Curriculum

Class : Sec3GS

Cycle: Secondary

Subject : Math

Textbook: Puissance

Units	Objectives	Learning Outcomes
Complex Numbers (15hrs)	• Modulus and argument of a complex number • Properties of modulus and argument • Trigonometric form • Exponential form • De Moivre's formula • Geometric interpretation for addition, multiplication of complex numbers and conjugate	• Calculate the modulus and the argument of a complex number in algebraic form • Interpret geometrically the modulus and argument of a complex number • Understand that the modulus represents the distance OA where A is the image of the complex number of affix z and argument represents angle (u,OA) . • Use properties of modulus $\|z\| \geq 0,\ \|z\| = \|-z\| = \|\bar{z}\|;\ \|z\|^2 = z.\bar{z}$; $\|z.z'\| = \|z\|.\|z'\|;\ \|z^n\| = \|z\|^n; \left\|\frac{z}{z'}\right\| = \frac{\|z\|}{\|z'\|}$; $\|z+z'\| \leq \|z\| + \|z'\|$ • Use properties of argument arg($\bar{z}$)=-arg(z) [2π] Arg(-z)= π+ arg(z0 [2π] Arg(z,z')= arg(z)+ arg(z') [2π] Arg(z^n)= narg(z) [2π] Arg($\frac{z}{z'}$)= arg(z)-arg(z') [2π] Arg(real)=0 [π] Arg(imaginary) = $\frac{\pi}{2}$ [π] • Change a complex no from algebraic form to trigonometric z=r(cosθ+isinθ) • Change from trigonometric form to algebraic form. • Use notation $e^{i\theta}$=cosθ+ isinθ

		• Change from trigonometric form to exponential form. • Change from exponential to trigonometric form. • Using uniqueness of trigonometric notation : 1) simplify complex expressions 2) solve equations in C 3) determine the nth roots of complex numbers 4) determine the trigonometric forms $\frac{\pi}{5}$, $\frac{\pi}{10}$-….. • Use De Moivre's formula: $[r(\cos\theta+i\sin\theta)]^n=r^n(\cos n\theta+i\sin n\theta)$ • Construct the point of affix $\bar{z}$ given the point of affix z. • Construct the point of affix –z given the point of affix z. • Locate vector of affix z+z' • Locate the vector AB of affix Z_B- Z_A
Complex Equations (10h)	• Solving 2nd degree equations with complex coefficients. • Solving 2nd degree equations with real coefficients with negative discriminant. • Factorize a 2nd degree trinomial with complex coefficients. • Calculate the nth root of unity. • Interpret graphically $\arg(\frac{z-a}{z-b})$ & $\left\|\frac{z-a}{z-b}\right\|$. • Use geometric interpretation to study collinearity and orthogonality. • Determine graphically and by calculation the set of points M such that $\left\|\frac{z-a}{z-b}\right\|$=k where k is real constant.	• Know that the sum of the nth roots are null. • Represent graphically the nth roots. • Know that the points representing the nth roots of unity are the vertices of a regular polygon. • Use relation $\left\|\frac{z-a}{z-b}\right\|=\frac{MA}{MB}$ & $\arg(\frac{z-a}{z-b})=(\overrightarrow{BM},\overrightarrow{AM})$ • Know that points A, B and M are collinear if $\arg(\frac{z-a}{z-b})=0\ [\pi]$ • (AM) & (BM) are orthogonal if $\arg()\ \frac{z-a}{z-b}=\frac{\pi}{2}\ [\pi]$.

Calculus (15h) Vector and mixed product	• Determine the components of the vector product of 2 non zero vectors • Determine the mixed product of 3 non zero vectors	• Determine the analytic expression of the vector product. • Use vector product to calculate area of parm and triangle • Know that vector product is zero if the 2 vectors are collinear. • Use mixed product to calculate volume of tetrahedron & parallepiped. • Know that mixed product of 3 vectors is zero if vectors are coplanar.
Orthogonality between lines and planes in space	Characterize using analytical expression of vectors the orthogonality between two staright lines, straight line and plane, and two planes,	• Two straight lines of director vectors V(a,b,c) and V'(a',b',c') are orthogonal if aa'+bb'+cc'=0 • Line of director vector V is orthogonal to a plane of normal vector V' if V and V' are collinear. • Two planes of normal vectors V(u,v,w) and V'(u',v',w') are perpendicular if uu'+vv'+ww'=0
Relative position of 2 lines, 2planes or a line and a plane.	• 2 lines of director vectors V and V' are parallel (confounded) if V and V' are collinear. • 2 lines of director vectors V and V' are orthogonal if V and V' are orthogonal. • Know that 2 planes of normal vectors V and V' are parallel if V and V' are collinear.	• Determine the parametric equation of line of intersection of 2 intersecting planes. • Determine point of intersection of 2 lines. • Determine the point of intersection of a line and plane.
Distance from a point to a plane or from a point to a line	• Know and use the relation of distance from a point to a plane $d=\frac{\lvert ux_0+vy_0+wz_0+r\rvert}{\sqrt{u^2+v^2+w^2}}$ • Calculate the distance from a point to a line using various methods,	• Determine the equations of the bisector planes. • Calculate the height of a tetrahedron. • Calculate the distance between 2 parallel planes. • Calculate the length of the common perpendicular between 2 noncoplanar lines.
Numerical functions (65h)	• Composite function of 2 given functions	• Determine the composite functions of 2 given functions.

Inverse functions	• Characterize the inverse function of a specific function,	• Conditions for existence of inverse function. • Domain of definition of inverse function. • Sense of variation of inverse function. • Determine the explicit form of inverse functions. • Construct the graph of the inverse function by symmetry with respect to the first bisector.
Inverse trigonometric functions	• Study of the functions Arcsin,Arccos, Arctan	• Study inverse of sine function over $[-\frac{\pi}{2},\frac{\pi}{2}]$ & represent graphically. • Study inverse of cosine function over $[0,\pi]$ & represent graphically. • Study inverse of tangent function over $]-\frac{\pi}{2},\frac{\pi}{2}[$ & represent graphically.
Napierian logarithm	• Definition • Rules of calculation • Derivative and Integral • Limits • Study of function ln	• Consequences of definition • Specify domain of definition • Logarithm of product, quotient and power. • Solving equalities, inequalities and system of equations. • Calculate derivative of logarithmic functions. • Calculate integrals using change of variable, integration by parts. • Memorize basic limits and solve others by substitution, hospitals rule or common factor or denominator. • Study the sense of variation; draw the curve of logarithmic functions.
Exponentials	• Definition • Rules of calculation • Derivative and integral • Limits	• Consequences of definition • Exponential of product, quotient and power. • Solving equalities, inequalities

	• Study of the function	and system of equations. • Calculate derivative of exponential functions. • Calculate integrals using change of variable, integration by parts. • Memorize basic limits and solve others by substitution, hospitals rule or common factor or denominator. • Study the sense of variation; draw the curve of exponential fn
Numerical Sequence	• Distinguish between major, minor, bounded, convergent & non-convergent sequence. • Calculate limit of simple numerical sequences. • Use the properties of comparison to calculate limits. • Use the method of induction to show that a sequence is major, minor or monotonous. • Recurrent convergent sequence given by $U_{n+1}=f(U_n)$ admits a limit l such that f(l)=l	• Admit that an increasing & major sequence or decreasing and minor sequence is convergent. • If $U_n \leq V_n$ and $\lim U_n=+\infty \rightarrow \lim V_n=+\infty$ • If $U_n \leq V_n$ and $\lim V_n=-\infty \rightarrow \lim U_n=-\infty$ • If $V_n \leq U_n \leq W_n$ if $\lim V_n= \lim W_n= \alpha \rightarrow \lim U_n= \alpha$.
Continuity and Derivation (10h)	• Image of an interval by a continuous function. • Unique Root of a continuous function over[a,b] • Rules of derivative • Use of second derivative. • Calculate the successive derivatives of a function over an interval. • Hopital's Rule • Know the conditions for extension by continuity of a function at a point.	• The image of an interval by a continuous function is na interval of the same nature. • A function admits a unique root over [a,b] if f(x) is contiuous and monotonous over[a,b] and f(a)..f(b)<0 • Know that if a function f is continous and monoyonous over an interval I then f is a bijection over f(I). • Know and calculate the derivative of composite functions. • Use formula $(f^{-1})'(y_o)= \frac{1}{f'(x_o)}$ to calculate the derivative of inverse function. • Use second derivative to

		determine inflection point and maintain the relation between sign of second derivative and representative curve. • Use Hopital's Rule to calculate undetermined limits $\frac{0}{0}, \frac{\infty}{\infty}$. • Extension by continuity at a point a if lim to left of a at f(x) equals to limit to right of a at f(x)equals to a real number l.
Integration (15h)	• Define a definite integral of a continuous function over [a,b] • Use Properties (P1) to (P7) • Use different methods to calculate integrals • Use integrals to calculate the area and volume	• $\int_a^b f(x)dx$ =F(b)-F(a) where F(x) is primitive of f(x). • Know the fundamental theorem of integration. • (P1) $\int_a^a f(t)dt = 0$ $\int_b^a f(t)dt = -\int_a^b f(t)dt$ • (P2) Chasle's relation $\int_a^b f(t)dt = \int_a^c f(t)dt + \int_c^b f(t)dt$ • (P3) linearity $\int_a^b \alpha f(t) + \beta g(t)dt = \alpha \int_a^b f(t)dt + \beta \int_a^b f(t)dt$ (P4) if f(x) ≥0 over[a,b] then $\int_a^b f(x)dx \geq 0$ (P5) if f(x) ≥g(x) over[a,b] Then $\int_a^b f(x)dx \geq \int_a^b g(x)dx$ • (P6) if f is even over[-a,a]

		$\int_{-a}^{a} f(x)dx = 2\int_{0}^{a} f(x)dx$ If f is odd over[-a,a] then $\int_{-a}^{a} f(x)dx = 0$ • (P7) f is continuous and periodic of period T then $\int_{0}^{T} f(x)dx = \int_{a}^{a+T} f(x)dx$ • Decomposition of a rational function into partial fractions. • Method of change of variable • Linearization of a trigonometric polynomial by trigonometric formulas or complex numbers. • Use method of integration by parts. • Calculate area between two curves by use of integrals. • Calculate the volume of a solid by rotation around coordinates axes. • Calculate the approximate value of integrals by the method of rectangles.
Differential Equations (10 h)	• Identify a differential equation and determine its order. • Solve first order differential equations. • Solve second order differential equations.	• Identify vocab(order, coefficient, equation with second member, without a second member, general solution) • Solve first order diff eqs of form y'= $\int f(x)dx$ • Solve first order diff eqs of form y'+ay=0. • Solve first order diff eqs of form y'+ay=b. • Solve diff equations with independemt variables $\int f(x)dx = \int g(y)dy$ • Solve first order y'+ay=f(x).

		• Solve second order diff eq of form y"=f(x). • Solve second order diff eq of form ay"+by'+c=0. • Solve second order diff eqof form y"+w^2y=k.
Trigonometric functions (5h)	• Study of functions of form acos(bx+c) and a sin(bx+c) • Use metric relations in a triangle (law of sine and cosine)	• Distinguish amplitude, frequency and period. • Represent graphically functions a cos(bx+c) and a sin(bx+c)
Conics (20 h)	• Define a conic by its focus F, directrix (D) & eccentricity such that e= $\frac{MF}{d(M,D)}$ • Define focal axis as axis of symmetry. • Determine parameter p of a conic. • Know that any point M on parabola is equidistant from focus and directrix. • Y^2=2pX or X^2=2pY is the reduced eq of parabola in system (S,I,j) where S is the vertex and p is the distance between focus and directrix. • Determine equation of tangent at point M of parabola, • Know that $\frac{X^2}{a^2}+\frac{Y^2}{b^2}$=1 or $\frac{X^2}{b^2}+\frac{Y^2}{a^2}$=1 is reduced equation of ellipse or hyperbola. • Know that ellipse (hyperbola) admits 2 axes of symmetry, 2 foci , 2 directrices and center of conic. • Calculate the area of the domain limited by an ellipse.	• Distinguish between parabola, ellipse and hyperbola based on value of e. • Know that the vertices of a conic are the points of intersection with focal axis. • Write the equation of a conic in an orthonormal system. • Determine the elements of a conic given its reduced equation. • Determine the focus and directrix of parabola if eq is of form Y^2=2pX or X^2=2pY. • Know that vertex of parabola is midpoint of subtangent and p is the length of subnormal. • Determine focus, directrix and parameter of parabola of form y=ax^2+bx+c or x=ay^2+by+c. • Know that the tangent at a point of a parabola is the bisector of FMH or perpendicular bisector of [FH]. • Another definition of parabola is set of centers of circles passing through F and tangent to (D). • Determine foci, directrices, focal axes of an ellipse(hyperbola) given by its reduced equation. • Another definition for ellipse is the set of points whose sum of

	• Know principal & secondary circle of ellipse or hyperbola. • Determine asymptotes of hyperbola. • Another definition of hyperbola is the set of points whose difference to 2 fixed points is constant. • Determine nature, reduced equation and principal elements of curve defined by $AX^2+BY^2+CX+DY+E=0$	distances to 2 fixed points is constant. • Know rectangular hyperbola. • Determine equation of tangent at a point of ellipse (hyperbola) • Use equation of hyperbola in a system of its asymptotes. • Know parametric equation of ellipse and write eq of tangent and normal in parametric form.
Transformation (35h)	• Displacements(translation or rotation) • Study composite of 2 rotations or composite of rotation and translation. • Determine the image of a point, line or circle by translation or rotation, homothecy or similitude. • Know and use the properties of displacement. • Homothecy: characterize a homothecy by its center w and ratio k h(w,k). • Determine the composite of 2 homothecies with same center or different centers. • Determine the composite of homothecy and translation. • Determine 2 homothecies that transform 2 circles. • Characterize a direct plane similitude of center w, ratio k and angle α. S(w,k,α) • Know that similitude is the composite of homothecy h(w,k) and rotation R(w,α) • Determine the composite of 2 similitudes. • Determine the complex form of different transformations of form f(z)=az+b	• Displacement, homothecy and similitude conserves collinearity, parallelism, oriented angles, orthogonality, distances and barycenter. • Study the effect of homothecy / similitude on geometric figures(use thales) • The center of homothecy / rotation/similitude is the only invariant point. • Know that h(w, $\frac{1}{k}$) is the inverse transformation of h(w,k) • In homothecy and similitude distances are multiplied by k and areas by k^2. • K=1 (identical mapping) • K=-1 (central symmetry) • A homothecy of ratio k<0 can be considered similitude of ratio $\lvert k \rvert$ and angle π. • Know that S(w, $\frac{1}{k}$, -α) is the inverse of S(w,k,α) • In translation a=1 and bis affix of translation vector V. • In rotation $a=e^{i\alpha}$ and $z_w=\frac{b}{1-a}$ • In similitude $a=k\,e^{i\alpha}$,$z_w=\frac{b}{1-a}$

Counting(10h)	• Factorial of a natural number • Arrangement with repetition • Arrangement without repetition • Combination • Newtons Binomial	• Applications on use of factorial • Solve word problems to distinguish between formulas. • Use binomial's formula to develop $(a+b)^n$
Statistical Series in one Variable (5h)	• Statistical Vocabulary • Graphical Representation' • Characteristics of a statistical series • Use of the calculator	• Identify population , individual and character • Calculate relative frequency, cumulative frequency and cumulative relative. • Draw bar graph, circular diagram, histogram and polygon' • Calculate Mode, Median, mean, standard deviation and variance.
Probability (20h)	• Equiprobable events • Conditional probability/total probability • Tree diagram' • Random variable	• Reminder of basic vocabulary • Calculate probability of equiuprobable events • Use tree diagram to calculate conditional probability • Distinguish independent events • Set the probability distribution table • Calculate the expected value