TOPICS		Content	Guidance	R	A	G
Algebra & Functions	**2.1**	**Index laws**	$\sqrt{2}$ is irrational			
	2.2	**surds**	including rationalising the denominator			
	2.3	**Quadratic functions & their graphs**	f(x) notation			
		Discriminant	including conditions for number of real roots			
		Completing the square	including coef of x not equal to 1			
		solution of quadratic equations	factorising			
			formula			
			completing the square			
		solving quadratic equations in a function of the unknown	powers of x, trig functions, e & log functions (where you can put it equal to a different letter to make a normal quadratic)			
	2.4	**simultaneous equations**	elimination or substitution			
			including one linear & one quadratic			
	2.5	**linear & quadratic inequalities & intrerpret graphically**	including $px^2 + qx + r > ax + b$			
			means where the curve is above the line etc			
		including inequalities with brackets & fractions	eg need to be rearranged first into solvable form			
		express solutions through correct use of 'and' & 'or'	ie set notation			
		graphs of inequalities	shading & use of dotted & solid lines to find solution set			

	2.6	**manipulating polynomials , algebraic division & use of factor theorem**	including factorising a cubic			
		simplify rational expressions by factorising & cancelling & algebraic division	ie algebraic fractions			
	2.7	**Graphs of functions; sketch curves**	cubic & quartic functions			
		modulus functions	sketch modulus functions & use to solve equations & inequalities			
		$\frac{a}{x}$ & $\frac{a}{x^2}$	asymptotes			
		interpret solutions of equations in relation to graphs & points of in				
		proprtional relationships & their graphs	$y \propto x \; or \; \frac{1}{x}$ or =kx etc			
	2.8	**composite funtions, inverse functions & their graphs**	function is one-to-one or many-to-one, f: l →domain & range			
	2.9	**transforming graphs & sketching**	apply a combination of transformations to any graphs on the syllabus (quadratic, cubic, sin, tan, cos, e^x & a^x)			
	.2.10	**partial fractions**	& apply to integration, differentiation, & series expansion			
	2.11	**modelling**	eg trig functions - tides/hours of sunlight, reciprocal for inverse proportion, exponential for growth & decay			
Coordinate Geometry	**3.1**	**straight line equations**				
		gradient conditions of parallel & perpendicular lines				
		straight lines in context				
	3.2	**equation of a circle**	find raduis & centre (in either form)			
		complete the square to find centre & radius				
		circle properties:				
		angle in a semicircle	find equation of circumcircle given 3 points			
		radius bisects chord at right angles				
		tangent is perpendicular to radius	equation of a tangent using this			
	3.3	**parametric equations & conversion between Cartesian & parametric forms**	pay attention to the domain of t			
	3.4	**use parametrics in modelling**	inclusing constant velocity as in kinematics			

Sequences & Series	**4.1**	**binomial for positive integer power, n!**	pascal's triangle, notations $\binom{n}{r}$ & nC_r			
		any rational power & valid for |r|<1	may be used with partial fractions & mat be asked about validity of expansion			
	4.2	**sequences including an nth term rule, increasing, decreasing & periodic functions**	eg: $U_n = \frac{1}{3n+1}$ is decreasing as $U_{n+1} < U_n \; for \; all \; n$ $U_n = 2^n \; is \; increasing$ as $U_{n+1} > U_n$ etc			
	4.3	**sigma notation**	know that $\sum_{1}^{n} 1 = n$			
	4.4	**arithmetic sequences & series**	proof of sum formula, including sum of first *n* natural numbers			
	4.5	**geometric sequences & series**	proof of sum formula, use of logs, sum to infinity of convergent series & condition |r|<1			
	4.6	**use in modelling**	eg savings scheme (percentage increase forms geometric series)			
Trigonometry	**5.1**	**sin, cos, tan**	unit circle			
		sine & cosine rules	including ambiguous case of sine rule			
		area of triangle				
		radians, including arc length & area of sector				
	5.2	**small angle approximations**	$\frac{\cos 3x - 1}{x \sin 4x} \approx -\frac{9}{8}$			
	5.3	**trig graphs (symmetry & periodicy)**				
		exact values of sin/cos/tan of $0, \frac{\pi}{6}, , \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \pi$				
	5.4	**sec cosec & cot, arcsin arccos & arctan; their graphs, ranges & domains**	angles in degrees & radians			
	5.5	$\tan\theta = \frac{\sin\theta}{\cos\theta}$	use to solve equations & prove further identities in both degrees & radians			
		$\sin^2\theta + \cos^2\theta = 1$, $1 + \tan^2\theta = \sec^2\theta$, $1 + cot^2\theta = \text{cosec}^2\theta$				

	5.6	**double angle formulae & sin/tan/cos (A+B) & (A-B)** **geometric proofs of these** $r\sin(\theta \pm \alpha)$ & $r\cos(\theta \pm \alpha)$	apply to half angles solve equations like $a\cos\theta + b\sin\theta = c$			
	5.7	**solve trig equations including quadratics & multiples of the angle**				
	5.8	**proofs of identities**				
	5.9	**solve problems in context including vectors, kinematics & forces**				
Exponentials & logs	**6.1**	**know & use** a^x, e^x	& their graphs. Understand difference in shape between $a < 1$ & $a > 1$			
	6.2	**know that the gradient of** e^{kx} is ke^{kx}	When the rate of change is proportional to *y* , an exponential model should be used			
	6.3	**know** $\log_a x$ **is the inverse of** a^x				
		ln *x*	solve equations like $e^{ax+b} = p$ & $\ln(ax+b) = q$			
	6.4	**log laws**				
	6.5	**solve equations in the form** a^x=b				
	6.6	**reduce exponentials to linear relations**	plot log *y* against log *x* & log *y* against *x* . & find gradient & intercept of line			
	6.7	**growth & decay**	know that "initial" means t=0			
Differentiation	**7.1**	**understand the derivative as the gradient of the tangent at a general point (x,y), as a limit & as a rate of change**				
		sketch the gradient function	given y=f(x), sketch y=f'(x) . Can also relate to speed & acceleration			
		second derivatives				
		differentiation from first principles	for powers of x & for sin & cos (use formula)			
		convex & concave sections of curve & points of inflection	know that stationary points are where f'(x)=0, that point of inflection is f''(x) changes sign & use second derivatives for nature of maximum & minimum points			
	7.2	**differentiate** x^n	put in index form first if necessary			

		differentiate $a^x, e^x, \sin kx$ $\cos kx, \tan kx, \ln x$				
	7.3	**apply differentiation to to find gradients, tangents & normals**				
		max & min & points of inflection	max & min problems in context			
		increasing & decreasing functions	apply to curve sketching			
	7.4	**product , quotient & chain rules, including connected rates of change & inverse functions**	cosec, cotan & sec			
			use $\frac{dy}{dx} = \frac{1}{\frac{dx}{dy}}$ & $\frac{dV}{dt} = \frac{dV}{dr} \times \frac{dr}{dt}$			
	7.5	**inplicit & parametric**	equations of tangents & normals of curves given parametrically or implicitly			
	7.6	**construct simple differential equations in pure maths & in context**	info given may include direct proportion			
Integration	**8.1**	**integration as reverse of differentiation**	constant of integration			
	8.2	**integrate** $x^n,\ e^{kx},\ \frac{1}{x},\ \sin x,\ \cos x$	put in index form first if necessary			
			given f'(x) and a point on the curve, find an equation of the curve			
			include other standard trig functions & use identities to integrate $sin^2\ cos^2\ tan^2$			
	8.3	**areas under curves**				
		areas between 2 curves				
	8.4	**integration as a limit**	$\int_a^b f(x)dx = \lim_{\delta x \to 0} \sum_{x=a}^{b} f(x)\delta x$			
	8.5	**integration by substitution**	includes finding suitable substitution			
		integration by parts				
		inverse chain rule				
	8.6	**integration using partial fractioning**				
	8.7	**differential equations**	may need to sketch family of curves			

	8.8	**interpret solutions of differential equations in context**	includes links to kinematics (variable acceleration) & limitations on the model			
Numerical methods	**9.1**	**find roots of f(x)=0 by considering changes of sign**	know that function has to be continuous			
		understand how it can fail				
	9.2	**iteration**	cobweb & staircase			
	9.3	**Newton-Raphson**	understand how it works geometrically; fails if near turning points			
	9.4	**trapezium rule**	use a sketch to deterime over/under-estimate			
			$\overrightarrow{AB} = \boldsymbol{b} - \boldsymbol{a}$			