سلطنة عمان
وزارة التربية والتعليم
المديرية العامة للمدارس الخاصة
دائرة برامج ومناهج المدارس الخاصة

Pure Math Syllabus (2019-2020)

For Bilingual Program

Grades (11 – 12)

Based on:

1. Text Books:
   Advanced Maths AS Core For Edexcel (C1-C2) – Pearson Longman
   Advanced Maths AS Core For Edexcel (C3-C4) – Pearson Longman
2. Minimum student contact time (220 min/week)

GRADE 11
Semester 1

Area of maths covered	Topic	Chapter in book PEARSON LONGMAN	Components of topic to be covered	No. of Weeks	Objectives
ALGEBRA	Quadratic Equations & Functions	C1:3 (pg 41-63)	• **Solving quadratic equations by:** ○ Factorizing ○ Quadratic formula ○ Completing the square • **Sketching quadratic graphs** ○ Max/Min; ○ Shape ○ Turning Point (vertex) & Axis of Symmetry • **Nature of roots**(working with the discriminate)	1.5	Completing the square. Solution of quadratic equations. Solution of quadratic equations by factorisation, using the formula and completing the square. Quadratic functions and their graphs Graphs of functions; sketching curves defined by simple equations. Geometrical interpretation of algebraic solution of equations. Use of intersection points of graphs of functions to solve equations. The discriminate of a quadratic function
	Inequalities	C1:4 (pg 65-70)	• **Solving inequalities** ○ Linear ○ Quadratic	0.5	Solution of linear and quadratic inequalities. For example, $ax + b > cx + d$, $px^2 + qx + r > 0$, $px^2 + qx + r < ax + b$
	Equations	C1:5 (pg 72-87)	• **Solving simultaneous equations** ○ Linear, ○ One linear & one quadratic (algebraically & graphically) • **Intersection of linear & quadratic functions** (3 cases of discriminate)	1	Simultaneous equations: analytical solution by substitution. For example, where one equation is linear and one equation is quadratic. Graphs of functions; sketching curves. Geometrical interpretation of algebraic solution of equations. Use of intersection points of graphs of functions to solve equations.
	Exponents & Logs	C2:18 (Pg 312-323)	• Logarithms: ○ Definition.- log ↔ exp. ○ Rules: $\log_c ab$; $\log_c(a \div b)$, $\log_c(a^n)$ ○ Special cases ; $\log_a a$, $\log_a 1$, $\log_a(1 \div a)$. • Exponential function: ○ Graphs. ○ Relationship between (log and exp).	2	*Sketch* $y = a^x$ and translations $y = a^{ax+b} + c$ Laws of logarithms • To include: $\log_c ab$; $\log_c \frac{a}{b}$; $\log_c a^n$ • Special cases $\log_a a$; $\log_a 1$; $\log_a (\frac{1}{a})$

GEOMETRY	Co-ordinate geometry	C1:6 (pg 92-110)	• **Revision:** ○ Coordinates, Midpoint, Gradient(value,+,-) ○ y = mx + c (Drawing and writing the equations if two points are given) ○ The length of a line segment joining (x_1,y_1) to (x_2,y_2) • **Straight line :** ○ Gradient as tanθ. ○ Special cases for gradient (0, 1 , -1, ∞) ○ Parallel and perpendicular lines ($m_1=m_2$, $m_1.m_2= -1$) • Equation of a line: $y - y_1 = m(x - x_1)$ or $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$ • Forms of equations of straight lines: ○ y=mx + c, y=mx, y=x+c ○ y=c, y=o, x=c, x=0 ○ ax+by+c=0 • Sketching • Applications: ○ Advanced use of the previous knowledge	3.5	Equation of a straight line, including the forms $y - y_1 = m(x - x_1)$ and $ax + by + c = 0$. To include: • the equation of a line through two given points • the equation of a line parallel (or perpendicular) to a given line through a given point. For example, the line perpendicular to the line $3x + 4y = 18$ through the point (2, 3) has equation $y - 3 = \frac{4}{3}(x - 2)$ Conditions for two straight lines to be parallel or perpendicular to each other. EX: ask for an equation for a line that is parallel to a line cuts a given equation for a curve in two points. To include equation of circle in the form $(x - a)^2 + (y - b)^2 = r^2$
TRIGONOMETRY	Solving triangles, Radians and applications	C2:17 C2:16.1 (Pages 252,253 & 282-302)	• Solutions of triangle (sin, cos, area rule) • Radians: ○ Definition. ○ Radians ↔ Degrees. ○ Angles and Quadrants ($0^\circ \geq \theta \geq 360^\circ$). ○ Area of sector and length of arc. ($A_1=0.5r^2\theta$, $s=r\theta$) ○ Area of a triangle. ($A_2=0.5ab\sin C$) ○ Area of segment. ($A= A_1- A_2$) ○ Special triangles	3	The sine and cosine rules, and the area of a triangle in the form $\frac{1}{2}ab\sin C$. Radian measure, including use for arc length and area of sector. Use of the formulae $s = r\theta$ and $A = \frac{1}{2}r^2\theta$
	Trig functions and angles in all	C2:16.2-16.5 (pg 254-268)	• Trigonometric functions for any angle: ○ Sign. ○ Magnitude. ○ Special cases. • Graphs of trigonometric functions: ○ y=sinx, cosx, tanx. ○ Transformations of the graphs : $y = \pm af(\pm x \pm A) \pm B$	2	Sine, cosine and tangent functions. Their graphs, symmetries and periodicity. Knowledge of graphs of curves with equations such as $y = 3\sin x$, $y = \sin\left(x + \frac{\pi}{6}\right)$, $y = \sin 2x$ is expected

Grade 11 : Semester 2

ALGEBRA	Algebra and functions	C2:12 (pg 187-200)	• Identities • Long division ○ Revision the concepts ; (Quotient, Divisor, Dividend, and Remainder) ○ Dividing a polynomial by (ax+b). ○ Dividing a polynomial by (ax^2+bx+c). ○ A simpler method of division (ex. $\frac{ax+b}{cx+d} = A + \frac{B}{Cx+D}$) • Remainder and Factor theorem • Factorising polynomials	1.5	Algebraic division; use of the Factor Theorem and the Remainder Theorem. Students should know that if f(x) = 0 when $x = a$, then ($x - a$) is a factor of f(x). Students may be required to factorise cubic expressions such as $x^3 + 3x^2 - 4$ and $6x^3 + 11x^2 - x - 6$. Students should be familiar with the terms 'quotient' and 'remainder' and be able to determine the remainder when the polynomial $f(x)$ is divided by $(ax + b)$. Should use a known factor to determine another factor.
	Binomial expansion	C2:14 (pg 218-227)	• Binomial expansion using Pascal's triangle. • Notation n! and $\binom{n}{r}$ • Formula for binomial expansion	2	The students should be • able to use Pascal's triangle to expand $(a+b)^n$ for small positive integers n. • Familiar with notations n! and $\binom{n}{r}$ • able to use the binomial expansion formula to expand $(a+b)^n$ for all positive integers n
SEQUENCE & SERIES	Arithmetic series	C1:8.3 (pg 136-145)	Arithmetic Series ○ Definition. ○ The concepts; common difference, progression. ○ Formula for the nth term arithmetic series. ○ Advanced applications. ○ Formula for the sum of n term(s) of arithmetic series. ○ Advanced applications.	2.5	Arithmetic series, including the formula for the term & sum of the first n natural numbers. The general term and the sum to n terms of the series are required. The proof of the term & the sum to n terms formula should be known.
	Geometric series	C2:20 (pg 349-362)	Geometric Series ○ Definition. ○ The concepts; common ratio, progression. ○ Formula for the nth term in the arithmetic sequences. ○ Advanced applications. ○ Formula for the sum of n term(s) of arithmetic sequences. ○ Advanced applications.		The sum of a finite geometric series; the sum to infinity of a convergent geometric series, including the use of $\|r\| < 1$. The general term and the sum to n terms are required. The proof of the sum formula should be known.

ALGEBRA	Standard functions and curve sketching	C1:7 (pg 113-128)	• **Sketching and interpreting the curves of standard functions:** ○ y=a, y=ax+b, $y=ax^2+bx+c$ ○ $y = \frac{1}{x}$, $y = x^3$ ○ $y = \sqrt{x}$, $y= \sqrt[3]{x}$, $y= \frac{1}{x^2}$, $y = \frac{1}{x^n}$, $y = \sqrt[n]{x}$ • **Introducing the concepts ; Continuity, Discontinuity, Asymptote** • **Geometrical Interpretation of the solution of equations** ○ Solving two equations graphically. ○ Points of intersection between an equation and a given line (intersection- being tangent-…etc) ○ Explaining if two points intersect or don't. ○ Other advanced applications.	2.5	Graphs of functions; sketching curves defined by simple equations. Geometrical interpretation of algebraic solution of equations. Use of intersection points of graphs of functions to solve equations. Functions to include simple cubic functions and the reciprocal function $y = \frac{k}{x}$ with $x \neq 0$ Knowledge of the term asymptote is expected.
TRIGONOMETRY	Identities & Equations	C2:16.6-16.7 (pg 268-277)	• Trigonometric Identities: ○ $\tan\theta = \sin\theta \div \cos\theta$. ○ $\sin^2\theta + \cos^2\theta = 1$. ○ $\sin\theta = \cos(90^\circ-\theta)$, $\cos\theta = \sin(90^\circ-\theta)$ • Solution of trigonometric equations: ○ Simple. (Ex; $A\sin(a\theta \pm b)=B$) ○ Quadratic. ○ Advanced equations (required the above knowledge)	2	Knowledge and use of $\tan\theta = \frac{\sin\theta}{\cos\theta}$ and $\sin^2\theta + \cos^2\theta = 1$ Proving various identities Solution of simple trigonometric equations in a given interval. Students should be able to solve equations such as $\sin\left(x + \frac{\pi}{2}\right) = \frac{3}{4}$ for $0 < x < 2\pi$, $\cos(x + 30^\circ) = \frac{1}{2}$ for $-180^\circ < x < 180^\circ$, $\tan 2x = 1$ for $90^\circ < x < 270^\circ$, $6\cos^2 x + \sin x - 5 = 0$, $0^\circ \leq x < 360$, $\sin^2\left(x + \frac{\pi}{6}\right) = \frac{1}{2}$ for $-\pi \leq x < \pi$.

<table>
<tr>
<td>ALGEBRA</td>
<td>Transformations of graphs</td>
<td>C3:2
(pg 11-42)</td>
<td>• Even and Odd functions:
○ Definitions.
○ Determining of a given function is an odd or even function.
○ Relationship between the graphs of odd and even functions.
• Modulus functions:
○ Definition of |x|.
○ Equations with modulus signs.
○ Inequalities with modulus signs.
○ Sketching functions involving modulus signs.
○ Comparison: |f(x)|, f(|x|).
• Transformation of graph of f(x) to :
○ y = f(x)±a
○ y = f(x±a)±b
○ y = -f(x)
○ y = f(-x)
○ y = a f(x)
○ y = f(ax)
• Sketching a graph of a function using the previous transformations rules.</td>
<td>4</td>
<td>Definition of a function.
$y = f(x)$, $f(x) = x^a$ with a odd or even.

The modulus function. $|ax+b| = |cx+d|$ and $|ax+b| \geq 3$

Combinations of the transformations y = f(x) as represented by y = af(x), y = f(x) + a, y = f(x + a),
y = f(ax).
Students should be able to sketch the graph of, for example, y = 2f(3x), y = f(-x) + 1, given the graph of y = f(x) or the graph of,
for example, $y = 3 + \sin 2x$, $y = -\cos\left(x + \frac{\pi}{4}\right)$

The graph of y = f(ax + b) will not be required.</td>
</tr>
<tr>
<td colspan="4">TOTAL NO. OF WEEKS</td>
<td>28</td>
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</table>

Grade 12

Semester 1

Area of maths covered	Topic	Chapter in book PEARSON LONGMAN	Components of topic to be covered	No. of Weeks	Objectives
ALGEBRA	Partial fractions	C4:8 (pg 179-187)	• Distinct linear factors. • Repeated linear factors. • Improper fractions.	1.5	Rational functions. Partial fractions to include denominators such as $(ax+b)(cx+d)(ex+f)$ and $(ax+b)(cx+d)^2$ and (ax^2+b) .Use other resources for quadratic factor that cannot be factorised.
CALCULUS	Differentiation	C1:9 (pg 148-164)	• Rates of change • Tangent to a curve • Gradient of a curve • Differentiation • The notation • Function notation • Vocabulary • Differentiating from first principles • Differentiation of polynomials • Tangents and normals	2	The derivative of f(*x*) as the gradient of the tangent to the graph of *y* = f (*x*) at a point; the gradient of the tangent as a limit; interpretation as a rate of change; second order derivatives. For example, knowledge that $\frac{dy}{dx}$ is the rate of change of *y* with respect to *x*. Knowledge of the chain rule is not required. The notation f '(*x*) may be used. Differentiation of x^n , and related sums and differences. For example, for *n* ≠ 1, the ability to differentiate expressions such as $(2x+5)(x-1)$ and $\frac{x^2+5x-3}{3x^{\frac{1}{2}}}$ is expected. Applications of differentiation to gradients, tangents and normals. Use of differentiation to Find equations of tangents and normals at specific points on a curve. Using the 1st principle to find simple differentiations. $f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$
	Differentiation	C2:15 (pg 230-243)	• Increasing and decreasing functions • Stationary points • Identifying the type of a stationary point • Maximum and minimum problems	1.5	Applications of differentiation to maxima and minima and stationary points, increasing and decreasing functions. The notation f''(*x*) may be used for the second order derivative. To include applications to curve sketching. Maxima and minima problems may be set in the context of a practical problem.

TRIGONOMETRY	Trig involving all trig ratio's in all quadrants	C3:3 (pg 46-80)	• Reciprocal Functions: ○ Definition. ○ Identities. ○ Graphs. ○ Comparing the six trigonometric functions. ○ Identities (involved all the six trigonometric functions). ○ Equations (involved all the six trigonometric functions). • Addition formulae: ○ sin(A±B), cos(A±B), tan(A±B). ○ Advanced applications of all of the previous formulae. • Double angle formulae: ○ sin2A, cos2A, tan2A. ○ Advanced applications of all of the previous formulae. • Half-angle formulae: ○ Sin0.5A, cos0.5A, tan0.5A. ○ Advanced applications of all of the previous formulae	3.5	Knowledge of secant, cosecant and cotangent. Their relationships to sine, cosine and tangent. Understanding of their graphs and appropriate restricted domains. Angles measured in both degrees and radians. Knowledge and use of $\sec^2\theta=1+\tan^2\theta$ and $\text{cosec}^2\theta = 1 + \cot^2\theta$. Knowledge and use of double angle formulae; use of formulae for $\sin(A \pm B)$, $\cos(A \pm B)$ and $\tan(A \pm B)$ and of expressions for $a\cos\theta + b\sin\theta$ in the equivalent forms of $r\cos(\theta \pm a)$ or $r\sin(\theta \pm a)$. To include application to half angles. Knowledge of the ($\tan \frac{1}{2}\theta$) formulae will *not* be required. Students should be able to solve equations such as $a\cos\theta + b\sin\theta = c$ in a given interval, and to prove simple identities such as $\cos x \cos 2x + \sin x \sin 2x \equiv \cos x$. Note: Inverse trigonometrical functions and the factor formulae are not required.
INTEGRATION	Integration	C1:10 (pg 165-173)	• The reverse of differentiation • Finding the constant C • Using the integral sign • Rules for integrating x^n • Integration of a polynomial • Applying integration	1.5	Indefinite integration as the reverse of differentiation. Students should know that a constant of integration is required. Integration of x^n For example, the ability to integrate expressions such as $\frac{1}{2}x^2 - 3x^{-\frac{1}{2}}$ and $\frac{(x+2)^2}{x^{\frac{1}{2}}}$ is expected Given $f'(x)$ and a point on the curve, students should be able to find an equation of the curve in the form $y = f(x)$.
	Integration	C2:19 (pg 325-347)	• Indefinite and definite integrals • Area under a curve • To find an area using integration • Area between a curve and a straight line • Area between two curves • The Trapezium rule • Formula for the trapezium rule	1.5	Evaluation of definite integrals. Interpretation of the definite integral as the area under a curve. Students will be expected to be able to evaluate the area of a region bounded by a curve and given straight lines. Eg find the finite area bounded by the curve $y = 6x - x^2$ and the line $y = 2x$. $\int x\,dy$ will not be required. Approximation of area under a curve using the trapezium rule. For example, evaluate $\int_0^1 \sqrt{(2x+1)}$ using the values of $\sqrt{(2x+1)}$ at $x = 0, 0.25, 0.5, 0.75$ and 1.

Probability			• Elementary probability • The terminology of probability • Sample space • Addition rule • Multiplication rule • Tree diagrams • Independent and mutually exclusive events • Number of arrangements	1.5	Elementary probability. Sample space. Exclusive and complementary events. Conditional probability. Understanding and use of $P(A') = 1 - P(A)$, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$, $P(A \cap B) =$ $P(A)\,P(B\|A)$. Independence of two events. $P(B\|A)=P(B)$, $P(A\|B) = P(A)$, $P(A \cap B) = P(A)P(B)$. Sum and product laws. Use of tree diagrams and Venn diagrams. Sampling with and without replacement

Grade12 Semester 2

EXPONENTS & LOGS	The functions e^x and lnx	C3:4 (pg 90-96)	• Logarithms: ○ Relationship and graph of e^x and lnx. ○ $\ln e^x = x$ ○ $e^{\ln N} = N$ ○ $\ln = \log_e$ • e^x and its inverse lnx: ○ Graphs of $y = af(x+a)+b$ if $f(x) = e^x$ where a and b are positive or negative ○ Graphs of $y = af(x+a)+b$ if $f(x) = \ln x$ where a and b are positive or negative ○ Solving equations involving e^x and lnx	2	The function e^x and its graph. To include the graph of $y = ae^{bx+c} + d$. The function $\ln x$ and its graph; $\ln x$ as the inverse function of e^x. Solution of equations of the form $e^{ax+b} = p$ and $\ln(ax + b) = q$ is expected.

CALCULUS	Differentiation	C3:5 (pg 98-136)	• The chain rule • Differentiation of powers of f(x) • The use of • Differentiation of the exponential function and natural logarithms • Differentiation of functions of the type $e^{f(x)}$ • Differentiation of ln x • Differentiation of ln kx • Differentiation of ln (f(x)) • Simplifying a logarithmic function before differentiating • Differentiation of products and quotients • The product rule • The quotient rule • Differentiation of trigonometric functions • Differentiation of sin x and cos x • The derivatives of sin f(x) and cos f(x) • Angle x in degrees • The derivatives of powers of sin x and cos x • Trigonometric differentiation involving the product and quotient rules • Differentiation of tan x , cot x , sec x and cosec x	3	Differentiation of e^x, ln x, sin x, cos x, tan x and their sums and differences. Differentiation using the product rule, the quotient rule and the chain rule. Differentiation of cosec x, cot x and sec x are required. Skill will be expected in the differentiation of functions generated from standard forms using products, quotients and composition, such as $2xSin4x$, $\frac{e^{3x}}{x}$ and $tan2x$. The use of $\frac{dy}{dx} = \frac{1}{\left(\frac{dx}{dy}\right)}$ Eg finding $\frac{dy}{dx}$ *for* $x = \sin 3y$
	Further Differentiation	C4:10 (pg 201-213)	• Implicit differentiation • Second derivatives of implicit functions stationary points • Connected rates of change	2	Differentiation of simple functions defined implicitly. The finding of equations of tangents and normals to curves given implicitly is required.
INTEGRATION	Integration	C4:12 (12.1-12.4) (pg 244-270)	• Integration as the limit of a sum • Solids of revolution • Volume of revolution • Integration of e^x and $\frac{1}{x}$ • Limits of the definite integral $\int_a^b \frac{1}{x} dx$ • Integration by recognition • Integrals of the type $\int k(f(x))^n f'(x)dx$ • Integrals of the type $\int kf'(x)e^{f(x)}dx$	3	Integration of e^x, $\frac{1}{x}$ Students should recognize integrals of the form $\int \frac{f'(x)}{f(x)} dx = \ln f(x)$ Evaluation of volume of revolution. $\pi \int y^2 dx$ is required, These methods as the reverse processes of the chain and product rules respectively. NOTE: Trigonometric Integration is NOT required.

STATISTICS	Normal Distribution	?	• The normal distribution • The standard normal distribution • Area under the curve of the normal distribution curve	2	The Normal distribution including the mean, variance and use of tables of the cumulative distribution Knowledge of the shape and the symmetry of the distribution is required. Knowledge of the probability density function is not required. Derivation of the mean, variance and cumulative distribution function is not required. Interpolation is not necessary. Questions may involve the solution of simultaneous equations
TOTAL NUMBER OF WEEKS				25	

M. Hawthorn Sign: ________ **Date:** 10/06/09

A. Stevens Sign: ________ **Date:** 10/06/09

M. Katira Sign: ________ **Date:** 10/6/09

Moosa Hadi Sign: ________ **Date:** 10-06-09

Ahmed Al Thuhli Sign: ________ **Date:** 10/06/09