SOUTH PACIFIC BOARD FOR EDUCATIONAL ASSESSMENT

Pacific Senior Secondary Certificate

Mathematics

Prescription

Form 6

Effective from January 2008

Pacific Senior Secondary Certificate

Mathematics

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Rationale

The importance and usefulness of Mathematics in influencing our daily lives are undeniable. We simply can not do away with the application of Mathematics, from simple counting things at home to writing sophisticated reports at work, the skills and knowledge of Mathematics play central roles.

Mathematics has been taught at schools for many years, and in many schools, Mathematics has become a compulsory subject at all levels. Many students leave formal schooling at the end of their Form 6 year, while others move on to higher levels and eventually to university and other higher education institutions. It is vital that courses of studies and prescriptions at this level are designed in such a way that the needs of those who leave school at this point and those who continue on to higher education are both catered for.

Recent developments in science and technology have been rapid and their impacts on education and our lives are more than noticeable. It is therefore crucial that we respond to those developmental forces by constantly upgrading and improving our educational offerings so that our students are adequately equipped to cope with the demands of modern living.

The review exercise was carried out with the following considerations in mind:

1. Retain the standard of the mathematical skills and knowledge taught at Form 6 level in comparison with the other countries.

2. Equip students with the required mathematical skills and knowledge to continue on to further and higher education.

3. Adequately prepare students who leave school at the end of Form 6 so that they may contribute constructively to society.

4. Keep up with the new development in Science and Technology and promote the use of technology in real life applications.

5. Encourage students to use their mathematical skills as a tool to explore and solve mathematical problems in real life situations.

General Aims

The PSSC Mathematics course intends to:

1. Develop enquiring minds in students so that they may take genuine interests in Mathematics and actively engage in research and research-related activities.

2. Provide students with mathematical knowledge and skills to enable them to deal successfully with the demands of their careers as well as the intricacies of real life.

3. Encourage students to use the new developments in Science and Technology in their academic works and everyday living.

4. Equip students with mathematical skills so that they can make well-judged deductions and reasonings and draw logical and meaningful conclusions when facing new or unfamiliar real life situations.

Prerequisite

Students undertaking this PSSC course will be expected to have successfully completed the Form 5 Mathematics course.

Time Allocation

It is recommended that schools allow a minimum of five hours per week contact time in the classroom with the teacher, with a minimum of thirty productive weeks per year.

Course Content and Learning Outcomes

TOPIC 1: ALGEBRA		
1.1	**Solve a linear equation written in any form.**	
	1.1.1	Identify linear equations.
	1.1.2	Simplify linear equations. (e.g expand brackets, eliminate fractional terms, collect like terms etc.)
	1.1.3	Apply algebraic operations correctly. (i.e addition, subtraction, multiplication and division)
	1.1.4	Check the accuracy of answers using algebraic methods such as back substitution when required.
1.2	**Solve two linear equations simultaneously**	
	1.2.1	Solve two equations simultaneously using elimination or substitution method.
	1.2.2	Operate any other appropriate method to solve the two linear simultaneous equations
1.3	**Solve linear inequations of the form** $ax+b \le cx+d,\ a,b,c,d \in \Re$	
	1.3.1	Solve the inequations by appling algebraic operations correctly
	1.3.2	Evaluate the correct solution set.
1.4	**Solve linear inequations of the form:** $ax+b \ge cx+d \ge ex+f,\quad a,b,c,d,e,f \in \Re$	
	1.4.1	Solve the linear inequations using any appropriate method
	1.4.2	Evaluate the correct solution set
1.5	**Change the subject of formulae**	
	1.5.1	Identify the subject and collect like terms
	1.5.2	Rearrange the formula to obtain the correct subject
1.6	**Solve quadratic equations**	
	1.6.1	Identify quadratic equations
	1.6.2	Factorise quadratic equations
	1.6.3	Expand and simplify factors of a quadratic equation
	1.6.4	Solve quadratic equations by factorisation
	1.6.5	Solve quadratic equations using quadratic formula
	1.6.6	Find the point or points of intersection between a quadratic function and a straight line.
1.7	**Solve cubic equations or function**	
	1.7.1	Identify cubic functions
	1.7.2	Expand and simplify factors of a cubic equations
	1.7.3	Factorise a cubic function using the factor theorem (no proof required)
	1.7.4	Solve cubic functions by factorisation only

TOPIC 1: ALGEBRA		
1.8	**Operate rational algebraic expressions**	
	1.8.1	Simplify algebraic expressions
	1.8.2	Add algebraic expressions
	1.8.3	Subtract algebraic expressions
	1.8.4	Multiply algebraic expressions
	1.8.5	Divide algebraic expressions
1.9	**Solve exponential equations (including those with negative and fractional indices)**	
	1.9.1	Apply laws of indices to simplify exponential expressions or equations
	1.9.2	Solve the exponential equations using any appropriate method.
1.10	**Solve logarithmic equations**	
	1.10.1	Apply laws of logarithms to simplify logarithmic expressions or equations
	1.10.2	Convert to and from logarithmic form and index form
	1.10.3	Solve logarithmic equations using any appropriate method

TOPIC 2: COORDINATE GEOMETRY		
2.1	**Calculate the distance between two points**	
	2.1.1	Identify the variables x_1, x_2, y_1, y_2
	2.1.2	Find the distance between two points using Pythagoras Theorem
	2.1.3	Find the distance between two points using the Distance Formula.
2.2	**Calculate the midpoint of a line segment**	
	2.2.1	Identify the variables x_1, x_2, y_1, y_2
	2.2.2	Correctly substitute values of x and y into formula
	2.2.3	Find the midpoint using any appropriate method
2.3	**Calculate the gradient of a line segment**	
	2.3.1	Calculate gradient using the coordinates of two points
	2.3.2	Find the gradient using $\Delta y/\Delta x$
	2.3.3	Evaluate the gradient using trigonometric relationships
2.4	**Calculate the angle between a line segment and the horizontal**	
	2.4.1	Determine the size of the angle between a line segment and the horizontal
	2.4.2	Calculate the gradients using trigonometric relationships
	2.4.3	Find the angle between line segments using a known gradient
2.5	**Use the gradient to find the equation of a straight line**	
	2.5.1	Identify the general formulae of a straight line
	2.5.2	Express the formula in the form $\boldsymbol{y=mx+c}$
	2.5.3	Find the value of ***c.***

TOPIC 2: COORDINATE GEOMETRY		
2.6	**Use two points on a line to find the equation of the line**	
	2.6.1	Identify the x and y coordinates of two points on the line
	2.6.2	Find the gradient m of the line
	2.6.3	Write the equation in the form $y=mx+c$
2.7	**Sketch the graph of a straight line**	
	2.7.1	Find the x- and y- intercepts of the line
	2.7.2	Determine the gradient of the line
	2.7.3	Sketch the line on the x-y plane
2.8	**Find the gradients of parallel and perpendicular lines**	
	2.8.1	Define parallel and perpendicular lines
	2.8.2	Find the gradients of parallel lines
	2.8.3	Find the gradients of perpendicular lines
	2.8.4	Solve application problems involving parallel and perpendicular lines
2.9	**Find the point of intersection of two lines**	
	2.9.1	Identify conditions which give rise to two lines intersecting at one point
	2.9.2	Solve the two linear equations simultaneously
	2.9.3	Determine the x- and y- coordinates of the point of intersection
2.10	**Identify the types of triangles and quadrilaterals using the lengths and gradients of their sides**	
	2.10.1	Find the lengths of sides of figures using the distance formula or any appropriate method
	2.10.2	Find the gradients of the sides of figures on the x-y plane
	2.10.3	Identify the type of triangle or quadrilateral by comparing the lengths and/or gradients of their sides
2.11	**Sketch and label the graph of a circle centred at the origin and of the form:** $x^2 + y^2 = r^2$, $r \in \Re$	
	2.11.1	Identify features of a circle centred at the origin
	2.11.2	Find the equation of a circle centred at the origin
	2.11.3	Sketch a circle centred at the origin on the x-y plane
2.12	**Sketch and label the graph of a circle NOT centred at the origin and of the form** $(x-a)^2+(y-b)^2=r^2$**, {a,b,r}** $\in \Re$**, or of the form** $x^2+mx+y^2+ny=k$**,** $\{m,n,k\} \in \Re$	
	2.12.1	Identify important features such as radius and centre, of a circle not centred at the origin
	2.12.2	Apply translation method to transform a circle of the form $x^2+y^2=r^2, r\in\Re$ to the form $(x-a)^2+(y-b)^2=r^2$, $\{a,b,r\}\in\Re$ and vice versa
	2.12.3	Evaluate the translation vectors in 2.12.2
	2.12.4	Sketch a circle not centred at the origin on the x-y plane

TOPIC 2: COORDINATE GEOMETRY		
	2.12.5	Find the equation of a circle not centred at the origin.
	2.12.6	Convert equations of circles of the form $x^2 + mx + y^2 + ny = k$ to the form $(x-a)^2 + (y-b)^2 = r^2$ and vice versa. Variables *a, b, k, m, n* and *r* are Real Numbers
2.13	**Find the equation of a circle of known radius centred on the point (a, b)**	
	2.13.1	Recognise the general form of the equation of a circle $(x-a)^2 + (y-b)^2 = r^2$
	2.13.2	Substitute the values of a, b and r into the general form of the equation to obtain the equation of the circle
	2.13.3	Write other forms of the circle equation into $(x-a)^2 + (y-b)^2 = r^2$ and vice versa eg. $(x-1)^2 + (y-2)^2 = 4^2 \leftrightarrow x^2 + y^2 - 2x - 4y - 11 = 0$

TOPIC 3: SEQUENCES AND SERIES		
3.1	**Generate a sequence given a general term**	
	3.1.1	Identify features of a general term
	3.1.2	Use a general term to generate a sequence
3.2	**Determine the general term from a given list of terms of an Arithmetic sequence**	
	3.2.1	Show that a list of terms is an Arithmetic sequence
	3.2.2	Find the first term of an Arithmetic sequence
	3.2.3	Evaluate the common difference of an Arithmetic sequence
	3.2.4	Determine the general term of an Arithmetic sequence
3.3	**Determine the general term from a given list of terms of a Geometric sequence**	
	3.3.1	Show that a list of terms is a Geometric sequence
	3.3.2	Find the first term of a Geometric sequence
	3.3.3	Evaluate the common ratio of a Geometric sequence
	3.3.4	Determine the general term of a Geometric sequence
3.4	**Find the sum of an Arithmetic series**	
	3.4.1	Apply the appropriate formula to find the sum of an Arithmetic series.
3.5	**Find the sum of an Geometric series**	
	3.5.1	Apply the appropriate formula to find the sum of a Geometric series.

TOPIC 3: SEQUENCES AND SERIES		
3.6	**Apply nth term of an Arithmetic sequence, $T_n = a + (n-1)d$, and $S_n = \frac{n}{2}[a + (n-1)d]$, the sum of an Arithmetic series.**	
	3.6.1	Evaluate any unknown variable in T_n
	3.6.2	Evaluate any unknown variable in S_n
	3.6.3	Solve word problems involving the application of Arithmetic sequence and series including real life applications.
3.7	**Apply the nth term of a Geometric sequence, $T_n = ar^{n-1}$, and the sum of a Geometric series. $S_n = \frac{a(1-r^n)}{1-r}$ or $S_n = \frac{a(r^n = 1)}{r-1}$.**	
	3.7.1	Evaluate any unknown variable in T_n
	3.7.2	Evaluate any unknown variable in S_n
	3.7.3	Solve word problems involving the application of Geometric sequence and series including real life applications.
3.8	**Apply the sum to infinity, $S_\infty = \frac{a}{1-r}$**	
	3.8.1	State the conditions for the application of the sum to infinity
	3.8.2	Evaluate any unknown variable in S_∞.
	3.8.3	Calculate the sum to infinity S_∞
	3.8.4	Solve word problems involving the application of the Sum to infinity including real life applications.
3.9	**Evaluate sums using sigma notation**	
	3.9.1	List a series using a sigma notation
	3.9.2	Apply the appropriate method to find the sum of the series
3.10	**Write series in sigma notation**	
	3.10.1	Identify features of a sigma notation
	3.10.2	Evaluate limits and equation of a sigma notation for a given series
	3.10.3	Find the correct sigma notation for a given series.

TOPIC 4 : PROBABILITY		
4.1	**List all possible outcomes of an event**	
	4.1.1	Describe the event
	4.1.2	Identify the outcomes
	4.1.3	List all possible outcomes of an event
	4.1.4	Define and use the following terms: *event, sample space, element, trial, outcome, equally likely, bias, independent, conditional/ dependent.*
4.2	**Calculate the probabilities of equally likely events using the formula** $p(x)=\frac{n(x)}{n(s)}$	
	4.2.1	Define equally likely events
	4.2.2	Know the components of the formula
	4.2.3	Use the formula to calculate the probability
4.3	**Use tree diagram to predict outcomes**	
	4.3.1	Identify important features of tree diagrams
	4.3.2	Draw tree diagrams
	4.3.3	Calculate probabilities of familiar or simple applications using tree diagrams
4.4	**Construct and Use frequency tables to predict outcomes**	
	4.4.1	Identify important features of frequency tables
	4.4.2	Construct frequency and cumulative frequency tables
	4.4.3	Draw graphs from frequency table data
	4.4.4	Interpret graphs and data from frequency tables
	4.4.5	Use frequency table data to calculate statistical parameters (mean, median, mode, range, standard deviation etc.)
	4.4.6	Use cumulative frequency tables to draw cumulative curves and solve simple application problems
4.5	**Calculate long run relative frequencies**	
	4.5.1	Identify formula
	4.5.2	Substitute correct values into formula
4.6	**Calculate the expected value of a number of trials**	
	4.6.1	Define ***'expected value'***
	4.6.2	Determine the number of trials
	4.6.3	Identify correct formula
	4.6.4	Substitute correct values into formula
4.7	**Calculate the mean and standard deviation of a given set of data**	
	4.7.1	Know the difference between *mean, mode* and *median*
	4.7.2	Know and use the formula for finding the mean and standard deviation
	4.7.3	Substitute values into formula

TOPIC 4 : PROBABILITY		
4.8	**Use Normal Distribution Curve to determine probabilities**	
	4.8.1	Recognise the shape of a normal curve
	4.8.2	Recognise the Normal Distribution as a description of a data set
	4.8.3	Identify and locate the positions of the mean and standard deviation on the Normal curve
	4.8.4	Know the relationship between probabilities and standard deviation values
	4.8.5	Associate standard deviation values (1sd, 2sd, 3sd) with qualitative probability descriptives – "*likely*", "*very likely*", "*almost certainly*", and with their respective probability values.
4.9	**Use the Standard Normal Distribution**	
	4.9.1	Know the parameters for a Normal Distribution
	4.9.2	Draw the normal curve using the parameters
4.10	**Use the *z*-score to calculate probabilities**	
	4.10.1	Define *z*-score
	4.10.2	Know the significance of a *z*-score
	4.10.3	Identify and use the formula for finding *z*-scores
	4.10.4	Locate the positions of *z*-scores on the normal curve
	4.10.5	Use the Table to determine the probability values represented by *z*-scores
4.11	**Calculate a specific statistics associated with a given Normal Distribution for a given probability**	
	4.11.1	Draw the normal curve using the correct parameters

TOPIC 5 : STATISTICS		
5.1	**Differentiate between continuous and non-continuous data**	
	5.1.1	Know and recognise continuous data and discrete data
	5.1.2	Categorise data as continuous or discrete
5.2	**Understand commonly used statistical terminologies**	
	5.2.1	Define: sample, survey, census, bias, normal distribution
5.3	**Select a random sample from a normally distributed population**	
	5.3.1	Define the nature of the population
	5.3.2	Understand various sampling methods
	5.3.3	Identify appropriate sampling methods
	5.3.4	Select sample using method identified in 5.3.3
5.4	**Conduct statistical analysis on sample data**	
	5.4.1	Identify and state the purpose and method of data collection
	5.4.2	Clean and organise data
	5.4.3	Determine statistical parameters to use in the analysis
	5.4.4	Calculate statistical parameters

TOPIC 5 : STATISTICS		
	5.4.5	Use appropriate ways of data presentation to display data
5.5	**Interpret data and draw conclusions**	
	5.5.1	Recognise patterns or trends shown by parameters
	5.5.2	Recognise patterns or trends shown by data presentations
	5.5.3	Relate patterns or trends to purpose of data collection
	5.5.4	Comment on the significance of the patterns and trends
	5.5.5	Draw conclusions about the purpose of data collection from the patterns and trends revealed by the data.

TOPIC 6 : GRAPHS OF FUNCTIONS		
6.1	**Plot and sketch the graph of:** $y = ax^2 + bx + c$ $y = ax^3 + bx^2 + cx + d$ $y = \log_a x$ $y = \frac{ax+b}{cx+d}$ $y = a^x$ $y = ax^{\frac{1}{2}}$	
	6.1.1	Use function to generate table of values.
	6.1.2	Plot graph of function, showing all intercepts.
	6.1.3	Determine asymptotes if any.
	6.1.4	Describe behaviour of functions for large values of *x.*
	6.1.5	Define "limit of a function".
	6.1.6	Find limit(s) of functions for specific values of *x.*
	6.1.7	Identify symmetries of odd and even functions.
	6.1.8	Determine domain and range of functions.
6.2	**Recognise the concepts of transforming functions by sketching the translations, change of scale, and reflection in the *x*-axis of the following basic functions:** $y = x^2$ $y = x^3$ $y = x^{\frac{1}{2}}$ $y = a^x$ $y = \frac{a}{x}$ $y = \log_a x$	
	6.2.1	Sketch the graph of a given function showing appropriate labels.
	6.2.2	Determine transformation and any change of scale involved using any of the basic functions above.
	6.2.3	Determine transformation and translation involving any of the basic functions.
	6.2.4	Determine reflection on the x-axis using any of the basic functions
6.3	**Find the equations and sketch the graphs of the inverse functions of:** $y = a^x$ $y = ax^{\frac{1}{2}}$ $y = \log_a x$ $y = ax^2$ $y = mx + c$	
	6.3.1	Find the equation of the inverse function.
	6.3.2	Use the inverse function to generate a set of values.
	6.3.3	Sketch or plot the graph of the inverse function showing all appropriate labels.

TOPIC 7: CALCULUS		
7.1	**Understand and recognise the relationship between the rate of change and the gradient.**	
	7.1.1	Define gradient in terms of rate of change.
	7.1.2	Use appropriate formulae to find gradient.
7.2	**Find the derivative of ax^n where a and n are rational numbers.**	
	7.2.1	Find the derivative of a function using the First Principle
	7.2.2	Differentiate functions using appropriate rule.
7.3	**Find the derivative of a polynomial.**	
	7.3.1	Identify polynomial and use the rule of differentiation appropriately.
7.4	**Recognise the derivative as the gradient of the tangent to a curve at a point.**	
	7.4.1	Apply derivative to find differential function.
	7.4.2	Solve for x, using $y=f(x)$ given the gradient.
	7.4.3	Determine gradient of tangent line at the point (x,y).
	7.4.4	Determine gradient of normal line at the point (x,y).
	7.4.5	Use appropriate method(s) to find the equations of the tangent and normal to the curve at a given point.
	7.4.6	Sketch the graphs of tangent or normal lines.
7.5	**Apply derivative to stationary points and minima/maxima problems.**	
	7.5.1	Find stationary points of a polynomial using $\frac{dy}{dx} = f'(x) = 0$ for x.
	7.5.2	Determine the minima or maxima values.
	7.5.3	Determine the nature of a curve using Second Derivative Tests.
	7.5.4	Sketch graphs of polynomials using derivative information.
7.6	**Find the anti-derivative of ax^n where a and n are rational numbers and $n \neq -1$.**	
	7.6.1	Apply anti-derivative rule (for polynomial) appropriately.
7.7	**Find the anti-derivative of a polynomial.**	
	7.7.1	Identify polynomial and use appropriate rule(s) of anti-derivative.
	7.7.2	Find the value of the constant.
7.8	**Evaluate definite integrals.**	
	7.8.1	Evaluate definite integrals using appropriate anti-derivative rule(s).
7.9	**Find the area between a curve and *x*-axis.**	
	7.9.1	Draw graph of the curve, showing area and limits
	7.9.2	Evaluate area between curve and x-axis

TOPIC 7: CALCULUS		
7.10	**Find area between two curves.**	
	7.10.1	Draw graphs of the two curves.
	7.10.2	Write intended area in terms of definite integrals
	7.10.3	Evaluate definite integrals

TOPIC 8: TRIGONOMETRY		
8.1	**Calculate values of sin *x*, cos *x*, tan *x* for** $0^\circ \le x \le 360^\circ$	
	8.1.1	Calculate values of sin x for $0^\circ \le x \le 360^\circ$.
	8.1.2	Calculate values of cos x for $0^\circ \le x \le 360^\circ$.
	8.1.3	Calculate values of tan x for $0^\circ \le x \le 360^\circ$.
8.2	**Sketch the graph of *y* = sin *x*, *y* = cos *x*, *y* = tan *x* for** $0^\circ \le x \le 360^\circ$**.**	
	8.2.1	Sketch graph of $y = \sin x$ for $0^\circ \le x \le 360^\circ$ with appropriate labels.
	8.2.2	Sketch graph of $y = \cos x$ for $0^\circ \le x \le 360^\circ$ with appropriate labels.
	8.2.3	Sketch graph of $y = \tan x$ for $0^\circ \le x \le 360^\circ$ with appropriate labels.
8.3	**Draw graph of any trigonometric function of the form** $y = A\begin{matrix}\sin\\ \cos\end{matrix}(Bx + C) + K$	
	8.3.1	Define, calculate and show correct amplitude.
	8.3.2	Define, calculate and show correct period and frequency.
	8.3.3	Determine how the graph of $y = \sin x$ changes scale, translates or reflects in the x-axis in order to get $y = a\sin x$ or $y = \sin ax$ or $y = \sin(x + a)$.
	8.3.4	Determine how the graph of $y = \cos x$ changes scale, translates or reflects in the x-axis in order to get $y = a\cos x$ or $y = \cos ax$ or $y = \cos(x + a)$.
	8.3.5	Draw graphs showing appropriate translations (shift) with appropriate labels across both axes.
	8.3.6	Identify graphs of $y = a\sin x$, $y = \sin ax$ or $y = \sin(x + a)$ as transformations of the graph of $y = \sin x$.
	8.3.7	Identify graphs of $y = a\cos x$, $y = \cos ax$ or $y = \cos(x + a)$ as transformations of the graph of $y = \cos x$.
8.4	**Solve trigonometric equations of the type: *a*sin (*x* + *b*) = *c*, *a*cos (*x* + *b*) = *c*, *a*sin *bx* = *c*, *a*cos *bx* = *c* for** $0^\circ \le x \le 360^\circ$ **and where** $a, b, c \in \Re$**.**	
	8.4.1	Solve $a\sin(x + b) = c$ using $x + b = \sin^{-1}\left(\frac{c}{a}\right)$ for $0^\circ \le x \le 360^\circ$ and where $a, b, c \in \Re$.

TOPIC 8: TRIGONOMETRY		
	8.4.2	Solve $a\cos(x + b) = c$ using $x + b = \cos^{-1}\left(\frac{c}{a}\right)$ for $0^\circ \le x \le 360^\circ$ and where $a, b, c \in \Re$.
	8.4.3	Solve $a\sin bx = c$ using $bx = \sin^{-1}\left(\frac{c}{a}\right)$ for $0^\circ \le x \le 360^\circ$ and where $a, b, c \in \Re$.
	8.4.4	Solve $a\cos bx = c$ using $bx = \cos^{-1}\left(\frac{c}{a}\right)$ for $0^\circ \le x \le 360^\circ$ and where $a, b, c \in \Re$.
8.5	**Prove simple identities using** $\sin^2 x + \cos^2 x = 1$, $\frac{\sin x}{\cos x} = \tan x$ **or other given simpler identities such as** $\sec\theta = \frac{1}{\cos\theta}$, $\cos ec\theta = \frac{1}{\sin\theta}$, $\cot\theta = \frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta}$.	
	8.5.1	Apply any of the given identities to show proof or equality by 'manipulating' either or both sides of the equation.
8.6	**Calculate the area of any triangle.**	
	8.6.1	Identify triangle and appropriate formulae to use.
	8.6.2	Equate variables correctly to known and unknown quantities.
	8.6.3	Apply formulae $A = \frac{1}{2}abSinC$ to find the unknown variable.
8.7	**Solve any triangle using the Sine and Cosine Rules.**	
	8.7.1	Identify triangle and appropriate formulae to use.
	8.7.2	Equate variables (formulae) to known and unknown quantities.
	8.7.3	Apply formulae $a^2 = b^2 + c^2 - 2bcCosA$ to find an unknown side.
	8.7.4	Apply formulae: $CosA = \frac{b^2 + c^2 - a^2}{2bc}$ to find an unknown angle.
	8.7.5	Apply formulae $\frac{a}{SinA} = \frac{b}{SinB} = \frac{c}{SinC}$ to find either an unknown side or an unknown angle.
8.8	**Convert to and from radians and degrees.**	
	8.8.1	Identify angle needed and use the appropriate relations: $\pi = 180^\circ; 2\pi = 360^\circ$
	8.8.2	Convert angle size from radians to degrees and vice versa.
8.9	**Calculate the length of an arc of a circle given the angle subtended at the centre and the radius.**	
	8.9.1	Identify the arc of the circle together with the angle subtended at the centre and the radius.
	8.9.2	Use the formulae for the length of an arc of a circle: $S = R\theta$
8.10	**Calculate the angle subtended at the centre given the length of an arc and the radius of the circle.**	
	8.10.1	Identify the angle subtended at the centre, the length of the arc and the radius of the circle.

TOPIC 8: TRIGONOMETRY		
	8.10.2	Identify and apply the formula for finding the length of an arc of a circle: $\theta = \frac{S}{R}$, where θ is measured in radians.
8.11	**Calculate the area of a sector of a circle.**	
	8.11.1	Identify the area of a sector of a circle, the angle subtended at the centre and the radius of the circle.
	8.11.2	Identify and apply the formula for finding the area of a sector of a circle: $A = \frac{1}{2}R^2\theta$
8.12	**Calculate the area of a segment of a circle.**	
	8.12.1	Find area of a segment using the area of a sector of a circle: $A = \frac{1}{2}R^2\theta$
	8.12.2	Verify how the area of the segment of a circle is equal to the area of the sector minus the area of the triangle: Area of the segment = $\frac{1}{2}R^2(\theta - \sin\theta)$
	8.12.3	Calculate the area of a segment of a circle.

ASSESSMENT

In order to be able to assess a wide range of mathematical skills and especially those that are difficult to be effectively assessed by an external examination, a component of school based internal assessment is included in this prescription.

The internal assessment components are aimed at providing students with an opportunity, without the pressures of examination conditions, and with access to resources, to demonstrate their ability to apply their mathematical knowledge and skills in real life situations. This opportunity, will allow them to demonstrate their ability to collect and process information, to make appropriate conclusions from their investigations and justify them, and to communicate their findings in a written and graphical form. Teachers and students are also given opportunities to display creativity and innovation in developing and designing assessment activities as part of the internal assessment tasks.

The programme will be assessed by an external examination at the end of the year, ONE common assessment task (CAT), ONE minor research task and THREE teacher designed tasks (TDT). The weighting ratio will be 70% for the external examination, 10% for the CAT, 10% for the minor project and 10% for the teacher designed tasks (TDTs). This weighting will be applied by SPBEA as part of their standard processing procedures. The CAT will be based on a topic or parts of a topic of the prescription to be selected by SPBEA and announced to the schools before the end of January each year.

It is intended that the objectives assessed by internal assessment methods will not be directly assessed again by the external examination. However, some overlaps may occur where some previously learned skills are used in other topics.

In order for students to qualify for full assessment in this course, it is necessary that they sit the external examination and present works for the internally assessed components.

Assessment Schedule	
	Weight (%)
External Examination	70
Internal Assessments: CAT (10%) Minor Research Task (10%) Teacher Design Tasks (TDT) (10%)	30
TOTAL	**100**

Four aspects of mathematical skills will be assessed by this prescription:

Aspect	Approx Weighting (%)
Mathematical knowledge and skills	25
Information processing	15
Communication of mathematical ideas	10
Applications of mathematics to problem solving	50
TOTAL	**100**

1. External Assessment (70%)

The external Assessment will still be an Examination with a total mark of 120 which is equivalent to 70% of the final mark.

The examination will offer a range of questions in which students will be required to demonstrate their:

- Knowledge of mathematical principles
- Ability to apply their mathematical knowledge to practical situations
- Ability to write correct mathematical statements
- Ability to process information
- Ability to make deductions and draw conclusions

The examination paper will consist of:

Section A (20 Multiple Choice questions worth 1 mark each) 20 marks
Section B (10 Long answer questions worth 10 marks each] 100 marks.

The **approximate weight** of each topic in the examination paper will be as follows:

TOPIC		WEIGHT	
		(%)	(Marks)
1	Algebra	14	24
2	Coordinate Geometry	8	14
3	Sequence and Series	8	14
4	Probability	8	14
6	Graphs and Functions	8	14
7	Calculus	12	20
8	Trigonometry	12	20
TOTAL		**70**	**120**

Questions in the external examination will be designed within a meaningful context that is appropriate to the varied and diversified backgrounds of the students. Contextual questions give students the opportunity to demonstrate their mathematical skills and abilities.

2. Internal Assessment (30%)

2.1 Task 1 : Minor Research Task (10%)

The research task is designed to allow assessment of a student's ability to apply a section of the prescription to a topic of their own choosing without pressured time restriction.

It is anticipated that students take about 10 to 12 hours of class time to complete all aspects of the project. This is equivalent to about two weeks if time allocation for mathematics class is one hour per day. It is important that both teacher and students pay attention to the following elements while carrying out the task.

(i) Structure and design of the research task
(ii) Choosing the topic and framing the hypothesis
(iii) Data collection and data preparation
(iv) Data display and presentation
(v) Data analysis
(vi) Data interpretation
(vii) Presenting findings and drawing conclusions

For (i) and (ii) the teacher is expected to do most of the work and students are expected to carry out (iii) – (vii) on their own.

Guidelines for carrying out the project are presented in Appendix A.

2.2 Common Assessment Task (CAT) (10%)

This will be based on a topic or parts of a topic to be selected by SPBEA. SPBEA will inform schools about the CAT topic before the end of January each year. Details such as completion date, deadline for submission of marks and any other special requirements will also be conveyed to schools before the end of January.

Teachers will be required to administer and mark the CAT under examination conditions. Any breach of regulations by both students and teachers will be treated in a similar manner to a breach of examination regulations.

2.3 Teacher Design Tasks (10%)

These are tasks other than written paper and pen tests. The teacher is required to construct **THREE** tasks with a combined weight of 10%. The tasks should focus on any aspect of mathematics (concept, idea, application, theory, history etc.)

Possible tasks could include:

- Seminar presentation
- Model making
- Poster production
- Speech/verbal presentation/power-point presentation
- Research/biography
- Assignments
- Games/competitions
- Fieldtrip report
- Creative writing (e.g. poem, short essay)
- Skits/action songs/dramatisation/role play
- Activities that demonstrate a mathematical concept or an application of it
- Other tasks planned by the teacher that could be submitted for approval

It is recommended that teachers organise students, either individually or in small groups (2-3 students) to demonstrate or present their activities on a weekly basis during class time.

ADVISORY SECTION

1. Texts and References

Barret, R. ( ), *Form 6 Mathematics Revision*, ESA Publications
Barton, D. and Johnson, W. (1992), *Theta Mathematics*, Longman, Auckland, New Zealand.
Bishop & Wallace, ( ), *Encounters, Books A, B, C and D.*, Longman
Sealy and Agnew, (,) *Senior Mathematics*, Longman
Turner et al, ( ), *Connections*, New House Publishers

APPENDICES

APPENDIX A

1. GUIDELINES TO MANAGING THE MINOR RESEARCH TASK

The intention of this minor research task is to provide students with the opportunity to demonstrate their ability to apply their knowledge and skills in collecting, presenting, analysing and reporting numerical data.

If this assessment method is to have credibility (that is the marks awarded to students are to reflect the quality of the students work, discriminate between different levels of success, and be fair, valid and consistent), the monitoring of the project must be fair, consistent and reliable.

The teacher is expected to provide students with guidance throughout the development and the completion of the project. All development should be carefully monitored to ensure that the final product is the student's own work.

It is recommended that students should not spend too long on this project. Two weeks, or three weeks at the longest, should be allowed for this task.

AIM

For each student to produce a written report about their statistical investigation of a randomly collected sample of 30 numerical items from a population of approximately 200.

OBJECTIVES

Students will:

(i) be responsible for ensuring that timelines and deadlines are adhered to, all paper work are secured and in good condition, and that the work submitted for assessment is their own.

(ii) select a topic to study, formulate a hypothesis, and have the teacher approve both. An example of a hypothesis is ***"The mean height of all Form 3 students in School X is 1.54 metres."*** The activities in the study aim at supporting (proving) or rejecting (disproving) the hypothesis. The teacher is expected to do most of the work in designing the task and in formulating the hypotheses.

(iii) by a due date, submit to the teacher a written statement called Chapter 1, which briefly **describes the task**, **defines the question**, and **outlines how the students will go about selecting their samples**.

(iv) use a random numbers process to select a sample of 30 numerical items from a population of approximately 200. This should be completed within one week after submitting *Chapter 1*.

(v) immediately after selecting the sample, prepare a second written statement called *Chapter 2* which outlines the sample selection process.

(vi) by a due date, submit to the teacher a final written report that contains *Chapter 3*, *Chapter 4* and *References* with the following details:

Chapter 3

- Presentation and display of sample data using appropriate tables and graphs. Use **not more than two** types of graphs to display your data.
- Analysis of data. The following questions should be used to guide the data analysis:
  - What are the measures of central tendency and what do they tell you about the data?
  - What are the measures of the spread of the distribution and what do they tell you about the data?
  - What are the confidence intervals and what are their significance?

Chapter 4

- A well presented summary of findings
- Discussion on the Second Confidence Interval that has been calculated.
- Conclusion relating the findings to the hypothesis.

References

- A list of the sources of information (books, other printed materials, interviews etc.)

- Sign the project register to show that the student has handed in the completed project to the teacher

The teacher will:

- discuss with the students the nature, aims, process, reporting, and assessment of the project.

- give each student a written description of the process for the management of their project which will include the way the teacher will manage the project, all due dates, penalties for late work, and how the project will be assessed.

- approve and keep a register of each student's choice of topic and hypothesis;

- review Chapter 1 and comment about it on the mark sheet which will be attached to it by the teacher;

- review Chapters 1 and 2 and comment on them on the same mark sheet
- sign and date the project register to show that Chapters 1 and 2 have been approved
- mark Chapters 3 and 4 according to the assessment schedule
- take part in any in-school moderation process if it is required
- adjust the marks of the projects if necessary, according to the moderation outcomes
- keep records of the marks obtained by students
- submit students' marks together with a copy of the signed project checklist to the PSSC Coordinator or Principal.
- select six (6) samples for moderation and submit to the PSSC Coordinator. The samples should consist of the two (2) top projects, two (2) middle projects, one from between the top and the middle, and one from between the middle and the lowest project.

APPENDIX B

Achievement Based Assessment Criteria for Marking the Minor Research Task

The project will be marked from three perspectives:

- Information Processing: how the student gathers, manages and analyses the information obtained,
- Communication: how the student explains or represents the facts, the results, and the significance of the findings,
- Numerical Skills: the accuracy with which the student performs the calculations.

Within each perspective a range of marks are available for students to earn. Teachers are encouraged to use the full range of marks available.

The following process for marking a set of projects is recommended:

- Read all the projects completely through, making a subjective assessment of the total worth of the project as you proceed;
- On the basis of this preliminary reading, sort the projects into 4 groups, namely: *very good*, a*bove average*, *below average*, *poor*;
- Mark one randomly selected project from each group;
- Repeat this process until all the projects are marked. As you mark, place the projects in order of merit according to your marking;
- Re-read all projects in merit order, making a subjective assessment on the same basis as for the first reading and comparing the worth of the project relative to those which came before. Adjust your marks to establish relativities between projects as establishing the order of merit.
- Finally, if necessary, interview student(s) whose research tasks or certain aspects of their tasks need to be clarified. This interview should not be used to adjust marks, but to clear up any uncertainties in the teacher's mind about the task, and to ensure that the work handed in is the student's own work.

Information Processing

Gathering and analysing information or data

Marks	Achievement Criteria	Assessment Schedule
5	Gathers some relevant information	Presents an incomplete report which indicates the use of an appropriate method for gathering data
10	Gathers some relevant information and assembles it systematically	Presents an incomplete report which indicates the use of an appropriate method for gathering data and which displays the data in a systematic and appropriate manner
15	Gathers relevant information, assembles it systematically and analyses it.	Presents a complete report which meets all the deadlines for the survey, indicates the use of an appropriate method for gathering and displaying data, and in which the appropriated calculations are performed.
20	Assembles and analyses relevant information and draws a valid conclusion	Presents a complete report which meets all the deadlines for the survey, and from the results of the data analysis draws a valid conclusion in response to the question behind the survey
25	Assembles and analyses relevant information, draws a valid conclusion or conclusions and evaluates findings	Presents a complete report which meets all the deadlines for the survey, draws a valid conclusion in response to the question, and includes a searching through, and evaluation of the process and its relevance to the original question

Communication

Expressing mathematics in written or oral form, using symbols, graphs, diagrams etc. Recognition will be given to presentation which enhances the visual impression of the report.

Marks	Achievement Criteria	Assessment Schedule
4	Attempts to communicate mathematical ideas	Presents a report with some written commentary
8	Communicates mathematical ideas	Presents a report which explains the process used to conduct the survey
12	Communicates linked mathematical ideas	Presents a report which appropriately conveys reasoned views on the outcome of the survey relative to the hypothesis.
16	Communicates linked mathematical ideas logically and clearly	Presents a completed report which relates each chapter to the question asked, which supports the conclusion by the use of appropriate graphs and/or diagrams, and which links the conclusion back to the hypothesis
20	Communicates complete mathematical arguments logically and in an appropriate style	Presents a report which leaves the reader in no doubt that the conclusion is the most appropriate one for the data collected. The argument is to be cogent, reasoned, supported by clear and appropriate graphs and/or diagrams, and the whole is presented as a logical package linked to the hypothesis.

Numerical Skills

Applying the correct mathematical technique as required, and calculating outcomes accurately.

Marks	Achievement Criteria	Assessment Schedule
3	Attempts to calculate statistics appropriately	Some calculations are made, but not all the appropriate formulae are used.
6	Calculates some statistics appropriately	Some calculations are made using most of the appropriate formulae, but not all calculations are performed correctly.
9	Calculate statistics appropriately and with a measure of success	All formulae are applied appropriately, but not all are calculated correctly.
12	Correctly calculates all statistics	All formulae are applied appropriately, all calculations are correct, but not all results are related back correctly to the hypothesis
15	Correctly calculates all statistics, and correctly interprets the results of their calculations in relation to the hypothesis	All formulae are used appropriately, all calculations are correct, and the interpretations of the results are correctly related back to the hypothesis.

Moderation of Minor Research Task Marks

Within-school moderation

Where a school has more than one class, taught by more than one teacher, there will need to be a system in place to ensure that all teachers mark the projects consistently. This process should be straight forward, but should include:

- a meeting before the process begins to share and bring closer together markers views on the interpretation of the marking schedules,
- the marking of common projects (say 3 per 30 students) by all teachers. The marks are then compared and teachers adjust their judgements accordingly for consistency.
- a check marking process where one teacher is elected to check mark a sample of projects, say at a rate of 3 per 30 students,
- a meeting after the process to discuss any situations which may have arisen during the marking and to make any adjustments to the marks.

Between-country moderation

Upon completion of the within-school moderations, representative samples will be selected by the moderation leader and sent to SPBEA for a between-country moderation by an external moderator.

The external moderator will advise moderation leaders if any mark ranges within national distributions need adjusting.

If any mark adjustments need to be made, schools in that country will be advised by SPBEA of the size of the adjustments to be made.

If no mark adjustments are required, schools will be advised to retain the marks approved during the within-country moderation.

Submission of IA marks to SPBEA

Every school will send all its IA marks to reach SPBEA by the dates specified from SPBEA.

Every school will forward the six (6) samples for moderation together with a copy of the mark sheet to the PSSC coordinator.

Checklist for the Management of the Minor Research Task

To be signed and returned to SPBEA when the raw marks are submitted.

SCHOOL:_____

COUNTRY:_____

DATE:_____

Steps taken	Date completed Signature of teacher
Instruction sheet outlining project and including due dates given to all students	
All students given advice, and each has chosen a suitable topic	
Chapter 1 monitoring completed	
Chapter 2 monitoring completed	
Completed tasks marked according to the scheme	
Within-school moderation of marking (if required) carried out	
Student interviews completed	
Student mark verification sheets signed	

All tasks have been carried out in accordance with the spirit of the Teachers Manual.

SIGNED:_____

POSITION IN SCHOOL:_____

Minor Research Task Student Mark Sheet

STUDENT:_____ **TEACHER:**_____

TITLE of TASK:_____

_____

HYPOTHESIS:_____

_____

CHAPTER ONE: The Topic Due Date: _____

Was this chapter completed on time? Yes/No
Is the data to be collected numeric? Yes/No
Is the process to collect the data well described? Yes/No
Is the process manageable? Yes/No
Comments:_____

_____

CHAPTER TWO: Random Sampling and data collection Due Date: _____

Was this chapter completed on time? Yes/No
Description of sampling procedure? Yes/No
Random number table included? Yes/No
Description of the field work done? Yes/No
List of data collected? Yes/No
Comments:_____

_____

CHAPTER THREE: Numerical processing of data Due Date: _____

Was this chapter completed on time? Yes/No
Presentation including completeness
Graphs? Yes/No
Accuracy of calculations
Explanations? Yes/No
Comments:_____

_____

CHAPTER FOUR: Conclusions Due Date: _____

Calculation of the C.I.
Explanation of C.I. as it applies to this project
Accuracy of evaluations
Validity of conclusions
Comments:_____

_____

MARK ACCOUNTING:

Information processing	_____	out of 25	= _____
Communication	_____	out of 20	= _____
Numerical skills	_____	out of 15	= _____
		Total out of 60	= _____

Record of Student Minor Research Tasks

Entries should be by date and signature. An example is shown in the first line of the table.

Student	Task Title/Date	Ch 1	CH 2	CH 3 & 4	Raw mark/60	Moderated mark	All completed
Paula Tooti 6RU	Heights of secondary school students. Is the mean over 1.54 m?				45	43	

PSSC MATHEMATICS

Task Outline Form : Minor Research Task

Year: _____

School: _____ Country: _____

(a) Brief description of aim of task.

(b) Brief description of activities:

(c) Expected outcomes of activities:

(d) List of possible areas/topics

PSSC MATHEMATICS

Task Outline Form : Teacher Design Task

Year: _____

School: _____ Country: _____

Task No. _____ Title of Task: _____

(a) Brief description of task (aim, duration, structure etc.)

(b) Description of activities

(c) Expected outcomes of activities

Pacific Senior Secondary Certificate

MATHEMATICS

Internal Assessment Programme Summary Form

Country: _____ **School:** _____

TASK	Start Date	End Date	Total Mark	Total Weight	
A. CAT			**20**	**10%**	
B. MINOR RESEARCH TASK:					
Chapter 1.Design and Hypothesis			**60**	**10%**	
Chapter 2.Sampling and data collection					
Chapter 3. Data analysis					
Chapter 4.Data interpretation, making inferences and drawing conclusions					
C. Teacher Design Tasks (TDT)					
1.			**60**		**10%**
2.					
3.					

Notes:

1. Unless otherwise stated, task outlines for all tasks must be submitted together with this completed IA Summary Form
2. For Teacher Design Tasks (TDT) select THREE tasks with a combined total mark of 60 and combined total weight of 10%. Teachers are expected to devise their own marking schemes for these tasks.

Teacher's Name: _____

Teacher's Signature: _____ **Date:** _____

Principal's Name: _____

Principal's Signature: _____ **Date:** _____

MAT 1

PSSC Mathematics

IA MARK CAPTURE FORM

(Minor Research Task)

School: _____

Student Identification		**Total Teacher Mark (Out of 60)**	**COMMENTS**
Name	**SPIN**		
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			

MAT 2

PSSC Mathematics

IA MARK CAPTURE FORM

(Teacher Design Tasks)

School: _____

Student Identification		**Total Teacher Mark** **(Out of 60)**	**Comments**
Name	**SPIN**		
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			