less than 7. (6) Draw a Venn diagram showing the following. (a) $A \cap B$; (b) $A \cup B$; (c) A' ; (d) $A \cup B'$; (e) $A' \cap B \cap C$. (7) Write, as a product of its prime factors, (a) 60; (b) 144. (Hint: draw a factor tree.) (8) Write, in index form, (a) 60; (b) 144. (9) Are the numbers 60 and 144 square numbers? (10) What is the Highest Common Factor of 60 and 144? (11) What is the Lowest Common Multiple of 60 and 144? (12) The index form of 256 is 2^8 . Find the square root of 256. (13) What is the smallest whole number we must multiply 792 by in order to change it to be a square number?

FIH Factors and Multiples (6)

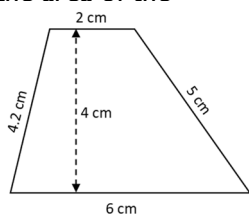
There is one question in every exam paper where “the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing”. This means that you will get marks not just for the right answer, but for *how* you set out your answer.

To make sure you obtain these marks (usually two marks in each examination paper), split the answer page in half, using the **Sum** and **Explanation** headings. On the left-hand side (“Sum”), write down any mathematical calculations you make. On the right-hand side (“Explanation”), explain why you have made that particular calculation. This needs to be done even if the sum is $1 + 1 = 2$.

Sum	Explanation



(1) How many cm are there in 50 mm? (2) How many feet are there in 36 inches? (3) How many kg are there in 4,300 g? (4) How many ml are there in 4.8 litres? (5) Around how many gallons are there in 9 litres? (6) Given that 5 miles \approx 8 km, draw a conversion graph to convert between length in miles and length in km. (7) How many symmetry lines does a parallelogram have? (8) In which quadrilaterals do the diagonals cross at a right angle? (9) What is (a) the perimeter; (b) the area of a rectangle measuring 7 cm by 4 cm? (10) What is the area of a triangle with base 10 cm and height 6 cm? (11) What is the area of the trapezium on the right? (12) How many vertices does a cuboid have? (13) How many edges does a tetrahedron have? (14) Draw a net for a cube. (15) What is the volume of a 4 cm \times 2 cm \times 3 cm cuboid?



FIH Measuring Shapes 1 (8)



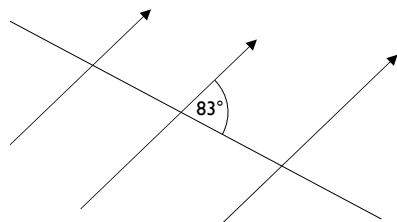
(1) Which number comes next? (a) 8, 11, 14, 17, ...; (b) 3, 6, 12, 24, ...; (c) 1, 4, 9, 16, ...; (d) 1, 5, 2, 6, 3, 7, 4, 8, ... (2) (a) If 8 goes into the green machine, what is the output? (b) If 4 comes out of the green machine, what was the input? (3) Write an expression for (a) 4 more than x ; (b) half of x . (4) If $x = 4$, $y = 2$, calculate the value of (a) $7x - 3y$; (b) x^2 ; (c) $\frac{3x}{y}$; (d) $3y^2 + 5$. (5) It is possible to use the formula $P = 2a + 2b$ to find the perimeter of a rectangle. What is the value of the perimeter P if $a = 7$ cm, $b = 4$ cm? (6) Simplify the following: (a) $4x + 6x + x$; (b) $5x + 2y + 3x + 7y$; (c) $8x - 5y - 12x + 2y$. (7) Solve the following equations: (a) $x + 4 = 9$; (b) $y - 2 = 4$; (c) $2x = 8$; (d) $\frac{x}{2} = 8$; (e) $2x + 1 = 15$; (f) $4y - 2 = y + 19$.



FIH Introducing Algebra (7)



(1) Fill in the blanks using $<$ or $>$: (a) $8 \dots 2$; (b) $-4 \dots 3$; (c) $-8 \dots -9$. (2) Calculate (a) $8 + -4$; (b) $9 - -3$; (c) $-5 + -4$; (d) $-8 - -9$. (3) Calculate (a) 3×-4 ; (b) $-8 \div 2$; (c) -6×-3 ; (d) $12 \div -3$. (4) Calculate (a) $2834.2 + 25.324$; (b) $90 - 27.2$; (c) 823.4×6 ; (d) $0.28 + 0.047$; (e) $7.35 \div 3$. (5) Order the following, from least to greatest: 3.09, 3.6, 3.009, 3.96, 3.06, 3.096. (6) Change (a) 76%; (b) 2% to be decimals. (7) Change (a) 0.27; (b) 0.4 to be percentages. (8) Round off 52.7852 correct to (a) one decimal place; (b) two decimal places; (c) three decimal places. (9) Calculate all the missing angles in the diagram.



(10) Rotate the triangle (1, 1), (3, 1), (3, 3) 90° clockwise around the point (1, -1).

FIH The End of Year 8 (10)



(1) What is the mode of... (a) 8, 3, 2, 4, 5, 3; (b) 3, 4, 1, 3, 2, 4; (c) 8, 2, 4, 5, 1, 6. (2) What is the mode of the shoe size data in the table on the right? (3) Draw a pictogram, using the key $\blacklozenge = 2$ people, to show the shoe size data on the right. (4) Draw a vertical line diagram to show the shoe size data on the right. (5) Draw a line graph to show the shoe size data on the right. (6) In words, describe the probability (a) that Christmas day will be on December 25th next year; (b) you will land on ‘heads’ when flipping a fair coin. (7) Draw a probability scale. Mark the points (a), (b) to show how probable, in your opinion, the next pupil you will see will be (a) male; (b) a twin.

Shoe size	Number of children
3	4
4	5
5	10
6	9
7	2

FIH Data Handling and Statistics 2 (9)

Buttons on a scientific calculator



(1) Percentage button: [%] E.g. Calculate 23% of £40: [4] [0] [X] [2] [3] [%] [=]

(2) Time button: [T] E.g. Calculate 5 hours 23 minutes + 3 hours 53 minutes: [5] [T] [2] [3] [T] [3] [T] [5] [3] [T] [=] (3) Index form button: **FACT**

E.g. Write 360 in index form: [3] [6] [0] [=] [SHIFT] [T]

(4) Reciprocal button: [1/x] E.g. What is the reciprocal of the fraction $\frac{3}{4}$? [=] [3] [▼] [4] [▶] [1/x] [=] (5)

Button to change an improper fraction to a mixed number: $(\frac{b}{c} \div \frac{d}{e})$ E.g. Change $\frac{26}{5}$ to a mixed number:

[=] [2] [6] [▼] [5] [=] [SHIFT] [S_D]

(6) Random number button: **RanInt** E.g. Choose a random number between 1 and 500: [ALPHA] [1] [SHIFT] [T] [5] [0] [0]

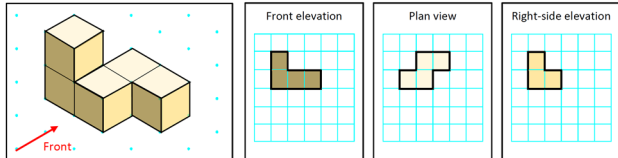
[=]. Remember about the **TABLE MODE** in trial and improvement questions or for plotting graphs, and the **VERIFY MODE** to check algebra.



(a) Circle Terminology. (b) Circumference and Area of a Circle. (c) Shapes on Isometric Paper. (d) Plans and Elevations. (e) Pythagoras' Theorem (2-D). (f) Scale Drawings.



Circle Terminology: circumference; radius; diameter; tangent; chord; arc; sector; segment. A circle's diameter is double its radius. Circle Circumference = $\pi \times \text{Diameter}$; Area of a Circle = $\pi \times \text{Radius}^2$. ($\pi = 3.14$ to 2 decimal places.) Finding the radius from the area: Divide by π , then take the square root. It is possible to draw 3-D shapes on isometric paper, e.g. the 6-block solid below.



Pythagoras' Theorem: $c^2 = a^2 + b^2$ (the square of the hypotenuse is equal to the sum of the squares of the two other sides).



(a) The Median. (b) The Median Class. (c) The Interquartile Range. (d) Cumulative Frequency Diagrams. (e) Scatter Diagrams. (f) Probability as a Fraction.



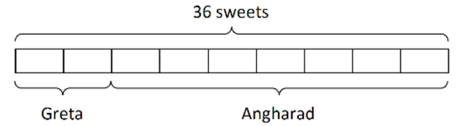
To find the median of a data set, (a) order the data from least to greatest; (b) find the number that is in the middle / find the mean of the 2 numbers in the middle. *Interquartile Range = Upper Quartile - Lower Quartile. The method for finding the quartiles depends upon whether the number of data items is odd or even. It is possible to use a cumulative frequency diagram to estimate the median and quartiles.* A scatter diagram shows positive correlation, negative correlation or no correlation. If there is correlation, we can draw a line of best fit either by eye or by using a mean point. **The probability that an event will not happen = 1 - the probability that the event will happen. Expected Frequency = Probability \times Number of Trials.**



(a) Introducing Bar Modelling. (b) Ratios. (c) Fractions. (d) Reciprocals.



It is possible to use bar models to visualise ratio or fraction questions. For example, the bar



model on the right shows a question

where we need to share 36 sweets between Greta and Angharad according to the ratio 2 : 7. Equivalent ratios: 2 : 7 is equivalent to 6 : 21 (multiply by 3). Simplifying ratios: The ratio 40 : 60 simplifies to give 2 : 3 (divide by 20). The ratio 4 : 5 in the form 1 : n is 1 : 1.25 (divide by 4). The improper fraction $\frac{11}{4}$ is the same as the mixed number $2\frac{3}{4}$. The reciprocal of a whole number is $\frac{1}{\text{the number}}$. A number multiplied by its reciprocal always gives the answer 1.



(a) Linear Nth Term. (b) Expanding Brackets. (c) FOIL (d) Solving Equations 2. (e) Trial and Improvement.



The *n*th term of the sequence 7, 10, 13, 16, 19, ... is $3n + 4$. Why? The sequence increases by 3, so the *n*th term starts with $3n$. If there

was another number at the start of the sequence, it would have to be $7 - 3 = 4$, so the *n*th term ends with + 4. The first 3 terms of the sequence with *n*th term $4n - 2$ are $4 \times 1 - 2 = 2$, $4 \times 2 - 2 = 6$, $4 \times 3 - 2 = 10$. Expanding gets rid of brackets, e.g. $4(x - 2) = 4x - 8$, $x(x + 4) + 5(2 - x) = x^2 + 4x + 10 - 5x = x^2 - x + 10$. We use **FOIL (First, Inside, Outside, Last)** to expand a double bracket, e.g. $(2x + 3)(x - 4) = 2x^2 - 8x + 3x - 12 = 2x^2 - 5x - 12$. This workbook introduces solving equations that contain brackets or fractions, and uses trial and improvement to solve an equation.



(a) Rounding Off: Significant Figures. (b) Estimation. (c) Compound Interest. (d) Foreign Money. (e) Household Bills.



When rounding off to one significant figure, you must find an estimate for the number that uses, at most, one digit that is non-zero.

For example, $79 \approx 80$, $0.27 \approx 0.3$, $850 \approx 900$. Rounding off to 2 significant figures: $7,293 \approx 7,300$, $0.02384 \approx 0.024$. Estimation: round off each number in the question to one significant figure, e.g. $\frac{482.6 \times 43.5}{2168.12} \approx \frac{500 \times 40}{2000} = \frac{20000}{2000} = 10$. Compound interest is used to borrow or to invest money. You must work a year at a time - the amount of money added each year changes. Foreign Money: If the exchange rate is $\text{£}1 = \text{€}1.14$, then $\text{£}120$ would be worth $120 \times 1.14 = \text{€}136.80$. Household bills terms (e.g. electricity, gas, water): unit cost; standing charge; value added tax; reading; quarter; rateable value.



(1) Share £35 between Arwyn and Brenda according to the ratio 3 : 4. (2) The ratio of Iestyn's age to Juliet's age is 2 : 3. Juliet is 7 years older than Iestyn. How old is Juliet? (3) A long piece of cable is cut according to the ratio 2 : 3 : 4. The shortest piece of cable is 30 cm. How long is the longest piece of cable? (4) Which crisps are the best value for money: 32 g for 45 p, or 70 g for 99 p? (5) A map's scale is 1 : 20,000. If the length of a road on the map is 4 cm, what is the true length of the road in metres? (6) Calculate $\frac{5}{9}$ of £72.

(7) Change $\frac{23}{3}$ to be a mixed number. (8) Calculate (a) $\frac{2}{7} + \frac{3}{7}$; (b) $\frac{6}{11} - \frac{2}{11}$; (c) $2\frac{2}{3} + \frac{2}{3}$; (d) $\frac{2}{3} + \frac{4}{5}$; (e) $\frac{2}{3} \times \frac{4}{5}$; (f) $\frac{2}{3} \div \frac{4}{5}$; (g) $5\frac{3}{7} - 3\frac{4}{9}$. (9) Check your answers to question (8) using a calculator. (10) What is the reciprocal of (a) 9; (b) $\frac{2}{3}$; (c) $5\frac{1}{4}$? (11) Simplify (a) the ratio 20 : 32; (b) the fraction $\frac{20}{32}$.

FIH Parts of a Number (11)

Make sure that you can obtain the answers to the following questions on your calculator.



EVERY TIER

(1) $17^2 = 289$. (2) $\sqrt[3]{729} = 9$. (3) $\sqrt{36} + 4^3 = 70$. (4) $\frac{1}{7} - \frac{1}{8} = \frac{1}{56}$. (5) $\frac{2}{5} + \frac{3}{4} = 1\frac{3}{20}$. (6) $3\frac{2}{7} \times 2\frac{4}{9} = 8\frac{2}{63}$. (7) 3 minutes 47 seconds + 19 minutes 39 seconds = 23 minutes 26 seconds. (8) 37% of £83 = £30.71. (9) $\frac{2.4 \times 8}{26 - 4.5} = \frac{192}{21.5}$. (10) $\pi \times 7.5 = 23.56$ to 2 d.p. (11) $(2.3 \times 10^{12}) + (5.21 \times 10^{11}) = 2.821 \times 10^{12}$.

INTERMEDIATE AND HIGHER

(1) 520 in index form: $520 = 2^3 \times 5 \times 13$. (2) $\sin 30 = 0.5$. (3) $\tan^{-1}(\sqrt{3}) = 60^\circ$. (4) $2 \div 5000 = 0.0004$. (5) Choose a random number between 1 and 50 using *RanInt*. (6) Solve, using the *Table Mode*, the equation $x^2 + 6x - 10 = 0$ to 1 d.p. ($x = 1.4$) (7) Change $0.\dot{4}$ to the fraction $\frac{4}{9}$.

Calculator Skills



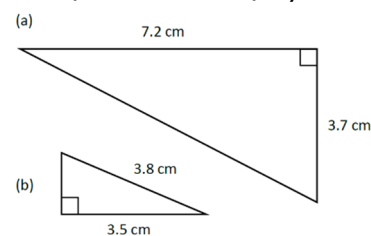
(1) What is the n th term of these sequences? (a) 13, 15, 17, 19, ...; (b) 26, 22, 18, 14, ...; (c) -20, -18, -16, -14, ...; (d) -50, -55, -60, -65, ... (2) What are the first 3 terms of the sequence with n th term $5n - 18$? (3) Expand

(a) $4(x + 3)$; (b) $y(y - 4)$; (c) $2x(x + 3) + 4(x - 5)$; (d) $(x + 2)(x + 8)$; (e) $(3y - 4)(y + 5)$; (f) $(x + y)(5y - 3)$; (g) $(3 + 2x)^2$. (4) Solve the following equations. (a) $2(x + 4) = 16$; (b) $3(x + 2) + 2x = 41$; (c) $4(x + 3) = 2(x - 6)$; (d) $3(2z + 1) - 5(3z - 2) = -5$; (e) $(x - 2)(2x + 1) = 0$; (f) $\frac{8}{x} = 2$; (g) $\frac{2x+6}{4} + 2 = 7$; (h) $\frac{3}{4x} + 1 = 4$; (i) $\frac{5x-8}{2} = \frac{3x+12}{4}$; (j) $\frac{3x+3}{4} - \frac{7x-13}{16} = 5$. (5) Use a trial and improvement method to solve the following equations. (a) $x^2 - 4x - 3 = 0$ correct to the nearest whole number; (b) $x^3 - 6x - 19 = 0$ to 2 decimal places.

FIH Developing Algebra 1 (13)



(1) With a compass, draw a circle with radius 3.6 cm. Add the following things to it: (a) a sector where the angle between the two radii is 50° ; (b) a segment where the length of the cord forming the segment is 5 cm; (c) a tangent; (d) an arc that goes $\frac{1}{4}$ of the way around the circle. (2) Calculate (a) the circumference; (b) the area of a circle with radius 4.8 cm. (3) What is the circumference of a circle with area 20 m^2 ? (4) On isometric paper, draw a solid formed by seven 1 cm^3 blocks. (5) Draw the front elevation, the plan view and the left-side elevation for your solid from question (4). (6)



Calculate the length x for the triangles on the left. (7) Using the scale 1 cm = 4 m, draw a rectangle measuring 12 m by 18 m.

FIH Measuring Shapes 2 (12)



(1) Round off the following numbers to one significant figure: (a) 843; (b) 4,289; (c) 0.00245; (d) 54,210; (e) 32; (f) 0.857. (2) Round off the numbers in question (1) to 2 significant figures. (3) Find an estimate for the following calculations. (a) $876 \times 6,875$; (b) $\frac{899,403}{12,456}$; (c) $\frac{3.24 \times 648}{895}$. (4) £1,200 is invested in a bank for 3 years at a compound interest rate of 5% a year. How much will the money be worth at the end of the 3 years? (5) If the exchange rate is £1 = 3.92 real, (a) how much is £50 worth in real; (b) how much is 3,540 real worth in pounds? (6) One quarter, the current reading on Mrs Davies' electricity meter was 18,793 and the previous reading was 17,843. The electricity company charges 18.6 pence per unit along with a standing charge of £32.50. On top of this, value added tax is charged at a rate of 5%. Calculate Mrs Davies' total electricity bill.

FIH Working with Money (15)



(1) Calculate the median of the following data sets. (a) 16, 24, 29, 30, 34, 40, 47; (b) 71, 23, 41, 63, 48, 14, 28, 36. (2) Find the median class of the data below (the distance a group of learners travel to school one morning). (3) Calculate the interquartile range of the data sets from question (1). (4) (a) Draw a cumulative frequency diagram for the distance data on the right. (b) Use the diagram to estimate the median and the interquartile range. (5) Sketch a scatter diagram showing negative correlation. (6) What is the probability of obtaining a prime number when rolling a normal fair dice? (7) Two normal fair die are rolled and the numbers obtained on both dice are multiplied. What is the probability that the product is 12?

Distance travelled, d km	Frequency
$0 < d \leq 5$	64
$5 < d \leq 10$	79
$10 < d \leq 15$	45
$15 < d \leq 20$	12

FIH Data Handling and Statistics 3 (14)

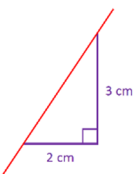
(16) Straight Line Graphs FIH



(a) Gradient of a Line. (b) Straight Line Graphs. (c) The Gradient of Parallel and Perpendicular Lines. (d) Reflections.



Gradient = $\frac{\text{change in the vertical distance}}{\text{change in the horizontal distance}}$. On the left, the gradient is $\frac{3}{2} = 1.5$. The equation $x = a$ gives a vertical line through the point $(a, 0)$, and the equation $y = b$ gives a horizontal line through the point $(0, b)$. In $y = mx + c$, the m represents the gradient (1 unit to the right, m units up/down), while c represents the y -intercept. Solving simultaneous equations graphically: plot the two lines and see where they intersect. Parallel lines have the same gradient. Perpendicular lines: one gradient = negative reciprocal of the other gradient. A straight line equation can provide a reflection line when reflecting a shape.



In $y = mx + c$, the m represents the gradient (1 unit to the right, m units up/down), while c represents the y -intercept. Solving simultaneous equations graphically: plot the two lines and see where they intersect. Parallel lines have the same gradient. Perpendicular lines: one gradient = negative reciprocal of the other gradient. A straight line equation can provide a reflection line when reflecting a shape.

(17) Movement with Sphero FIH



(a) Programming Sphero. (b) Travel Graphs. (c) Bearings. (d) Loci.



Distance = Time \times Speed.
Time = Distance \div Speed.
Speed = Distance \div Time.

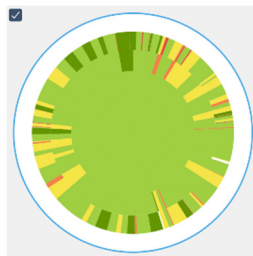


Speed is the gradient of a distance-time graph. The distance travelled is the area under a speed-time graph. Bearings are measured clockwise from the North in degrees. Each bearing contains three digits. A locus is a set of points satisfying some property, like a distance from a point (e.g. all points exactly 4 cm from the point A); a distance from a line (e.g. all points less than 3 cm from the line L); a perpendicular bisector (e.g. every point that is closer to the point A than the point B); or an angle bisector (e.g. every point that is closer to the line AB than the line AC). You need to use a compass and ruler to draw the perpendicular from a point to a line.

Revision Resources

(1) Diagnostic Questions, www.diagnosticquestions.com

A revision quiz for each of the 30 workbooks. An opportunity to view your progress and to decide which topics need improving.



(2) Times Tables Rock Stars, www.trockstars.com
An opportunity to practice your times tables.

(3) "Adolygu Mathemateg" YouTube Channel, www.youtube.com/adolygumathemateg
420 Welsh revision videos on the 30 workbooks.

(4) WJEC Question Bank, www.wjec.co.uk/question-bank
An opportunity to create a question paper using past examination questions.

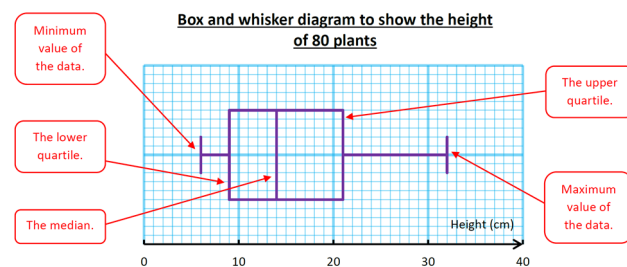
(18) Data Handling and Statistics 4 FIH



(a) Questionnaires. (b) Sampling. (c) Frequency Polygons. (d) Box and Whisker Diagrams. (e) Comparing Averages.



When designing a questionnaire, avoid asking leading questions; avoid using options that overlap; be careful where, when and how it is held; and choose clear and relevant questions. Types of sampling: (a) Simple random sampling; (b) Systematic sampling; (c) Stratified sampling. A frequency polygon is a line graph in which the mid-point of each class is plotted against the frequency.



(19) Powers and Roots IH



(a) Rules of Indices. (b) Standard Form. (c) Efficient Percentage Changes. (d) Graph Plotting.



Rules of Indices: (1) The Multiplication Rule: $n^a \times n^b = n^{a+b}$. (2) The Division Rule: $n^a \div n^b = n^{a-b}$. (3) The Zeroth Index Rule: $n^0 = 1$. (4) Raising a Power to Another Index: $(n^a)^b = n^{a \times b}$. (5) The Negative Index Rule: $n^{-a} = \frac{1}{n^a}$. (6) Unitary

Fraction Index Rule: $n^{\frac{1}{a}} = \sqrt[a]{n}$. (7) The General

Fraction Index Rule: $(\sqrt[b]{n})^a = n^{\frac{a}{b}} = \sqrt[b]{n^a}$.

Standard Form: $a \times 10^n$, where $1 \leq a < 10$ and n is an integer. An efficient method of adding 10% to a price: multiply by 1.10. You need to be able to reverse a percentage with or without a calculator. You need to be able to plot the following graphs: quadratic ($y = ax^2 + bx + c$); cubic ($y = ax^3 + bx^2 + cx + d$); reciprocal ($y = \frac{a}{x} + b + \frac{c}{x}$); exponential ($y = k^x$).

(20) Measuring Shapes 3 FIH



(a) Trigonometry of Right-Angled Triangles. (b) Transformations: Enlargement. (c) Tessellations. (d) Perimeter and Area of Composite Shapes.



Trigonometry of right-angled triangles:

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}; \cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

With an enlargement, the scale factor controls the size of the new shape, and the centre of enlargement controls the location of the new shape. The scale factor can be positive, fractional or negative. A tessellation involves repeating a shape (or shapes) to fill a space entirely, without gaps. A composite shape is a shape you can split into simpler shapes, like a triangle or a rectangle, in order to handle it.

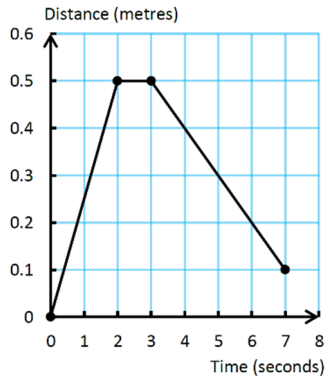
$$\text{Length of an Arc} = \frac{\theta}{360^\circ} \times \pi \times \text{diameter}$$

$$\text{Area of a Sector} = \frac{\theta}{360^\circ} \times \pi \times \text{radius}^2$$





(1) A car travels 192 miles on a motorway in 3 hours. Calculate its average speed. (2) Sioned walks 2 miles at an average speed of 3 miles per hour. For how many minutes was Sioned walking? (3) In the distance-time graph on the right, what was the speed between 3 seconds and 7 seconds? (4) Draw the following journey: (a) Travel 5 cm at a bearing of 040° ; (b) travel 3.6 cm at a bearing of 164° ; (c) travel 7.4 cm at a bearing of 275° . (5) Draw a line AB of length 6 cm. (a) Draw the locus of all the points that are exactly 3 cm from the line AB . (b) Draw the locus of all the points that are closer to A than to B .

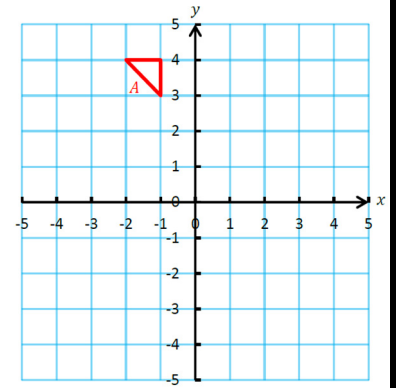


FIH Movement with Sphero (17)



(1) Draw a straight line with gradient (a) 3; (b) -2 ; (c) $\frac{3}{4}$. (2) Draw a set of axes going from -10 to 10 . Plot the following lines on the axes: (a) $x = 4$; (b) $y = -2$; (c) $y = x$; (d) $y = 2x + 1$; (e) $y = -3x + 7$; (f) $y = \frac{1}{2}x - 5$. (3) On a suitable set of axes, solve the simultaneous equations $y = 2x - 4$ and $y = -3x + 1$.

(4) The gradient of the line L is 6. Write down the gradient of a line that would be (a) parallel to L ; (b) perpendicular to L . (5) Reflect the shape A on the right (a) in the line $y = 2$; (b) in the line $x = 1$; (c) in the line $y = -x$.



FIH Straight Line Graphs (16)



(1) Why is the following question not suitable? "How often do you use the gym? Never 1-2 times 2-3 times More than 3 times ". (2) Use the following random digits to choose a sample of 3 people out of 400.

6737 3160 9630 6167 0858 1029
2944 1571 1460 3750 2960 3864.

(3) Use your calculator to choose a random sample of 5 people out of 150. (4) Choose a systematic sample of 8 people out of 90, starting with the third person. (5) A stratified sample of 25 people is to be chosen from the following members. How many people from each country should be chosen?

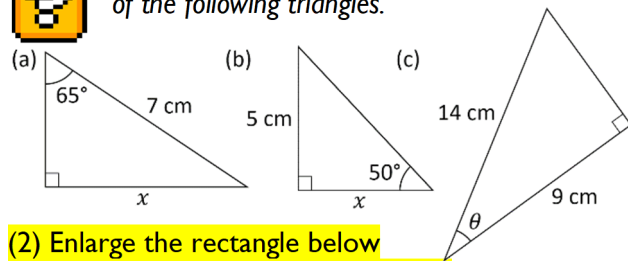
Country	USA	UK	Italy	France
Members	2,840	1,382	4,086	940

(6) Draw a frequency polygon for the distance data on card 14. (7) Using your answer to question (4) on card 14, draw a box and whisker diagram for the distance data. (8) List the advantages and disadvantages of using the mean, mode and median.

FIH Data Handling and Statistics 4 (18)

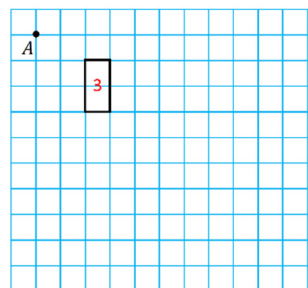


(1) Calculate the missing side or angle in each of the following triangles.

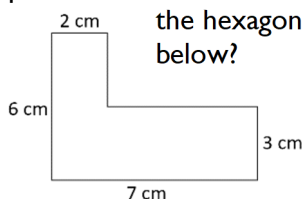


(2) Enlarge the rectangle below using A as the centre of enlargement.

(3) Draw a tessellation using triangles with base 4 cm and height 3 cm.



(4) What is the perimeter and area of the hexagon below?



FIH Measuring Shapes 3 (20)

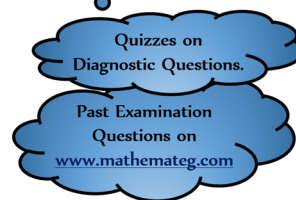


(1) Simplify the following. (a) $x^5 \times x^4$; (b) $y^{12} \div y^2$; (c) z^0 ; (d) $(w^5)^3$; (e) 2^{-3} ; (f) $25^{\frac{1}{2}}$; (g) $8^{\frac{2}{3}}$; (h) $16^{-\frac{3}{2}}$; (i) $4x^2y^5 \times 6x^4y^7$. (2) Write the following in standard form: (a) 263,000; (b) 0.0000283. (3) Calculate the following without using a calculator. (a) $(3.4 \times 10^5) + (7.18 \times 10^4)$; (b) $(7.36 \times 10^{-3}) - (1.9 \times 10^{-4})$; (c) $(2.5 \times 10^5) \times (6 \times 10^3)$; (d) $(4 \times 10^8) \div (5 \times 10^2)$. (4) Beth's weekly wage is £520. If she receives a pay rise of 20%, what would be her new weekly wage? (5) Nia invests £9,000 into NatWest bank at a compound interest rate of 2.4% a year. If Nia keeps the money in the bank for 10 years, how much money would she have at the end of the 10 years? (6) In a "10% off" sale, Will paid £36 for a jacket. What was the price of the jacket before the sale? (7) Plot the following graphs on a suitable set of axes. (a) $y = 3x^2 + 4x - 7$; (b) $y = -x^2 + 5$; (c) $y = x^3 - 7$; (d) $y = \frac{2}{x}$; (e) $y = 4^x$.

FIH Powers and Roots (19)

Practice answering questions, marking and correcting your answers.

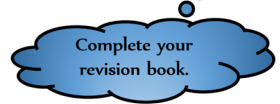
Practice answering questions, but do not mark them.



Highlighting pieces of text when reading.

Summarise your notes.

Re-read your notes passively.



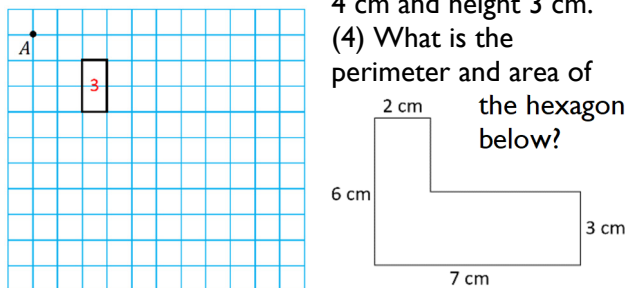
Revise everything the night before.

Prepare a Revision Timetable.

Revising a little, often.

Revising topics you already know well.

Effective and Ineffective Revision Methods



(21) Fractions, Percentages and Decimals FIH



- (a) Calculating. (b) Recurring Decimals.
- (c) Converting. (d) Exam Technique.



Changing fractions to decimals: Easy if the denominator is 10, 100, 1000, ...

e.g. $\frac{3}{10} = 0.3$, $\frac{45}{100} = 0.45$, $\frac{37}{1000} = 0.037$.

Otherwise (1) check whether you can change the denominator to be 10, 100, 1000, ... e.g. $\frac{11}{20} = \frac{55}{100} = 0.55$; (2) use a division frame to change the fraction to be a decimal. Use dot notation for recurring decimals, e.g. $0.444444 \dots = 0.\dot{4}$, $0.8727272 \dots = 0.8\dot{7}2$. After simplifying a fraction, if the denominator's product of prime factors contains the numbers 2 and/or 5 only, then the fraction is equal to a terminating decimal. You need to be able to convert between fractions, decimals and percentages, e.g. $47\% = \frac{47}{100} = 0.47$. **This includes changing a recurring decimal to a fraction.**

(23) Measuring Solids FIH



- (a) Solids. (b) Dimensions.
- (c) Composite Solids. (d) Similar Shapes.
- (e) Pythagoras' Theorem (3-D).



Surface area of a cuboid = total area of the six rectangular faces. **Volume of a prism = area of cross-section \times length.** Volume of a cylinder = $\pi r^2 \times$ length.

Volume of a pyramid = $\frac{1}{3} \times$ area of the base \times height. **Volume of a cone = $\frac{1}{3} \times \pi r^2 \times$ height.** **Surface area of a closed cone = $\pi r^2 + \pi r l$ (l = slant height of the cone).** **Volume of a sphere = $\frac{4}{3} \pi r^3$.** **Surface area of a sphere = $4\pi r^2$.**

Length: 1-D. Area: 2-D. Volume: 3-D. **The Frustum of a cone is the shape remaining when the top part of the cone is taken away.** Hemisphere = $\frac{1}{2}$ a sphere. Similar shapes are the exact same shape, but of different sizes. **If x = length scale factor, then x^2 = area scale factor and x^3 = volume scale factor.**

Examination Vocabulary

Calculate: It means 'work out the answer'. Be sure to write down your method. **Evaluate:** Give your answer to the question as a number or value. **Expand:** In algebra, it means multiply out the brackets. **Factorise:** The opposite of expanding, it means reintroduce brackets, taking out the greatest common factor you can find. **Estimate:** Work out an approximation for the sum by rounding off all the numbers to one significant figure. **Solve:** It means to calculate the value of something, usually the value of a variable in algebra. **Explain:** Write down how you obtained your answer, or how you know your answer is correct. **Sketch:** A diagram of a situation that doesn't have to be to scale. This doesn't mean that a ruler is not needed! **Draw:** Another way of saying 'draw a picture of the situation to scale', using mathematical equipment. **Simplify:** The process of making something simpler, e.g. collecting like terms in algebra or simplifying a fraction.

(22) Developing Algebra 2 IH



- (a) Simple Factorising. (b) Factorising Quadratic Expressions. (c) Simultaneous Equations.
- (d) Changing the Subject. (e) Expression, Equation, Formula, Identity.



Factorising means undoing expanding, e.g. $4x + 8 = 4(x + 2)$; $6x^2 - 9x = 3x(2x - 3)$. How to factorise $x^2 + 7x + 10$? Think of 2

numbers that add to 7 and multiply to 10. These numbers are 2 and 5, so $x^2 + 7x + 10$ factorises to give $(x + 2)(x + 5)$. **It is possible to factorise quadratic expressions of the form $ax^2 + bx + c$ using the splitting method or the detective method.** E.g. $3x^2 + 11x + 10 = (3x + 5)(x + 2)$. **Difference of Two Squares: $a^2 - b^2 = (a + b)(a - b)$.** Simultaneous equations ask you to solve 2 equations in 2 variables. The purpose of changing the subject is to re-arrange a formula so that a particular variable appears on its own on the left-hand side.

(24) Accuracy of Measurements IH



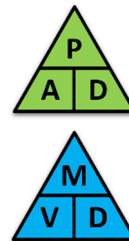
- (a) Upper and Lower Bounds. (b) Appropriate Degree of Accuracy. (c) Compound Measures.



For a measurement of 45 cm measured to the nearest cm, the upper bound is 45.5 cm (half of 1 cm greater) and the lower bound is 44.5 cm.

For a measurement of 130 litres measured to the nearest 10 litres, the upper bound is 135 litres (half of 10 litres greater) and the lower bound is 125 litres. If the question asks you to give an answer to an appropriate degree of accuracy, you should not give an answer more precise than the values used in the calculation.

Population = Area \times Population Density.
 Area = Population \div Population Density.
 Population Density = Population \div Area.
 Mass = Volume \times Density.
 Volume = Mass \div Density.
 Density = Mass \div Volume.



(25) Developing Algebra 3 IH



- (a) Direct and Inverse Proportion.
- (b) Proportion Equations.
- (c) Quadratic Nth Term. (d) Inequalities.
- (e) Regions of Graphs.



Direct Proportion: As one measure increases, the other measure also increases. **Inverse Proportion:** As one measure increases, the other measure decreases. **Nth term:** If the first difference is constant, write the n th term in the form $an + b$. Otherwise, (a) check to see whether the sequence has the form $n^2 + a$; (b) use the second difference to write the n th term in the form $an^2 + bn + c$. Solving an inequality is the same as solving an equation, but the symbol in the middle must be changed (a) when swapping sides; (b) when dividing or multiplying by a negative number. **To plot a region of a graph, (a) plot the individual lines; (b) show, using an arrow, a region for each line; (c) shade the region that satisfies all the arrows.**



(1) Factorise the following algebraic expressions. (a) $6x + 9$; (b) $20y - 30$;

(c) $8x^2 - 4x$; (d) $12x^2y + 18xy^2$;

(e) $x^2 + 14x + 48$; (f) $x^2 + 2x - 48$;

(g) $x^2 - 14x + 48$; (h) $2x^2 + 7x + 6$;

(i) $5x^2 - 17x - 12$. (2) Solve the following simultaneous equations: (a) $2x + 3y = 14$, $3x + 2y = 16$;

(b) $2x + 3y = 14$, $8x + 9y = -1$. (3) Aled buys 2 Cornish pasties and 3 sausage rolls in a shop, and pays £7. Ceinwen buys 4 Cornish pasties and 1 sausage roll in the same shop, and pays £9. What is the cost of 1 Cornish pastry and 1 sausage roll in the shop?

(4) Make x the subject of the following formulae.

(a) $p = 23 + x$; (b) $F = \frac{1}{2}x^2$; (c) $R = 5s - 7x$.

(5) Are the following expressions, equations, formulae or identities? (a) $4x + 2$; (b) $P = 2a + 2b$;

(c) $5x + 1 = 3x + 25$; (d) $2(x + 1) \equiv 2x + 2$;

(e) $A = \pi r^2$. (6) Prove that $(x + 6)(x - 2) - x(x + 3) \equiv x - 12$.

IH Developing Algebra 2 (22)



(1) Calculate the following. (a) $398 + 4829$;

(b) $693 - 246$; (c) 372×68 ; (d) $925 \div 37$;

(e) 2.6×10 ; (f) $63 \div 100$; (g) 0.0247×1000 ;

(h) 46.27×8 ; (i) $29.3 + 2.43$; (j) $52.6 - 7.84$;

(k) $14.7 \div 6$; (l) 0.3×0.2 ; (m) $4 \div 0.5$; (n) 50% of 80;

(o) 36% of £84; (p) $\frac{3}{5}$ of £35; (q) $1 - \frac{3}{7}$; (r) $\frac{5}{9} + \frac{2}{9}$;

(s) $\frac{2}{3} + \frac{3}{5}$; (t) $\frac{5}{9} - \frac{2}{9}$; (u) $\frac{2}{3} - \frac{3}{5}$; (v) $\frac{2}{3} \times \frac{3}{5}$; (w) $\frac{2}{3} \div \frac{3}{5}$.

(2) Change the following fractions to be decimals.

(a) $\frac{7}{10}$; (b) $\frac{12}{100}$; (c) $\frac{4}{100}$; (d) $\frac{462}{1000}$; (e) $\frac{36}{1000}$; (f) $\frac{4}{5}$; (g) $\frac{21}{25}$;

(h) $\frac{121}{200}$; (i) $\frac{3}{8}$; (j) $\frac{5}{6}$; (k) $\frac{3}{7}$. (3) Decide whether the

following fractions are equivalent to terminating

decimals or to recurring decimals. (a) $\frac{9}{10}$; (b) $\frac{5}{9}$; (c) $\frac{2}{25}$;

(d) $\frac{3}{12}$; (e) $\frac{24}{150}$. (4) Change the following

recurring decimals to be fractions. (a) $0.8\dot{4}$;

(b) $1.4\dot{2}\dot{7}$. (5) Change the following numbers to be

percentages. (a) 0.4; (b) $\frac{3}{5}$; (c) 0.87; (d) $\frac{2}{25}$.

FIH Fractions, Percentages and Decimals (21)



(1) Complete the table at the bottom of this card.

(2) The length and width of a rectangle are 7 cm and 8 cm, both correct to the nearest cm. (a) What

is the rectangle's greatest possible perimeter? (b) What is the rectangle's least possible area? (3) The length and width of a rectangle are 4.5 cm and 3.78 cm. Calculate, to an appropriate degree of accuracy, the area of the rectangle.

(4) The mass of a 200 cm³ piece of metal is 1.2 kg. What is the density of the metal, in g/cm³? (5) Mumbai has population 12,478,447 and area 603 km². What is the population density of Mumbai? (6) A car travels a distance of 37 miles in 1.6 hours. The distance is given correct to the nearest mile and the time is given correct to the nearest 0.1 hour. What is the greatest possible average speed of the car?

Measurement	Upper Bound	Lower Bound
400 cm (to the nearest 100 cm)		
45 ml (to the nearest 5 ml)		
120 litres (to the nearest 20 litres)		
2.7 cm (to one decimal place)		
370 mm (to 2 significant figures)		

IH Accuracy of Measurements (24)



(1) Calculate the surface area of a cuboid measuring 4 cm × 7 cm × 3 cm. (2) Calculate

(a) the volume; (b) the surface area of a closed

cylinder with radius 8 cm and height 12 cm. (3)

Calculate (a) the volume; (b) the surface area

of a closed hemisphere with radius 4.5 cm. (4)

How many dimensions do the following formulae have?

(a) $M = a - b$; (b) $M = 4abc$; (c) $M = 2ab + 3ac$;

(d) $M = 2\pi a + bc$. (5)

For the composite solid

on the right, calculate

(a) its volume; (b) the

distance AB. (6) In

two similar triangles,

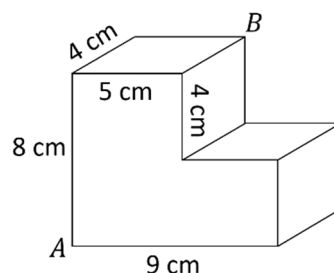
the two bases

measure 4 cm and 6

cm. What is the scale

factor? (7) If the area scale factor is 36, what is the

volume scale factor?



FIH Measuring Solids (23)



(1) A digger can dig a 560 m long ditch in 21 days. How much time would it take to dig a

240 m long ditch? (2) If 3 diggers can dig a

hole in 8 hours, how much time would 4 diggers take to

dig the same hole? (3) Sketch a graph that shows

inverse proportion. (4) y is in direct proportion to

x . Given that $y = 8$ when $x = 2$, find the

equation that connects x to y . (5) Given that

$y = 3$ when $x = 4$, and $y = 2$ when $x = 6$, find

the equation that shows the proportion

between x and y . (6) Find the n th term of the

following sequences. (a) 9, 14, 19, 24, 29, ...;

(b) 11, 14, 19, 26, 35, ...; (c) 2, 6, 16, 32, 54, ...

(7) Show the inequality $2 \leq x < 4$ on a number line.

(8) Solve the following inequalities. (a) $4x + 1 \geq 13$;

(b) $\frac{x}{2} < 6 + 2x$. (9) List the whole numbers that satisfy

the inequality $5 < 2x - 1 \leq 17$. (10) Shade the

region that satisfies the inequalities $y < 2$,

$x \geq -2$, $y \geq x - 1$.

IH Developing Algebra 3 (25)

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

Multiplication Tables

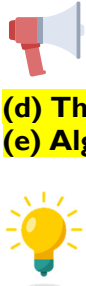


- (a) Congruent Shapes. (b) Angles in Polygons.
(c) Circle Theorems. (d) Transformations.

Congruent shapes are the same shape and the same size. **4 congruent triangles proofs: (1) SSS; (2) SAS; (3) ASA; (4)**

RHS. Polygon with n sides: total of the exterior angles = 360° ; Total of the interior angles = $180^\circ(n - 2)$; interior angle + exterior angle = 180° . Regular polygon: exterior angle = $\frac{360^\circ}{n}$; interior angle = $\frac{180^\circ(n-2)}{n}$ or $180^\circ - \frac{360^\circ}{n}$.

Circle Theorems: (1) Tangent and radius meet at a right angle; (2) The angle in a semicircle is a right angle; (3) The angle in the centre of a circle is twice the angle on the circumference; (4) Angles in the same segment are equal; (5) Opposite angles in a cyclic quadrilateral sum to 180° ; (6) Tangents from an external point are equal in length; (7) The angle between chord and tangent is equal to the angle in the alternate segment; (8) The perpendicular from the centre to a chord bisects the chord.



- (a) Transformations of Functions.
(b) Pre-Calculus.
(c) Further Changing the Subject.
(d) The Quadratic Formula.
(e) Algebraic Fractions.

Transformations of Functions:
 $y = f(x) + a$; $y = f(x + a)$; $y = af(x)$;
 $y = f(ax)$; $y = -f(x)$; $y = f(-x)$.

Draw a tangent to a non-linear function to estimate its gradient. Acceleration is the gradient of a velocity-time graph. Use the Trapezium Rule to estimate the area between a curve and the x -axis,

$$\frac{1}{2}h(y_0 + y_n + 2(y_1 + y_2 + \dots + y_{n-1})).$$

The Quadratic Formula: The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



- (a) Surds. (b) AER, APR.
(c) Histograms.

A rational number can be written in the form of a fraction $\frac{a}{b}$, where a and b are integers, and $b \neq 0$. A surd contains a root that does not correspond to a rational number, e.g. $\sqrt{5}$. Simplifying surds: $\sqrt{a} \times \sqrt{a} = a$, $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$. **AER, as a decimal, is calculated using the formula $(1 + \frac{i}{n})^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.**

$$\text{APR} = \frac{\text{Interest accrued over one year} \pm \text{costs}}{\text{Initial value}} \times 100\%.$$

For a histogram, Frequency Density = $\frac{\text{Frequency}}{\text{Class width}}$. The estimate of the median is the vertical line in the histogram that halves the total area of the histogram.



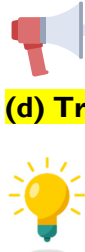
- (a) Relative Frequency. (b) Combined Events.
(c) Tree Diagrams.

Relative frequency of an event = $\frac{\text{How many times the event has occurred}}{\text{Number of trials}}$

The more trials are held, the better the relative frequency is as an estimate of the probability. Two events are independent if the result of the first event does not affect the probability of the second event. For independent events A and B , $P(A \cap B) = P(A) \times P(B)$.

For dependent events A and B ,
 $P(A \cap B) = P(A) \times P(B|A)$, where $P(B|A)$ is a **conditional probability (the probability of B occurring given that A has already occurred).**

For mutually exclusive events A and B ,
 $P(A \cup B) = P(A) + P(B)$. Tree diagrams are used to show combinations of two or more events. Each branch is labelled on the right with a result and in the middle with a probability.



- (a) 3-D Trigonometry. (b) The Sine Rule, The Cosine Rule.
(c) Area of a Triangle.

(d) Trigonometric Graphs.

The Sine Rule for finding sides:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

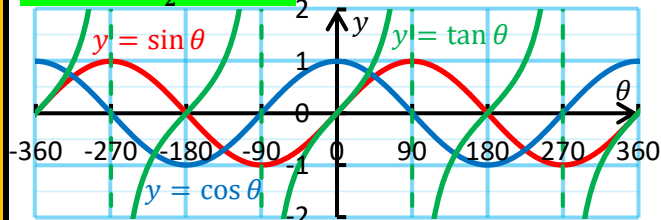
The Sine Rule for finding angles: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$. The

Cosine Rule for finding sides:

$$a^2 = b^2 + c^2 - 2bc \cos A$$

The Cosine Rule for finding angles: $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$. **Area of a**

$$\text{triangle} = \frac{1}{2} ab \sin C.$$



Years 7-9
Workbooks
(61 Mb)



Years 7-9
Additional Tasks
Workbooks
(35 Mb)



Years 10-11
Workbooks
(35 Mb)

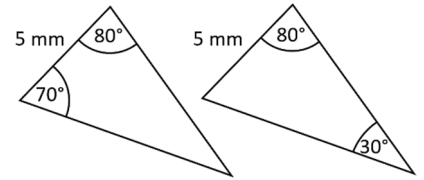


Years 10-11
Additional Tasks
Workbooks
(30 Mb)



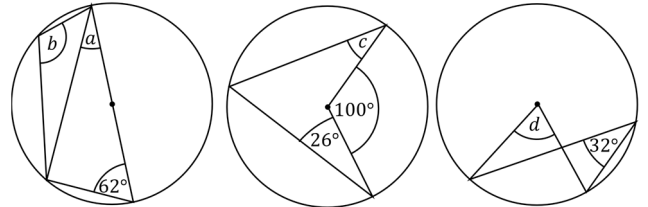


(1) Draw two congruent triangles. (2) Prove that the two



triangles on the right are congruent.

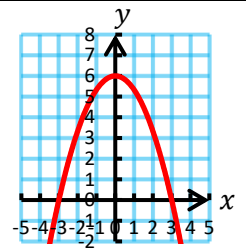
(3) What is the total interior angles of any heptagon? (4) What is the interior angle of any regular octagon? (5) The size of the exterior angles of a regular polygon are 18° . How many edges does the regular polygon have? (6) Two regular hexagons and an equilateral triangle meet at a vertex. Which shape would fill the gap between the shapes? (7) Calculate the size of the angles a, b, c, d below.



(1) A 6-sided die is rolled 200 times. It lands on the number 4 thirty-eight times. What is the relative frequency of the die landing on 4? (2) What is the probability of obtaining 'heads' on flipping a fair coin and landing on a square number when rolling a normal fair die? (3) Steffan rolls a die with 20 faces. What is the probability that the die lands on an even number or a factor of 27? (4) Two biased coins are thrown. The probability of obtaining 'heads' with the first coin is 80%. The probability of obtaining 'heads' with the second coin is 65%. (a) Draw a tree diagram to show what can happen if both coins are thrown. (b) Calculate the probability that one coin lands on 'heads' and the other coin lands on 'tails'. (5) A bag contains 5 red balls and 7 blue balls. If 2 balls are chosen randomly from the bag without replacement, what is the probability of obtaining balls with different colours?



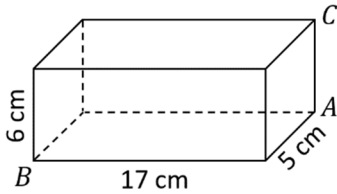
(1) For the function $y = f(x)$ on the right, draw the following transformations.



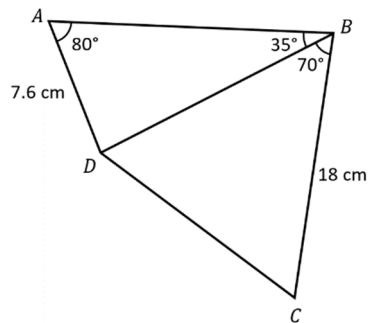
(a) $y = f(x) - 2$; (b) $y = f(x - 1)$; (c) $y = -f(x)$; (d) $y = f(2x)$. (2) Estimate the gradient of the function $y = f(x)$ on the right when $x = -2$. (3) Use the trapezium rule to estimate the area between the curve $y = f(x)$ above and the x -axis between $x = 0$ and $x = 3$. (4) Make r the subject of the formula $5(r + 3t) = 7(2 - 6r)$. (5) Solve the following equations. (a) $3x^2 + 8x + 2 = 0$; (b) $3x^2 - 8x + 2 = 0$; (c) $3x^2 + 8x + 6 = 0$. (6) Write $\frac{2x+3}{x-3} - \frac{x-2}{x-5}$ as a single fraction. (7) Solve (a) $\frac{6}{x-4} = \frac{5}{x-3}$; (b) $\frac{2x}{x-3} - \frac{x}{x-2} = 6$.



(1) Calculate the size of the angle \widehat{ABC} in the cuboid on the right. (2) For the diagram below, (a) Calculate the



length BD ; (b) Calculate the length CD ; (c) Calculate the area of the triangle BCD .



(3) Use the graph of $y = \sin x$ to solve $\sin x = 0.4$ between 0° and 360° . (4) Draw the graph $y = \sin(2\theta)$ between -180° and 180° .



(1) Which of the following numbers are rational numbers? $7, \sqrt{7}, \frac{1}{6}, \pi, \sqrt{9}, 0.2\dot{4}, \frac{6}{0}$.

(2) Simplify the following. (a) $6\sqrt{2} - 2\sqrt{2}$; (b) $4\sqrt{11} + 3\sqrt[3]{9} + 5\sqrt{11} - \sqrt[3]{9}$; (c) $\sqrt{18}$; (d) $\sqrt{20} \times \sqrt{45}$; (e) $(4 - 2\sqrt{5})(6 + \sqrt{5})$; (f) $(4 + 3\sqrt{5})^2$. (3) Calculate the AER for a savings account where 2.1% interest is paid each month. (4) Deiniol intends to borrow £9,000 from the company Loans4U. The interest rate is 2% each quarter, and the company charges a monthly fee of £4 for using the account. What is the APR? (5) Draw a histogram for the weight data on the right. (6) Use your histogram from question (5) to calculate an estimate of the (a) median; (b) lower quartile; (c) upper quartile.

Weight (w kg)	Frequency
$0 < w \leq 10$	9
$10 < w \leq 15$	6
$15 < w \leq 20$	7
$20 < w \leq 40$	5

Revision Videos

Excel Spreadsheet

(A list of all 420 videos that is possible to filter)



Information for Parents



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