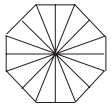
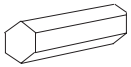
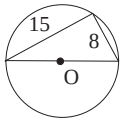
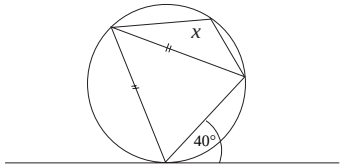
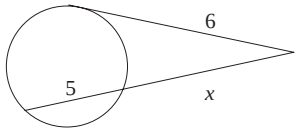
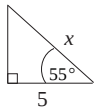
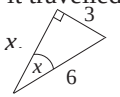
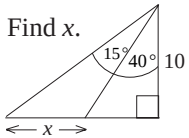
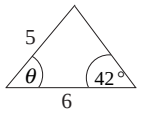
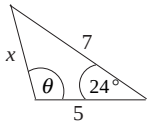
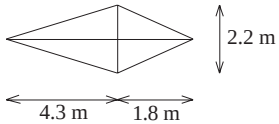
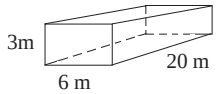
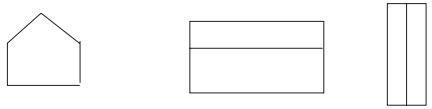
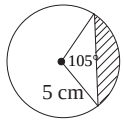
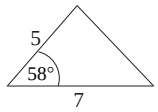
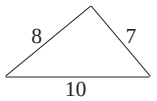
Hrs	Topic	Notes	Examples	References	Page
(3)	**1. <u>INDICES: STANDARD FORM</u>**				
	R: Index notation	Positive integer powers only	Simplify $a^5 \times a^3$; $m^4 \div m^2$		
	Prime factors		Find HCF of 216 and 240		
	Laws of indices				
	C: Negative / fractional Indices	With and without calculator	$81^{\frac{2}{3}}$ (without calculator); simplify $\left(\frac{m^2}{n}\right)^{-1}$		
	Standard form		Evaluate $\left(2.762 \times 10^{-12}\right) \times \left(4.97 \times 10^{21}\right)$(cal.)		
			Evaluate $\left(2.8 \times 10^4\right) + \left(7 \times 10^6\right)$ (no cal.)		
			Evaluate $\left(2.8 \times 10^4\right) \div \left(7 \times 10^6\right)$ (no cal.)		
(5)	**2. <u>FORMULAE: ALGEBRAIC FRACTIONS</u>**				
	R: Formation, substitution,	With and without calculator	Given $q = -2$, $v = 2.1$, find the value of		
	change of subject in formulae	Opportunity for revision of negative	$\sqrt{v^2 - q^2}$.		
		numbers, decimals, simple fractions.	Make L the subject of $t = 2\pi\sqrt{\frac{L}{g}}$		
	More complex formulae:		Given $u = 2$, $v = -3$, find f when $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$		
	– substitution – powers and roots				
	– change of subject with		Make v the subject of $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$		
	subject in more than 1 term				
	Common term factorisation		Factorise $x^3y^4 - x^4y^3 + x^2y$		
	C: Algebraic fractions – addition	Including denominators with	Simplify $\frac{x}{x+1} + \frac{2x}{2x-1}$		
	and subtraction	(i) numerical or single term (ii) linear term			

Hrs	Topic	Notes	Examples	References	Page
(5)	**3. <u>ANGLE GEOMETRY</u>**				
	R: Angle properties of straight lines, points, triangles, quadrilaterals, parallel lines				
	Angle symmetry properties of polygons	Include line and rotational symmetry	Calculate interior angle of a regular decagon Shade in diagram so that it has rotational symmetry of order 4 but no lines of symmetry. 		
	Symmetry properties of 3-D shapes	Include plane, axis and point symmetry	Describe fully the symmetries of this shape. 		
	Compass bearings	8 compass points and 3 figure bearings	Scale drawings of 2-stage journeys		
	C: Angle in a semi-circle	Application of Pythagoras and Trig.	Calculate the radius. 		
	Radius is perpendicular to the tangent				
	Radius is perpendicular bisector of chord				
	Angles in the same segment are equal				
	Angle at the centre is twice the angle at the circumference.		$x = ?$ 		
	Opposite angles of a cyclic quadrilateral add up to $180°$**.**				
	Alternate segment theorem.				
	Tangents from an external point are equal.		$x = ?$ 		
	Intersecting chords	AX.BX = CX.DX			
	Tangent/secant	$PT^2 = PA.PB$			

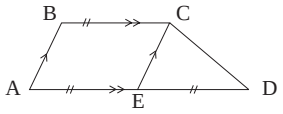
Hrs	Topic	Notes	Examples	References	Page
(6)	**4. <u>TRIGONOMETRY</u>**				
	R: Trigonometry (sin, cos, tan)	Angles of elevation and depression Bearings	Ship goes from A to B on a bearing $040°$ for 20 km. How far north has it travelled?		
		2-D with right-angled triangles only	Find x.  Find x. 		
	C: Sine and cosine rules	Including case with two solutions	Find x.  Find 2 solutions for θ. 		
	E: Graphs of sin, cos, tan.	Angles of any size	Find x and θ. 		
	Solutions of trig equations		Solve $\sin x = \frac{1}{2}$ for all x in range $0 \le x \le 720°$.		
(7)	**5. <u>PROBABILITY</u>**				
	R: Relative frequency – experimental probability and expected results		Experiment to find probability of drawing pin landing point up. $p(\text{ace}) = \frac{4}{52} = \frac{1}{13}$		
	Appropriate methods of determining probabilities	Using symmetry, experiment Simple tree diagrams	There are 5 green, 3 red and 2 white balls in a bag. What is the probability of obtaining (a) a green ball (b) a red ball (c) a non-white ball?		
	Probability of 2 events Multiplication law for independent events	By listing, tabulation or tree diagrams	Find the probability of obtaining a head on a coin and a 6 on a dice.		

Hrs	Topic	Notes	Examples	References	Page
	C: Addition law for mutually exclusive events		If for class, $p(\text{size 6 feet}) = 0.2$ $p(\text{size 7 feet}) = 0.3$ $p(\text{left - handed}) = 0.15$ (a) Calculate $p(\text{size 6 or 7 feet})$ (b) Explain why $p(\text{size 6 feet or left - handed}) \neq 0.2 + 0.15$		
	Addition Law for non-mutually exclusive events	Using Venn diagrams	(c) Calculate $p(\text{size 6 feet or left - handed})$ when $p(\text{size 6 feet and left - handed}) = 0.05$		
	Conditional probability; dependent events	Sampling without replacement	A bag contains 3 green, 5 red and 8 blue counters. Two counters are taken from the bag. Find the probability that (a) both counters are the same colour, (b) one is green and the other red.		
(7)	**6. NUMBER SYSTEM**				
	R: Estimating answers		$\frac{29.4 + 61.2}{14.8} \approx \frac{30 + 60}{15} \approx 6$		
	Use of brackets and memory on a calculator		$\frac{2.5 \times 14.3}{7.8 + 2.95} = 3.32558$ (to 5 d.p.)		
	C: Upper and lower bounds, including use in formulae	Including area, density, speed	9.7 means $9.65 \leq x < 9.75$ 100 metres (to nearest m) is run in 9.8 s (to nearest 0.1 s). Give the range of values within which the runner's speed must lie.		
	Irrational / rational numbers	Recurring decimals	Give irrational numbers between 5 and 6. Show that (i) $0.\dot{0}\dot{9}$ (ii) $0.1\dot{6}$ are rational.		
	Surds	Surd form of sin, cos, tan of $30^\circ, 45^\circ, 60^\circ$ Division of surds using conjugates			

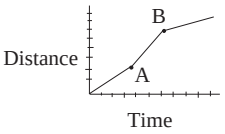
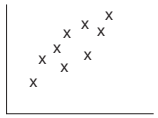
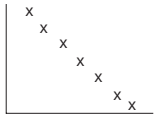
Hrs	Topic	Notes	Examples	References	Page
	Addition, subtraction, multiplication of surds	Expansion of two brackets	$\left(1+\sqrt{2}\right)\left(1-\sqrt{2}\right)$μ If p and q are different irrational numbers, is (i) $p+q$ (ii) pq rational / irrational / could be both?		
(7)	**7. MENSURATION** R: Difference between discrete and continuous measures	To include **estimation** of measures	Illustrate current postal rates; shoe sizes		
	Areas of parallelograms, trapezia, kites, rhombuses and composite shapes		Find the area of this kite.  		
	Volumes of prisms and composite solids	Area of cross-section × length of prism			
	Surface area of simple solids: cubes, cuboids, cylinders				
	Volume/capacity problems	Include compound measures such as density.	Find the mass of water to fill this swimming pool.  		
	2-D representations of 3-D objects	Use of isometric paper	For plan and side elevation shown, draw an isometric diagram. 		
	C: Units	Conversion between m and cm, m^2 and cm^2, m^3 and cm^3.			
	Appropriate degree of accuracy	Rounding sensibly for the context and the range of measures used			

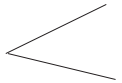
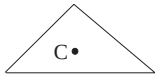
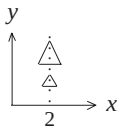
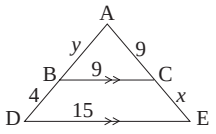
Hrs	Topic	Notes	Examples	References	Page
	Upper and lower bounds		$l = 9.57$ m $\Rightarrow$ $9.565 \le l < 9.575$		
	Volume and surface area of pyramid, cone and sphere and combinations of these (composite solids)		Calculate the radius of a sphere which has the same volume as a solid cylinder of base radius 5 cm and height 12 cm.		
	Length of circular arc, areas of sectors and segments of a circle		Calculate the shaded area. 		
	Dimensions	Notation [L] [T] [M] for basic dimensions	Which of the following could be volumes? πrl, x^3, $ab + cd$, $\frac{(ab)^2}{b}$ (*r, l, x, a, b, c, d,* are lengths)		
	Area of triangle $= \frac{1}{2} a b \sin C$		Find the area of the triangle. 		
	E: Area of triangle $= \sqrt{s(s-a)(s-b)(s-c)}$ *where* $s = \frac{1}{2}(a+b+c)$	Heron's formula	Find the area of the triangle. 		
(7)	**8. <u>DATA HANDLING</u>**				
	R: Two-way tables including timetables and mileage charts	12 hour and 24 hour clock	If a train arrives at a station at 13:26 and the connection leaves at 14:12, how long do you have to wait?		
	Frequency graphs	For grouped data; equal intervals Include frequency polygons and histograms			
	Questionnaires and surveys	Fairness and bias			
	C: Construct and interpret	Understand and use frequency density			

Hrs	Topic	Notes	Examples	References	Page
	histograms with unequal intervals **Frequency polygons** **Sampling** **Select and justify a sampling method to investigate a population.**	Different methods: random, quota, stratified Effect of sample size; reliability of conclusions	Determine the number of pupils in each school year to represent their views when the total representation is 20. The numbers of pupils in each year are year 7 8 9 10 11 number 122 118 100 98 62 (5) (5) (4) (4) (2)		
(6)	**9. <u>DATA ANALYSIS</u>** R: Problems involving the mean Mean, median, modal class for grouped data Cumulative frequency graphs**;** median, quartiles **C: Standard deviation for discrete and grouped/ continuous data**	Including discrete and continuous data Including percentiles Inter-quartile and semi-interquartile range Using formulae and statistical mode on a calculator Comparison of mean and st. dev. for 2 sets of data.	The mean of 6 numbers is 12.3. When an extra number is added, the mean changes to 11.9. What is the extra number? Find mean and st. dev. of weights of boys and girls of different ages: compare data and draw conclusions.		
(6)	**19. <u>VECTORS</u>** **C: Vectors and scalars** **Sum and difference of vectors**	Vector notation $\begin{pmatrix} a \\ b \end{pmatrix}$, $\vec{AB}$ or **a**			

Hrs	Topic	Notes	Examples	References	Page
	Resultant vectors		A plane is flying at 80 m/s on a heading of $030°$. However, a wind of 15 m/s is blowing from the west. Determine the actual velocity (speed and bearing) of the plane.		
	Components				
	Multiplication of a vector by a scalar				
	Applications of vector methods to 2-dimensional geometry		$\vec{AE} = \vec{ED} = \mathbf{a}$ and $\vec{AB} = \mathbf{b}$ Write down, in terms of **a** and **b**, (i) $\vec{CE}$ (ii) $\vec{CD}$ (iii) $\vec{DB}$ 		
	E: Know and use commutative and associative properties of vector addition				
(10)	**10. EQUATIONS**				
	R: Linear equations	One fraction and/or one bracket	Solve $2x-3=7;\ 3x-4=x+18$		
	Trial and improvement methods		Solve for x to 2 d.p. $x^3+7x-6=20$		
	Expansion of brackets		Multiply out $(2r+3s)(2r-5s)$		
	C: Simultaneous linear equations	Algebraic solutions	Solve $x-4y=7$		
	Factorisation of functions	Common terms, difference of two squares, trinomials, compound common factor	Factorise (i) x^4-1 (ii) x^3+x^2+x+1 (iii) $2x^2-x-3$ Solve (i) $4x^2-1=0$ (ii) $4x^2-9x=0$ (iii) $x^2-x=6$ (iv) $x^3+x^2-x-1=0$		
	Completing the square	Including max/min values	By completing the square, find the minimum value of x^2-4x+9.		

Hrs	Topic	Notes	Examples	References	Page
	Quadratic formula		Solve $5x^2 - x - 3 = 0$, giving answers to 2 d.p.		
	Multiplying and dividing algebraic expressions	Permissable cancelling	Simplify $\dfrac{x^2 - 9}{x^2 - x - 6}$		
	Equations leading to quadratics; related problems	Including equations from additions or subtractions of algebraic fractions	Solve $\dfrac{x}{x+1} + \dfrac{2x}{2x-1} = \dfrac{39}{20}$		
(4)	**11**. **FRACTIONS and PERCENTAGES**				
	R: Percentage and fractional changes	Discount, VAT, commission	VAT on hotel bill of £200?		
	C: Compound interest	Repeated proportional change	Find the compound interest earned by £200 at 5% for 3 years.		
	Appreciation and depreciation		A car costs £5,000. It depreciates at a rate of 5% per annum. What is its value after 3 years?		
	Reverse percentage problems		The price of a television is £79.90 including 17.5% VAT. What would have been the price with no VAT?		
(3)	**12**. **NUMBER PATTERNS and SEQUENCES**				
	R: Find formula for the *n* th term of a linear sequence.		*n* th term in sequence 8, 11, 14, 17, ..., ..., ...		
	Find a quadratic formula for the *n* th term of a sequence		Find *n* th term for (i) 3, 6, 11, 18, ..., $\left(n^2 + 2\right)$ (ii) 6, 7, 10, 15, ..., $\left(n^2 - 2n + 7\right)$		
	C: Express general laws in symbolic form				

Hrs	Topic	Notes	Examples	References	Page
(6)	**13. GRAPHS**				
	R: Graphs in context, including conversion and travel graphs ($s-t$ and $v-t$) and an understanding of speed as a compound unit	Draw and interpret Gradient and area under graph for **polygon** graphs only	Calculate speed between A and B from graph. 		
	Scatter graphs and lines of best fit		Name the type of correlations illustrated below. (a)  (b) 		
	Equation of straight line	Opportunities for use of IT	Find equation of straight line joining points (1, 2) and (4, 11).		
	Graphical solution of simultaneous equations				
	Graphs of common functions	Quadratic, cubic, reciprocal			
	C: Solve equations by graphical methods	Quadratic, cubic, reciprocal and exponential equations	Use the graph of $y = x^2 - 5x$ to solve $x^2 - 5x = 7$. Draw graphs of $y = x^2 + 5x$ and $y = x^3$ to solve $x^2 + 5x = x^3$. Solve graphically $2^x = 5$. Use the graphs of $y = x^2 - 5x$ and $y = 2x - 3$ to solve $x^2 - 7x + 3 = 0$.		

Hrs	Topic	Notes	Examples	References	Page
(9)	**14. LOCI and TRANSFORMATIONS: CONGRUENCE and SIMILARITY**				
	R: Constructions of loci	About point(s) and line(s)	Construct the locus of points equidistant from both lines. 		
	Translation	Using vector notation	Draw image after translation $\begin{pmatrix}-3\\2\end{pmatrix}$		
	Enlargements	Positive integers and simple fractions for scale factor	Enlarge diagram by scale factor $\frac{1}{3}$, centre C. 		
	C: Enlargements	Negative scale factor Finding the centre of enlargement			
	Reflections	Reflection in $y = x$, $y = -x$, $y = c$, $x = c$ Finding the axis of symmetry	Equation of mirror line. 		
	Rotations	Rotation about any point 90°, 180° in a given direction Finding the centre of rotation			
	Combination of two transformations				
	Congruence – conditions for triangles	SSS SAS AAS RHS			
	Similarity – similar triangles, line, area and volume ratio	Internal line ratio, e.g. 3:2 in example	Calculate (i) x and y (ii) ratio of areas ABC and BCED  *Sudso* is available in 800 g and 2.7 kg boxes which are similar in shape. The smaller box uses 150 cm^3 of card. How much card is needed for the larger box?		

Hrs	Topic	Notes	Examples	References	Page
(3)	**15. <u>VARIATION: DIRECT and INVERSE</u>**				
	R: Direct and inverse variation		For the following data, is y proportional to x? x: 3 4 5 6 y: 8 10 12 14		
	C: Functional representation	$y \propto x, y \propto x^2, y \propto x^3, y \propto \frac{1}{x}, \ y \propto \frac{1}{x^2}$ $y \propto \frac{1}{x^3}, \ y \propto \sqrt{x}, \ y \propto \frac{1}{\sqrt{x}}$	If y is proportional to the square of x and $y = 9$ when $x = 4$, find the positive value of x for which $y = 25$.		
	Graphical representation				
(4)	**16. <u>INEQUALITIES</u>**				
	R: Solution of linear inequalities and simple quadratic inequalities		Solve for x (a) $5x + 2 < x + 16$ (b) $x^2 \leq 25$		
	C: Graphical applications	Locating and describing regions of graphs	Sketch lines $y = x + 1$, $y = 3 - x$ and $x = 2$; hence, shade the region for which $y > x + 1$, $y < 3 - x$ and $x < 2$.		
	E: Linear programming				
(6)	**17. <u>USING GRAPHS</u>**				
	C: Transformation of functions	$y = f(x + a), \ y = f(x) + a$ $y = k f(x), \ y = f(kx)$	For given shape of $y = f(x)$, sketch $y = f(x) + 2, \ y = \frac{1}{2} f(2x), \ y = f(x + 1)$		
	Find the approximate area between a curve and the horizontal axis.	Interpretation of area Drawing trapezia; trapezium rule	Estimate the area between the curve $y = x^2 + 1$, the x-axis and the lines $x = 1$ and $x = 3$.		

Hrs	Topic	Notes	Examples	References	Page
	Construct and use tangents to estimate rates of change	Including max/min points Applications to travel graphs Speed from a distance/time graph. Acceleration and distance from a velocity/time graph.	A car accelerates so that its velocity is given by the formula $v = 10 + 0.3t^2$. Sketch the velocity/time graph for $t = 0$ to $t = 10$, and estimate the distance travelled by the car. Also estimate the acceleration when $t = 5$.		
	Finding coefficients	Find values of a and b in $y = ax^2 + b$ by plotting y against x^2.			
	E: Use of logarithms to produce straight line graphs	Find values of p and q from the graph of $y = pq^x$.			
(4)	**18. <u>3-D GEOMETRY</u>**				
	C: Length of slant edge of pyramid	Producing 2-D diagrams from 3-D problems	ABCDE is a regular square-based pyramid of vertical height 10 cm and base, BCDE, of side 4 cm. Calculate		
	Diagonal of a cuboid		(i) the slant height of the pyramid		
	Angles between two lines, a line and a plane, two planes	Pythagoras, sine and cosine rules	(ii) the angle between the line AB and the base (iii) the angle between one of the triangular faces and the square base.		