Pacific Community
Communauté du Pacifique

South Pacific Form Seven Certificate

MATHEMATICS WITH STATISTICS SYLLABUS

2023

EQAP

GENERAL INFORMATION

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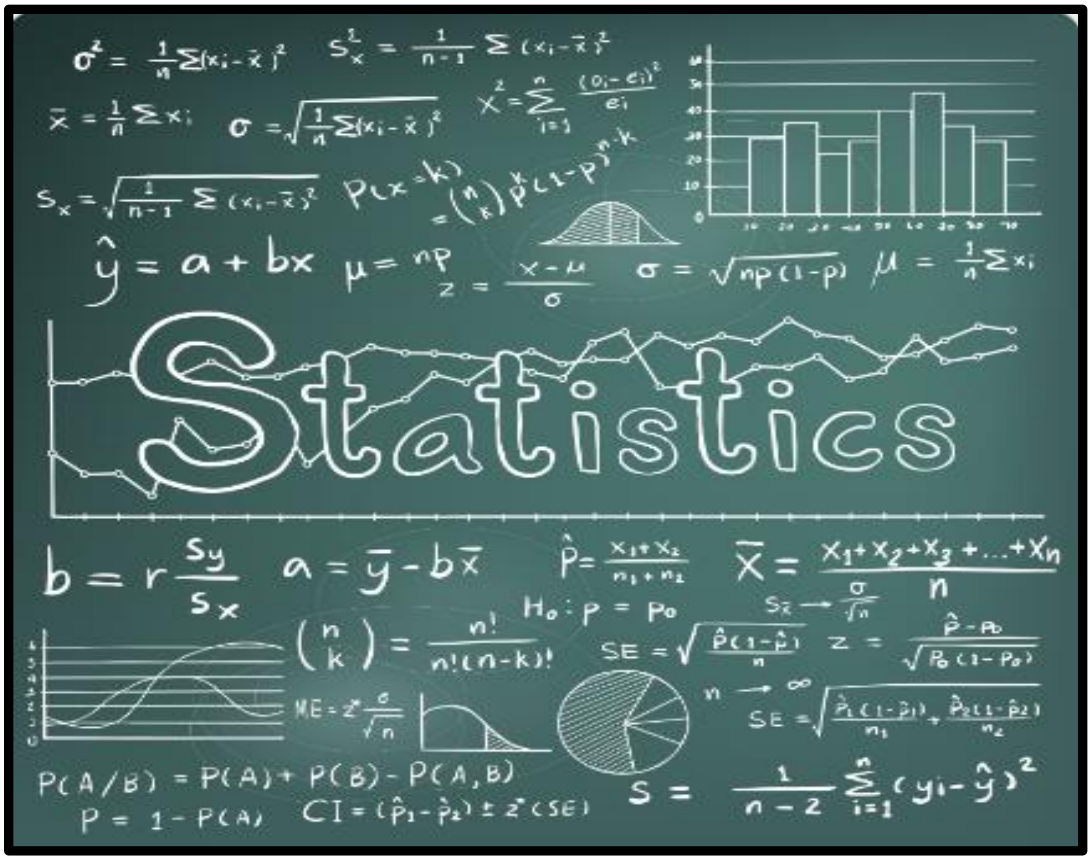
SOUTH PACIFIC FORM SEVEN CERTIFICATE
MATHEMATICS with STATISTICS

Contents



1.0 PREAMBLE AND RATIONALE

The SPFSC Mathematics with Statistics course has undergone a review and realignment. Three main factors that contributed to this review include:

1. The need to consider international trends in the teaching of Statistics and the subsequent expectations of universities in the Pacific region and internationally on what statistical understanding students should possess.
2. The need to raise student achievement by "doing less, but doing it better", which reflects another international trend in education.
3. The influence of changes in technology on the curriculum content.
4. The need for constructive alignment between the intentions and results of teaching and learning.

The main changes made to the syllabus include:

- The introduction of the analysis of bivariate data. It is considered that this is an important skill for further study at university across many fields.
- A focus on understanding and using the statistical investigation process in its complete form, as opposed to assessing small parts of it in isolation. This is in alignment with international trends and the need to have students who are more data literate.
- The introduction of three compulsory internal statistical investigations to acknowledge the three different data analysis methods: Bivariate analysis; Time series analysis; and making inferences to compare two populations. Again, this is to help develop more data literate students.
- A focus on using methods to model situations and to solve problems rather than looking at sub-skills in isolation. This is in alignment with international trends.
- The removal of the Calculus Strand to allow time for a more in-depth study of other topics. It was considered that those students who needed Calculus as a future pathway would need to enter the Mathematics in Calculus course anyway.
- The removal of the Time-Series Sub-Strand which can be pursued at higher levels when students go up to University. The content is too heavy for teachers to teach, and the removal of this Sub-strand should allow teachers to invest more time developing students' skills in other strands.
- The removal of the Sequences and Series topic was to allow time for more in-depth study of other topics. It was considered that much of the content was a repetition of what was covered in the national Year 12 syllabus and provided no future pathways for student enrolled in this course.
- The removal of binomial expansions through the use of the Binomial Theorem. It was considered that this aspect was no longer relevant in the context of this course and that a focus on permutations and combinations in the context of Probability was more suitable.
- The removal of approximating probability distributions and the introduction of combining probability distributions instead. With the changes in technology, approximating distributions has less relevance, whereas the ability to deal with more complex probability situations is now seen as being of importance.

- The inclusion of clear learning outcomes at different levels of generality (Major Learning Outcomes, Key Learning Outcomes, Specific Learning Outcomes)

The course content was then reorganised under four specific learning objectives, and assessment weightings were allocated to each objective based on teaching and learning time (including time needed for both formative and summative assessment). This, along with the change of emphasis towards understanding and using the statistical investigation process in its completeness, has led to a change in the internal and external assessment weightings.

2.0 COURSE AIM

The aim for this course is for students to realise the importance of Statistics and Modelling as a means for understanding what is happening in the real world.

3.0 PREREQUISITES

This aligned syllabus defines the requirements for the South Pacific Form Seven Certificate Mathematics (with Statistics) program in terms of unpacked learning outcomes, external examination, and internal assessment requirements.

Students also require knowledge and understanding of outcomes from the national Year 12 Mathematics syllabus, which are related to the specific outcomes of this syllabus.

The course is designed for students who may undertake further studies in a tertiary institution as well as for those students who will complete their formal education at the end of Year 13.

4.0 GENERAL OBJECTIVES

Students will be expected to:

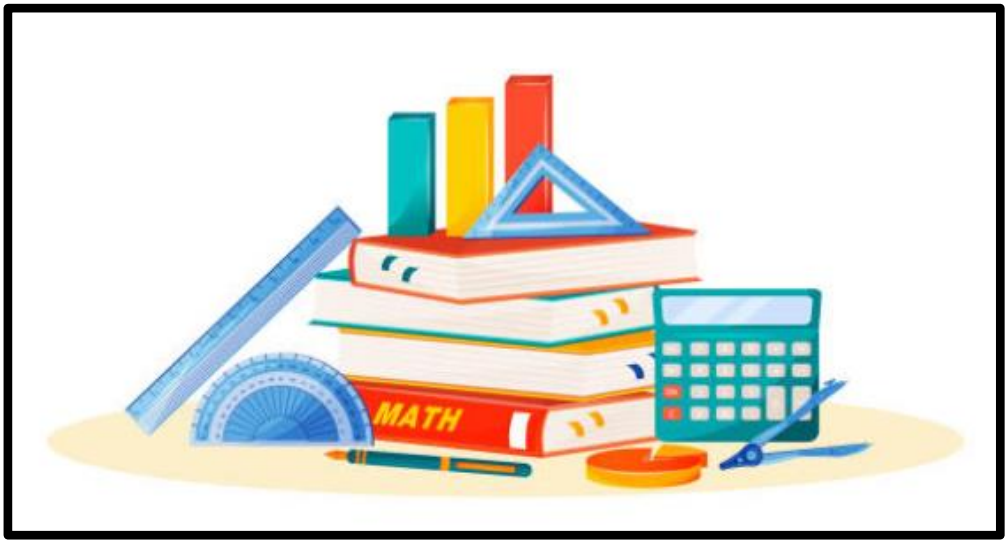
1. develop knowledge and skills related to Probability in order to solve problems and to investigate situations involving elements of chance.
2. model situations using graphical methods in order to solve problems
3. carry out statistical investigations and understand statistical processes.
4. use numeric and algebraic methods to solve problems

5.0 CONTENT COMPONENTS

The content of the SPFSC Mathematics with Statistics course is organised under four Strands and a number of Sub-Strands under each Strand. These are outlined below:

STRAND NUMBER	MAJOR LEARNING OUTCOME	SUB STRAND NUMBER	KEY LEARNING OUTCOME
1.	**Strand 1: Probability** *Students are able to demonstrate knowledge application and critical evaluation* to solve problems and to investigate situations related to Probability involving elements of chance.	1.1	**Probability** *Students are able to demonstrate knowledge and critical evaluation of probability problems.*
		1.2	**Discreet Probability Distribution** *Students are able to demonstrate knowledge and critical evaluation of problems involving expected values and variance of random variables from a discrete probability distribution.*
		1.3	**Probability Distribution** *Students are able to demonstrate knowledge and critical evaluation of using appropriate probability distributions to model a given situation and solve problems*
2.	**Strand 2: Modelling using Graphical Methods** *Students are able to demonstrate knowledge and critical evaluation of* models that show situations using graphical methods in order to solve problems.	2.1	**Piecewise Function** *Students are able to demonstrate knowledge and critical evaluation of simple piecewise functions in order to model data.*
		2.2	**Power & Exponential Functions** *Students are able to demonstrate knowledge application and critical evaluation of models that show real data using power and exponential functions in order to solve problems.*
		2.3	**Linear Programming** *Students are able to demonstrate knowledge application and critical evaluation of situations that model linear programming techniques to obtain optimal solution.*
3.	**Strand 3 : Statistical Investigations**	3.1	**Bivariate Data** *Students are able to demonstrate knowledge application and critical evaluation of*

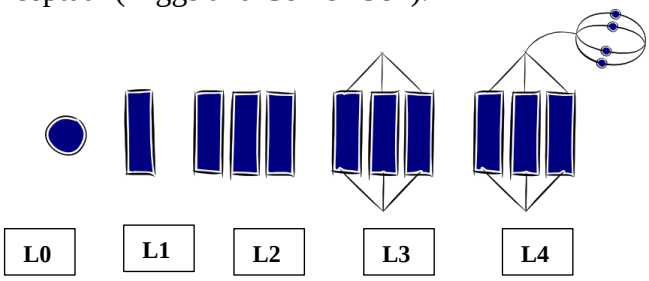
	Students are able to demonstrate knowledge application and critical evaluation of statistical. investigations and understand statistical processes		*statistical processes used to undertake an investigation of bivariate data.*
		3.2	**Comparing Two Populations** *Students are able to demonstrate knowledge application and critical evaluation of statistical processes by undertaking an investigation of numerical data in order to make a comparison between two populations.*
		3.3	**Statistical Processes** *Students are able to demonstrate knowledge application and critically evaluate questions related to statistical processes.*
4.	Strand 4: **Numerical and Algebraic Methods** *Students are able to demonstrate knowledge application and critical evaluation of the use of numeric and algebraic methods to solve problems.*	4.1	**Linear Equations** *Students are able to demonstrate knowledge application and critical evaluation of systems of 3 x 3 linear equations; Interpret solutions to linear systems of equations; Solve problems that can be modelled by systems of linear equations.*
		4.2	**Non-Linear Equations** *Students are able to demonstrate knowledge application and critical evaluation of the use of Bisection method or Newton-Raphson or Secant method to solve non-linear equations to a given precision.*



6.0 UNPACKING LEARNING OUTCOMES

In this syllabus, Learning Outcomes are stated at three levels of generality: Major Learning Outcomes (MLOs) are stated at the strand level, Key Learning Outcomes (KLOs) are stated at the sub-strand level, and Specific Learning Outcomes (SLOs) are unpacked from the Key Learning Outcomes. Each SLO is generally a combination of a cognitive skill and a specific content component. Each SLO is given a skill level, level 1 – 4, and this skill level results from the categorisation of the cognitive skill that is embedded in the SLO using the SOLO taxonomy[1].

The SOLO taxonomy provides a simple, reliable and robust model for three levels of understanding – surface, deep and conceptual (Biggs and Collis 1982).



At the **Prestructural** level (L0) of understanding, the task is inappropriately attacked, and the student has missed the point or needs help to start. The next two levels, Unistructural and Multistructural are associated with bringing in information (surface understanding). At the **Unistructural** level (L1), one aspect of the task is picked up, and student understanding is disconnected and limited. The jump to the Multistructural level is quantitative. At the **Multistructural** level (L2), several aspects of the task are known but their relationships to each other and the whole are missed. The progression to relational and extended abstract outcomes is qualitative. At the **Relational** level (L3), the aspects are linked and integrated, and contribute to a deeper and more coherent understanding of the whole. At the **Extended Abstract** level (L4), the new understanding at the relational level is re-thought at another conceptual level, looked at in a new way, and used as the basis for prediction, generalisation, reflection, or creation of new understanding (adapted from Hook and Mills 2011). [http://pamhook.com/solo-taxonomy/]

The progression from Level 1 to Level 4 is exemplified in the progression from *define* →*describe* → *explain* → *discuss* with each succeeding level indicating a *higher level of understanding,* as follows:

• **define** – to state a basic definition of a concept [Unistructural or L1] • **describe** – to give the characteristics of, or give an account of, or provide annotated diagrams. [Multistructural or L2]
• **explain** – to provide a reason for a relationship – an event and its impact, a cause and an effect, as to *how* or *why* something occurs. [Relational or L3]
• **discuss** – this means *linking ideas* (descriptions, explanations) to make generalisations or predictions or evaluations. It may involve relating, comparing, analysing, and justifying.
• **solve/calculate/compute** – to carry out a series of algorithms to arrive at a solution [Multistructural (L2) or Relational (L3) or even Extended (L4) depending on the complexity of the algorithm]. If there are two 'loadings' in the calculations (a standard problem) then skill level would be L2, if three 'loadings' (a complex problem) then L3 and four loadings (a more complex problem) for L4.

[1] Structure of Observed Learning Outcomes by Biggs and Collis (1982)

7.0 STRANDS, SUBSTRANDS, AND LEARNING OUTCOMES

STRAND 1: PROBABILITY

Major Learning Outcome
Students are able to demonstrate knowledge application and critical evaluation to solve problems and to investigate situations related to Probability involving elements of chance.

Sub strand 1.1: Probability (EA)

Key Learning Outcome
Probability *Students are able to demonstrate knowledge and critical evaluation of probability problems.*

	Specific Learning Outcomes (SLO): Students are able to	**Skill level**	**SLO code**
1.	**identify** an event in a given context.	1	Sta1.1.1.1
2.	**identify** a mutually exclusive / complementary / independent / inclusive / conditional event within a context.	1	Sta1.1.1.2
3.	**compute** probability of an event.	2	Sta1.1.2.1
4.	**solve** mutually exclusive/ independent /complementary/conditional event problems where probabilities are known.	2	Sta1.1.2.2
5.	**solve** standard problems using tree diagrams techniques.	2	Sta1.1.2.3
6.	**solve** simple permutations/combination problems.	2	Sta1.1.2.4
7.	**solve** standard probability of inclusive events (both conditions are true).	2	Sta1.1.2.5
8.	**determine** the probability of complements of events.	2	Sta1.1.2.6
9.	**solve** mutually exclusive /independent/complementary/conditional events problems where probabilities have to be calculated.	3	Sta1.1.3.1
10.	**solve** complex problems using tree diagrams/Venn diagram techniques.	3	Sta1.1.3.2
11.	**solve** complex problems using *tables of counts* and relative frequencies techniques / theoretical and experimental probability techniques.	3	Sta1.1.3.3
12.	**solve** complex problems using permutations/combinations techniques. e.g. The selection or arrangement of numbers is for a double digit number. (How many 2-digit numbers can be written from 4567 without repeating a number?)	3	Sta1.1.3.4
13.	**Calculate** probabilities of complementary / mutually exclusive/independent events given as word problems where other probabilities have to be calculated first.	4	Sta1.1.4.1
14.	**Calculate** probabilities of conditional/combined event given as word problems.	4	Sta1.1.4.2
15.	**Calculate** probabilities using tree diagrams/Venn diagrams techniques expressed as word problems.	4	Sta1.1.4.3

	Specific Learning Outcomes (SLO): Students are able to	Skill level	SLO code
16.	**solve** more complex problems using permutations/combinations techniques. - The selection or arrangement of numbers is for a three digit number. (How many 3-digit numbers can be written from 4567 without repeating a number?)	4	Sta1.1.4.4

Sub strand 1.2: Discrete Probability Distribution (EA)

Key Learning Outcome
Discreet Probability Distribution *Students are able to demonstrate knowledge and critical evaluation of problems involving expected values and variance of random variables from a discrete probability distribution.*

	Specific Learning Outcomes (SLO): Students are able to	Skill level	SLO code
1.	**define** random variable within a given context.	1	Sta1.2.1.1
2.	**define** standard deviation within a given context.	1	Sta1.2.1.2
3.	**define** probability distribution within a given context.	1	Sta1.2.1.3
4.	**calculate** the expected value of discrete random variables in a simple problem.	2	Sta1.2.2.1
5.	**calculate** the standard deviation of discrete random variables in a simple problem.	2	Sta1.2.2.2
6.	**calculate** the expected value of linear functions of random variables in a simple problem.	2	Sta1.2.2.3
7.	**calculate** the variance of linear functions of random variables in a simple problem. - Data is already small and sorted, and the mean is already calculated. - Can be solved just by substituting values in a formula. $\sigma^2 = \sqrt{npq}$ - $\sigma^2 = \frac{\sum(x-\bar{x})^2}{n-1}$ where the mean is already given.	2	Sta1.2.2.4
8.	**calculate** the expected value of sums of independent random variables in a simple problem. -	2	Sta1.2.2.5
9.	**calculate** the variance of sums of independent random variables in a simple problem.	2	Sta1.2.2.6
10.	**calculate** and interpret the expected value of discrete random variables in a complex problem.	3	Sta1.2.3.1

	Specific Learning Outcomes (SLO): Students are able to	Skill level	SLO code
11.	**calculate and interpret** the variance of discrete random variables in a complex problem. - The data is arranged and sequenced in a table. Mean is not calculated. - If a formula is used, a variable in the formula must be worked out first. $\sigma^2 = \sqrt{npq}$ Either p or q is not given $\sigma^2 = \frac{\sum(x-\bar{x})^2}{n-1}$ where the mean needs to be calculated.	3	Sta1.2.3.2
12.	**calculate and interpret** the standard deviation of discrete random variables in a complex problem.	3	Sta1.2.3.3
13.	**calculate** and interpret the variance or standard deviation of discrete random variables given as word problems. - The raw data in the word problem is random from a case-study or adopted from a Report. Needs to be arranged and sequenced in a table. - Then the average $\bar{x}$ must be calculated, - columns must be filled in for $(x - \bar{x})$, $(x - \bar{x})^2$, etc. - before using the formula.	4	Sta1.2.4.1

Explanatory Notes

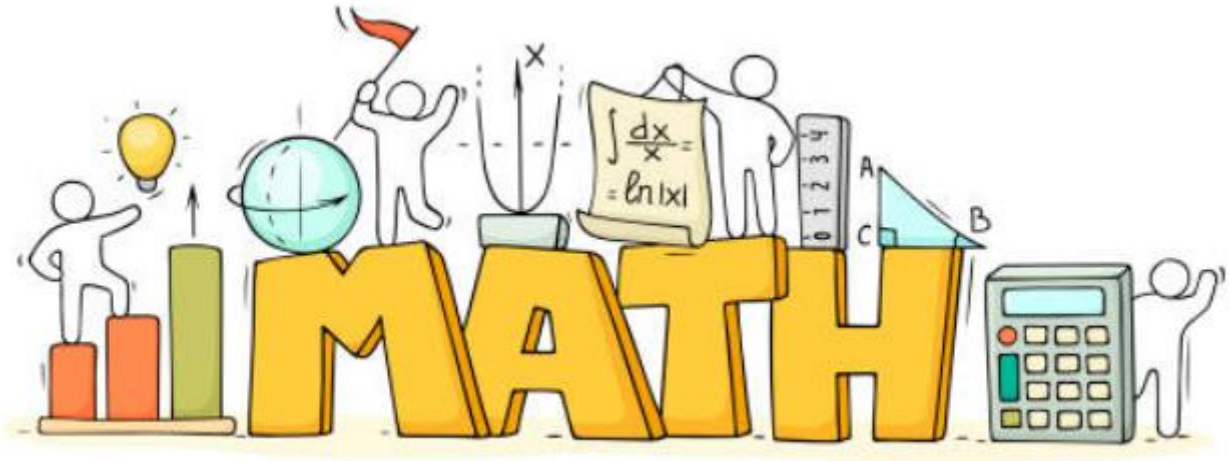
Note: The random variables could come from both given probability distributions and ones that can be developed from tree diagrams.

Sub strand 1.3: Probability Distribution (EA)

Key Learning Outcome
Probability Distribution *Students are able to demonstrate knowledge and critical evaluation of using appropriate probability distributions to model a given situation and solve problems*

	Specific Learning Outcomes (SLO): Students are able to	Skill level	SLO code
1.	**identify** properties of a binomial distribution /Poisson distribution within a given context	1	Sta1.3.1.1
2.	**state** the properties of a normal distribution within a given context.	1	Sta1.3.1.2
3.	**compute** parameters [*n, p*] of a binomial distribution.	2	Sta1.3.2.1
4.	**solve** problems involving number of events using binomial distribution.	2	Sta1.3.2.2
5.	**solve** simple problems involving probabilities using binomial distribution. [*Includes Probability of ONE event only. Probability can be read from the table or calculated using the formula. (Doesn't involve adding or subtraction of probabilities*)	2	Sta1.3.2.3
6.	**compute** probabilities associated with a Poisson distribution over a fixed time interval.	2	Sta1.3.2.4

	Specific Learning Outcomes (SLO): Students are able to	Skill level	SLO code
7.	**calculate** parameters [n,μ,σ] for a normal distribution.	2	Sta1.3.2.5
8.	**compute** probabilities associated with standard normal distribution.	2	Sta1.3.2.6
9.	**compute** probabilities associated with normal distribution. [*The probability calculated involves the mean on the normal curve. There is no subtraction/or addition of probabilities on the curve (no less than/ greater than or between). Can involve probably, very probably and almost certainly epochs.]*	2	Sta1.3.2.7
10.	**calculate** probabilities using formulae and tables.	2	Sta1.3.2.8
11.	**solve** complex problems using binomial distribution. [*Probability can be read from the table or calculated using the formula, but it involves adding more than one probability/sum of two - four probabilities*.]	3	Sta1.3.3.1
12.	**calculate** parameter [λ] for a complex Poisson distribution.	3	Sta1.3.3.2
13.	**solve** problems using Poisson distribution over a varying time interval.	3	Sta1.3.3.3
14.	**solve** complex problems using normal distribution. *[The probability (or percentage) calculated is either **greater than** or **less than** a value on a normal curve. Expected number is not embedded in the question.]*	3	Sta1.3.3.4
15.	**solve** inverse normal type problems.	3	Sta1.3.3.5
16.	**solve** problems involving sum and difference of independent normal distribution random variables.	3	Sta1.3.3.6
17.	**model** problems using binomial distribution. [*Use a real-life situation that has a probability that exceeds 50%. All tables for binomial distribution cannot exceed 50% so there has to be an additional load of adding probabilities from the terminal end on the table.*]	4	Sta1.3.4.1
18.	**model** problems in a real-life situation using Poisson distribution over a fixed/varying time interval.	4	Sta1.3.4.2
19.	**model** problems using normal distribution. [*The probability calculated is **between** two values on the normal curve. **Expected number** is included as part of the question.]*	4	Sta1.3.4.3
20.	**solve** problems involving combined distributions. [*Example, a two-step problem requiring first a normal distribution calculation and then a binomial distribution calculation*].	4	Sta1.3.4.4



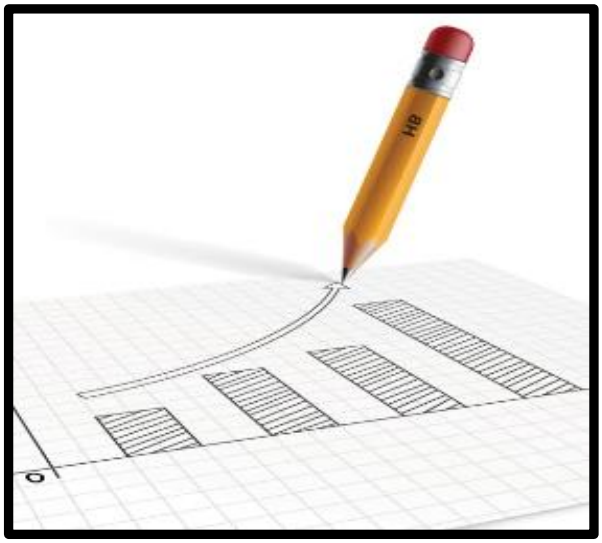
STRAND 2: MODELLING USING GRAPHICAL METHODS

Major Learning Outcome
Students are able to demonstrate knowledge and critical evaluation of models that show situations using graphical methods in order to solve problems.

Sub strand 2.1: Piecewise Function (EA)

Key Learning Outcome
Piecewise Function *Students are able to demonstrate knowledge and critical evaluation of simple piecewise functions in order to model data.*

	Specific Learning Outcomes (SLO)*:* Students are able to	**Skill level**	**SLO code**
1.	**define** discontinuous function.	1	Sta2.1.1.1
2.	**state** properties of a discontinuous function.	1	Sta2.1.1.2
3.	**interpret** piecewise functions which have components that are linear and quadratic.	2	Sta2.1.2.1
4.	**list** values from graphs of a piecewise / discontinuous function.	2	Sta2.1.2.2
5.	**sketch** simple piecewise functions (involving linear functions).	3	Sta2.1.3.1
6.	**generate** equations from graphs of simple piecewise functions.	3	Sta2.1.3.2
7.	**choose** values from graphs of piecewise functions (including non-differentiability, discontinuity)	3	Sta2.1.3.3
8.	**sketch** complex piecewise functions (involving linear and quadratic functions).	4	Sta2.1.4.1
9.	**formulate** equations from graphs or word problems of complex piecewise functions.	4	Sta2.1.4.2
10.	**model** real life problems using piecewise functions	4	Sta2.1.4.3



Sub strand 2.2: Power & Exponential Functions (EA)

Key Learning Outcome
Power & Exponential Functions *Students are able to demonstrate knowledge application and critical evaluation of models that show real data using power and exponential functions in order to solve problems.*

	Specific Learning Outcomes (SLO): Students are able to	**Skill level**	**SLO code**
1.	**draw** graphs of power / exponential functions	1	Sta2.2.1.1
2.	**solve** simple power/exponential equations.	2	Sta2.2.2.1
3.	**use** log / natural log to calculate values of unknowns.	2	Sta2.2.2.2
4.	**show** that variables are related by a power law / exponential law [Level 3 example to be given]	3	Sta2.2.3.1
5.	**draw** graphs of hyperbolic functions. [Level 2 example to be given]	3	Sta2.2.3.3
6.	**use** log-log technique to transform variables to relate power functions of the form $y = ax^n$ (where ^{n} is a positive integer) to model simple real data.	3	Sta2.2.3.4
7.	**use** semi-log technique to transform variables to relate exponential (index) functions of the form $y= am^x$ (where m can be any base) or $y=Ae^{kx}$ to model real data.	3	Sta2.2.3.5
8.	**solve** standard problems using the models. [Example of a standard problem?]	3	Sta2.2.3.6
9.	**Solve** problems by considering limitations of the model visually. [Example??]	3	Sta2.2.3.7
10.	**apply** log-log technique to transform variables to relate power functions of the form $y= ax^n$ (where *n* is a positive integer) to model complex real data.	4	Sta2.2.4.1
11.	**apply** semi-log technique to transform variables to relate exponential (index) functions of the form $y= am^x$ (where m can be any base) or $y=Ae^{kx}$ to model complex real data.	4	Sta2.2.4.2

For longer periods of time, a different but related equation is used. It is derived from the previous equation by calculus. You are not required to know this derivation.

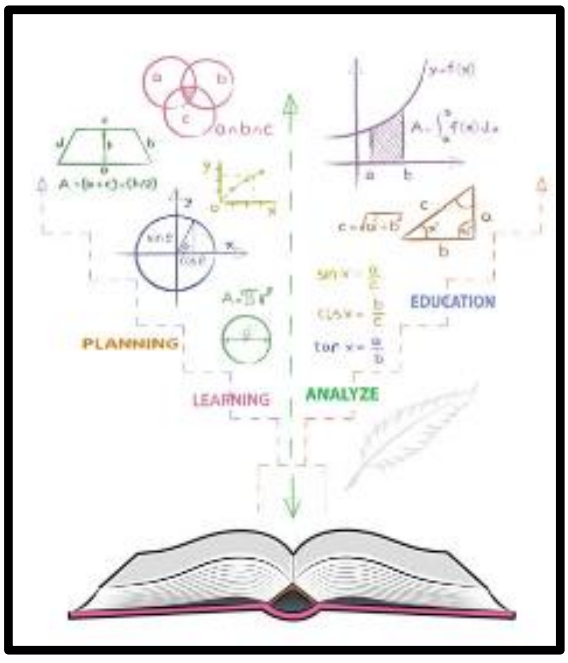
$$N = N_0 e^{-\lambda t}$$

N – number of atoms remaining;
N_0 – original number of atoms.
e – the exponential number = 2.718...
λ – the decay constant (s-1);
t – time (s)

Sub strand 2.3: Linear Programming (EA)

Key Learning Outcome
Linear Programming *Students are able to demonstrate knowledge application and critical evaluation of situations that model linear programming techniques to obtain optimal solution.*

	Specific Learning Outcomes (SLO)*:* Students are able to	**Skill level**	**SLO code**
1.	**identify** regions that are represented by inequations.	1	sta2.3.1.1
2.	**determine** the objective function (function that is to be maximised or minimised) from a problem.	2	sta2.3.2.1
3.	**show** the constraints (the inequations that show the restrictions that must be considered) from a problem (NB: in some cases the constraints may be given).	2	sta2.3.2.2
4.	**compute** the point where the objective function is maximised or minimised to solve the problem, when the points are obvious or stated.	2	sta2.3.2.3
5.	**graph** the constraints to obtain the feasible region and shade the region (shading in or shading out).	3	sta2.3.3.1
6.	**compute** the point where the objective function is maximised or minimised to solve the problem, when three corner points of the feasible region are to be determined first.	3	sta2.3.3.2
7.	**determine** the inequalities given a feasible region (where the feasible region has three corner points).	3	Sta2.3.3.3
8.	**construct** the constraints (the system of inequations that show the restrictions that must be considered) from a complex word problem	4	sta2.3.4.1
9.	**graph** the constraints in a complex problem to obtain the feasible region and shade the region (shading in or shading out).	4	sta2.3.4.2
10.	**derive** the point where the objective function is maximised or minimised to solve the complex problem, where more than three corner points of the feasible region are to be determined first.	4	sta2.3.4.3



STRAND 3: STATISTICAL INVESTIGATIONS

Major Learning Outcome
Students are able to demonstrate knowledge application and critical evaluation of statistical. investigations and understand statistical processes.

Sub strand 3.1: Bivariate Data (IA)

Key Learning Outcome
Bivariate Data *Students are able to demonstrate knowledge application and critical evaluation of statistical processes used to undertake an investigation of bivariate data.*

	Specific Learning Outcomes (SLO)*:* Students are able to	**Skill level**	**SLO code**
1.	**state** the properties of the Pearson's correlation coefficient, **r.**	1	sta3.1.1.1
2.	**state** a purpose for a statistical investigation.	1	sta3.1.1.2
3.	**identify** a sampling method appropriate to the purpose of the investigation.	1	sta3.1.1.3
4.	**identify** the variables of interest for the investigation.	1	Sta3.1.1.4
5.	**identify** the sources of variation in the investigation.	1	Sta3.1.1.5
6.	**describe** the methods of managing variations for best results.	2	Sta3.1.2.1
7.	**describe** the sampling method appropriate for the purpose.	2	sta3.1.2.2
8.	**describe** the data collection procedure.	2	Sta3.1.2.3
9.	**make** statements based on simple data shown on graphs.	2	sta3.1.2.4
10.	**formulate** relationship questions to be investigated.	2	sta3.1.2.5
11.	**describe** variables of interest from a given data set.	2	sta3.1.2.6
12.	**setup** data for the investigation.	2	sta3.1.2.7
13.	**display** collected data in an appropriate format in a recognised data file.	2	sta3.1.2.8
14.	**describe** the trend/strength of relationship in an investigation.	2	sta3.1.2.9
15.	**compile** logically, statistical (bivariate) data, results and conclusion.	2	sta3.1.2.10
16.	**illustrate** collected data as a scatter plot and **draw** the line of best fit using a recognised statistical tool.	3	sta3.1.3.1
17.	**make** concluding statements based on the line of best fit.	3	sta3.1.3.2
18.	**calculate** the Pearson's correlation coefficient, **r** of a given data set and relate to the data set.	3	sta3.1.3.3
19.	**make** concluding statements based on a given value of the Pearson's correlation coefficient, **r**.	2	sta3.1.2.12
20.	**calculate** the equation of line of best fit and relate to the data set;	3	sta3.1.3.4
21.	**discuss** trends and strength of relationship with supporting evidence.	4	sta3.1.4.1
22.	**formulate** conclusions based on the investigative question and supported with evidence.	4	sta3.1.4.2
23.	**evaluate** the strengths and limitations of the investigation design and/or process.	4	Sta3.1.4.3

Sub strand 3.2: Comparing Two Populations (IA)

Key Learning Outcome
Comparing Two Populations *Students are able to demonstrate knowledge application and critical evaluation of statistical processes by undertaking an investigation of numerical data in order to make a comparison between two populations.*

	Specific Learning Outcomes (SLO)*:* Students are able to	**Skill level**	**SLO code**
1.	**define** sample or populations to be studied.	1	sta3.2.1.1
2.	**identify** appropriate sampling method.	1	sta3.2.1.2
3.	**identify** outliers in the sample/population.	1	sta3.2.1.3
4.	**identify** the variable of interest of an investigation (planning).	1	sta3.2.1.4
5.	**identify** the populations to be investigated (planning).	1	sta3.2.1.5
6.	**identify** methods to manage variations.	1	sta3.2.1.6
7.	**state** the different methods of sampling.	1	sta3.2.1.7
8.	**state** a comparison question to be investigated.	1	sta3.2.1.8
9.	**describe** the sampling method used in the investigation.	2	sta3.2.2.1
10.	**plan/describe** methods of collecting and recording data.	2	sta3.2.2.2
11.	**plan/describe** the investigation by identifying the comparison question, variables of interest; the two populations; sources of variation and establishing methods to manage them.	2	sta3.2.2.3
12.	**describe** sources of variation and establishing methods to manage them (e.g. considering outside variables in data collection methods).	2	sta3.2.2.4
13.	**collect** data to be investigated and tabulated appropriately in a recognised statistical application.	2	sta3.2.2.5
14.	**describe** sources of variation on the collected data.	2	sta3.2.2.6
15.	**analyse** the data by summarizing data with statistical measures, using a recognised statistical application.	3	sta3.2.3.1
16.	**draw** and label appropriate graphical displays using a recognised statistical application.	3	sta3.2.3.2
17.	**reflect** on the data patterns and form a hypothesis	3	sta3.2.3.3
18.	**explain** in simple terms why a given sampling method may be unsatisfactory.	3	Sta3.2.3.4
19.	**classify** methods to manage variations (e.g. considering outside variables in data collection methods).	3	sta3.2.3.5
20.	**develop** inferences using confidence interval (difference of two means or proportions).	3	sta3.2.3.6
21.	**discuss** limitations of the investigation with supporting evidence.	4	sta3.2.4.1
22.	**draw** conclusions based on the results of the investigation and support with evidence.	4	sta3.2.4.2

Sub strand 3.3: Statistical Processes (EA)

Key Learning Outcome
Statistical Processes *Students are able to demonstrate knowledge application and critically evaluate questions related to statistical processes.*

	Specific Learning Outcomes (SLO): Students are able to	**Skill level**	**SLO code**
1.	**state** the central limit theorem.	1	sta3.3.1.1
2.	**compute** the margin of error.	2	sta3.3.2.1
3.	**compute** the sample size (n) using the margin of error.	2	sta3.3.2.2
4.	**compute** the point estimate of the population mean/population proportion (sample mean).	2	sta3.3.2.3
5.	**compute** the standard error in a given confidence interval.	2	sta3.3.2.4
6.	**express** the confidence interval in a statement.	3	sta3.3.3.1
7.	**show** how the margin of error changes when certain parameters of the population/sample or confidence interval are altered.	3	sta3.3.3.2
8.	**apply** the central limit theorem to solve problems related to confidence interval.	3	sta3.3.3.3
1.	**apply** point estimates calculations to solve problems related to confidence interval.	3	sta3.3.3.4
2.	**calculate** the 90% / 95% / 99% confidence interval for a population mean.	3	sta3.3.3.5
3.	**calculate** the 90% / 95% / 99% confidence interval for a population proportion.	3	sta3.3.3.6
4.	**compare and contrast** standard error and margin of error.	3	sta3.3.3.7
5.	**express the** impact of the size of the confidence interval on the margin of error.	3	sta3.3.3.8
6.	**calculate** the 90% / 95% / 99% confidence interval for the difference in means.	4	sta3.3.4.1
7.	**calculate** the 90% / 95% / 99% confidence interval for the difference in proportions.	4	sta3.3.4.2
8.	**solve** complex word problems related to confidence interval.	4	sta3.3.4.3
9.	**predict** the effect of the margin of error.	4	sta3.3.4.4
10.	**Calculate and interpret** confidence interval for population means / proportions / difference in means	4	sta3.3.4.5
11.	**evaluate** the validity of claims using confidence interval.	4	sta3.3.4.6

Explanatory Notes

Assessment will involve a selection from:

- performing or commenting on aspects of the processes involved in substrands 3.1, 3.2, 3.3
- understanding the central limit theorem
- calculations related to confidence intervals (mean, proportion, difference of mean, difference of proportion) at the 90%, 95% & 99% level of confidence & interpreting these intervals
- understanding point estimates and sample size (n) using the margin of error
- calculating the *All relevant formula that students will require for calculations indicated in the table of SLOs above are to be provided in the formula sheet as well as part of items in tests and examinations, where necessary.*

STRAND 4: NUMERICAL AND ALGEBRAIC METHODS

Major Learning Outcome
Students are able to demonstrate knowledge application and critical evaluation of the use of numeric and algebraic methods to solve problems.

Sub strand 4.1: Linear Equations (EA)

Key Learning Outcome
Linear Equations *Students are able to demonstrate knowledge application and critical evaluation of systems of 3 x 3 linear equations; Interpret solutions to linear systems of equations; Solve problems that can be modelled by systems of linear equations.*

	Specific Learning Outcomes (SLO): Students are able to	**Skill level**	**SLO code**
1.	**state** the different types of solutions in solving linear equations.	1	sta4.1.1.1
2.	**write** linear systems of equations for a given basic situation.	2	sta4.1.2.1
3.	**solve** simple linear systems of equations for a given situation by elimination/substitution/graphing method.	2	sta4.1.2.2
4.	**describe** the nature of solutions of a linear system of equations.	2	sta4.1.2.3
5.	**determine** the condition for infinitely many solutions to a given set of equations.	2	sta4.1.2.4
6.	**solve** linear systems of equations (use of matrices is accepted).	3	sta4.1.3.1
7.	**write** linear systems of equations for a given complex situation, involving three equations in three variables.	3	sta4.1.3.2
8.	**solve** application word problems by elimination /substitution / graphing method.	3	sta4.1.3.3
9.	**interpret** the nature of solutions of linear system of equation with description.	3	sta4.1.3.4
10.	**solve** 3 x 3 linear system of equation based on real life situations using algebraic method or matrices where three equations are given.	4	sta4.1.4.1

Explanatory Notes

Assessment will focus on using simultaneous equations to solve problems in context:

- solving 3x3 linear systems of equations (use of matrices is accepted).
- forming linear systems of equations for a given situation and solving them in context.
- determining and interpreting the nature of solutions, including
- Unique or dependent solutions
- No solution
- Geometric interpretations

Sub strand 4.2: Non-Linear Equations (EA)

Key Learning Outcome
Non-Linear Equations *Students are able to demonstrate knowledge application and critical evaluation of the use of Bisection method or Newton-Raphson or Secant method to solve non-linear equations to a given precision.*

	Specific Learning Outcomes (SLO): Students are able to	**Skill level**	**SLO code**
1.	**state** the advantage or disadvantage of using the Newton-Raphson/Bisection method.	1	sta4.2.1.1
2.	**determine** the presence of roots of a hyperbolic function between two x values.	2	sta4.2.2.1
3.	**determine** the nature of the roots after using the Newton-Raphson to improve the approximation to a given precision.	2	sta4.2.2.2
4.	**differentiate** power functions in order to use the Newton-Raphson Method.	3	sta4.2.3.1
5.	**use** the Newton-Raphson/Bisection/Secant method to solve the equation f(x).	3	sta4.2.3.2
6.	**solve** a non-linear equation using the Newton-Raphson / Bisection / Secant method with a given starting value.	4	sta4.2.4.1
7.	**apply** a suitable method to find an approximate solution to a non-linear equation.	4	sta4.2.4.2

Explanatory Notes
Assessment will focus on:

- *use of the Newton-Raphson or the Bisection Method or Secant Method (or any two of the three) to improve the approximation to a given precision.*
- *differentiate simple power functions in order to use the Newton-Raphson Method (this involves derivatives of polynomials only. If needed, derivatives of other functions will be given)*

NB: Students will be expected to be familiar with all the three methods (Newton-Raphson, bisection and Secant methods.)

The starting values will be provided.

8.0 ASSESSMENT

Assessment in this Mathematics with Statistics course is in two parts - External Assessment and Internal Assessment. The respective weightings are

1. **External Assessment (EA): 60%**
2. **Internal Assessment (IA) : 40%**

The Principal, or his/her nominee, will certify that the syllabus requirements have been fulfilled.

8.1 Suggested Teaching Time and Weightings

STRAND	EXTERNAL / INTERNAL ASSESSMENT	SUGGESTED TIME ALLOCATION	APPROXIMATE WEIGHTING
1. Strand 1: Probability	*External*	*8 weeks*	*20 %*
2. Strand 2: Modelling Using Graphical Methods	*External*	*5 weeks*	*17 %*
3. Strand 3: Statistical Investigations	*External & Internal*	*12 weeks (4 weeks external / 8 weeks internal)*	*50 % (10% external / 40% internal)*
4. Strand 4: Numerical and Algebraic Methods	*External*	*3 weeks*	*13 %*
Total		*28 weeks*	*100%*

8.2 Assessment Blueprint

Strand	Assessment Type	SKILL LEVEL/ SCORE				
		1	2	3	4	Weight
1. Probability	EA					**20**
2. Modelling using graphical methods	EA					**17**
3. Statistical investigations	EA					**10**
	IA	2	2	2	2	**20**
	IA	2	2	2	2	**20**
4. Numerical and algebraic methods	EA					**13**
Total number of items		**10**	**10**	**10**	**10**	**100**
Total skill score		**10**	**20**	**30**	**40**	

The External Examination will be a **three-hour** written examination and will be out of **60%**. The paper will assess a selection of learning outcomes from all four Strands in the following proportions:

Strand		Total score per section	Suggested Exam Time
1	Probability	20	60 mins
2	Modelling using graphical methods	17	50 mins
3	Statistical investigations	10	30 mins
4	Numerical and algebraic methods	13	40 mins

Learning outcomes that are assessed using Internal Assessment will not be assessed in the External Assessment.

Students would be expected to know, understand, and apply any mathematical skill related to the outcomes. Examination questions, which require specific mathematical knowledge, will be based on the outcomes. However, students can be assessed the same learning outcomes using an unfamiliar context to assess students' application of the mathematical concepts in the real world context.

Emphasis or the number of questions in the examination will reflect the teaching time and weightings allocated to each topic.

A standard list of formulae will be incorporated in the examination paper. Additional formulae may be provided where appropriate. A copy of the formulae list is attached as Appendix 1 in this syllabus.

The use of calculators and computers is an integral part of mathematics. Students will be required to supply their own calculators for use in the examination. The use of calculators during the examination must conform to the EQAP Rules and Procedures governing electronic calculators.

8.3 Internal Assessment

There are two internal assessment tasks, and these include:

Task 1: Statistical Investigations - **Bivariate Project** (20%)

Task 2: Statistical Investigations - **Comparison Project** (20%)

These assessments will complement the written examination. They emphasize those specific outcomes in the syllabus for which assessment by an External Examination is less appropriate, e.g. carrying out statistical investigations.

To meet the internally assessed component requirement, students will carry out two tasks and then submit two pieces of written or word-processed work, reporting on the statistical investigations undertaken. The two investigations to be carried out are briefly described below.

At the beginning of each year, each school presenting students for the South Pacific Form Seven Certificate Mathematics (with Statistics) assessment must complete an Internal Assessment programme proposal and forward to EQAP by the date set down by the Director. The form must clearly indicate the time (start and completion date) each investigation is intended to be undertaken. The Internal Assessment Programme Proposal template is provided as Appendix 3. Teachers are advised to fill in all the required details based on information provided in the syllabus as well as those from their schools and submit the proposal to EQAP by the stipulated due date. Failure of a school to submit an acceptable IA programme proposal will result in possible disqualification of the IA program for that school.

Students should be given ample notification about an Internal Assessment task and ample time to complete the task. It is recommended that students be provided with the scoring rubrics for each task so that they are fully informed of the criteria against which their task responses will be assessed. A sample of candidate responses to all internal assessment tasks undertaken must be available for verification on request until 30 November of the year of the examination.

The moderation of Internal Assessment will be done in accordance with EQAP policy as specified from time to time.

The assessment/scoring schedules for the two IA tasks are included in the next section.

Using statistical tools

The use of an Excel spreadsheet in the investigations to **calculate simple factors like** the **median, mean, standard deviation and variance and for drawing graphs is an expectation for both Tasks 1 and 2**. Students are also encouraged to use other statistical packages that may be available to them.

8.3.1 IA Task 1 - Statistical Investigation using Bivariate data

Instruction to Students:	
The investigation will involve bivariate numerical data:	
1	Develop an investigation topic and research question or questions and verify with the teacher Students are to choose one topic from the list below. Students that chose the same topic can work together however, each student is to submit his or her own report. 1: Relationship between student scores in English and Mathematics in Year 12 examination 2: Relationship between student scores in English and History in Year 12 examination 3: Relationship between student scores in Physics and Mathematics in Year 12 examination 4: Relationship between student scores in Accounting and Mathematics in Year 12 examination 5: Relationship between student scores in Accounting and Economics in Year 12 examination 6: Relationship between student scores in Geography and History in Year 12 examination 7: Relationship between height and weight of students in a class 8. Relationship of the absentee rate between boys and girls in a class.
2	Planning the investigation: based on the relationship questions agreed with the teacher, students are to: • identify the population • identify the variables to be investigated • identify the sources of variation • state a null hypothesis for the relationship • describe methods of managing variation • identify an appropriate sampling method • outline the data collection and recording procedure according to the plan
3	Gathering the data

	• collect and record data • *Note: It is expected that students record data in an Excel file or any other recognised statistical application.* •
4	Analysing the data • plot data as a scatter plot • draw a line of best fit (either using technology or using the method of two medians) • determine the equation of the line of best fit and relate this to the data set. • calculate the Pearson's correlation coefficient, **r** (NB: if students do not have access to computer technology, teachers may need to consider restricting the amount of data that is to be analysed) • *Note: It is expected that students use the functions in Excel or any other recognised statistical application/tool to carry out calculations and draw graphs.*
5	Developing a conclusion • interpret the trend • discuss the strength of the relationship (correlation) • discuss whether the null hypothesis has been proven true or not • write a conclusion summarising the finding (this should answer the investigative question) • discuss the strength of the research. • discuss limitations of the research
6	Write a report on the above.
7	Refer to the scoring rubric when writing the report.

8.3.2 IA Task 2 – Statistical Investigation 2 – Comparison Project

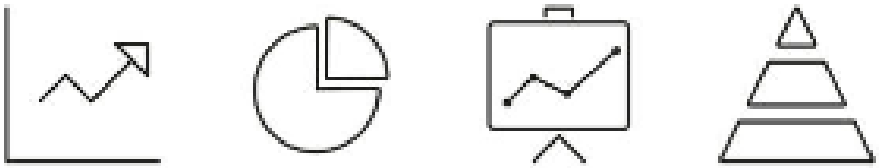
Instruction to Students:	
The investigation will involve:	
1	Posing a comparison question to be investigated
2	Planning the investigation • identify the two populations • identify the variable of interest • identify sources of variation • Describe methods to manage variation (e.g. considering outside variables in data collection method) • choose a sampling method • plan methods of collecting and recording data
3	Gathering the data • collect and record data • manage & sort data • clean data (removal of outliers) • *Note that it is expected that students use Excel or any other recognised statistical application for recording and sorting data*
4	Analysing the data • summarise data with statistical measures • draw appropriate displays • reflect on the distribution • formulate a hypothesis • Note that *Note: It is expected that students use the functions in Excel or any other recognised statistical application/tool to carry out calculations and draw graphs.*
5	Developing a conclusion • interpret data • make inferences using confidence interval (difference of two means or proportions). • relate the findings to the hypothesis • write a conclusion to answer the investigative question • discuss limitations
6	Write a Report on the above.
7	Refer to the scoring rubric when writing the Report

8.4 Scoring Rubrics

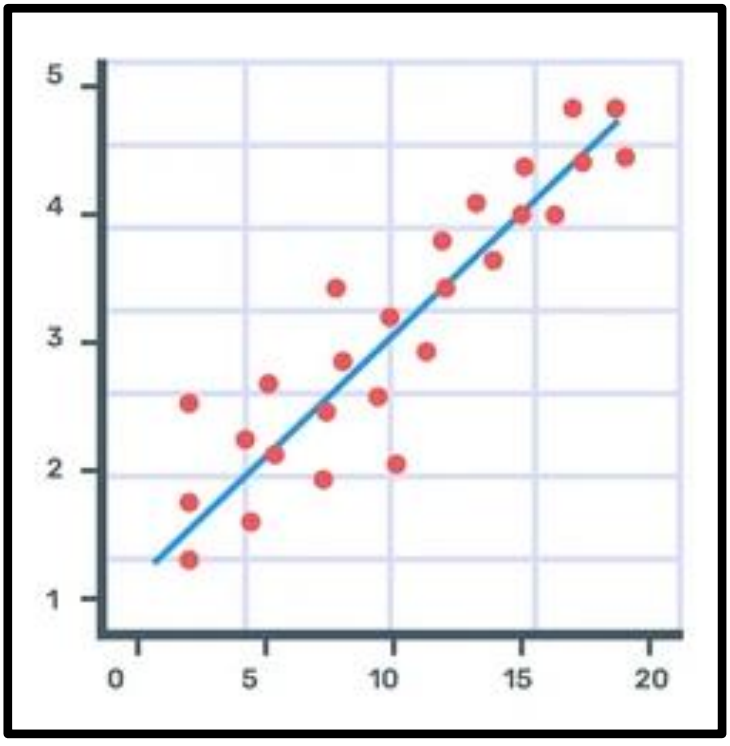
8.4.1 IA Task 1 Scoring Rubric

Statistical Investigation using BIVARIATE data (20%)

ITEM #	SLO CODE	SKILL LEVEL	EVIDENCE	STUDENT RESPONSE LEVEL			
				Level 1	Level 2	Level 3	Level 4
1a	sta3.1.1.2	1	Purpose stated	Purpose of investigation cleary stated.			
1b	Sta3.1.1.4	1	Variables of interest are identified	At least one variable identified			
1c	Sta3.1.2.2	2	Sampling procedure is described	Procedure is partialycorrect	Procedure is fully correct.		
1d	sta3.1.2.7	2	Data combined	Data collected but not clearly recorded	Combined Data, clearly recorded and cleaned (outliers removed)		.
1e	sta3.1.2.8	2	Collected data displayed in an appropriate form	Data collected but not clearly recorded in an appropriate form Statistical tool is used	Combined Data displayed and recorded appropriately Statistical tool is used		
1f	sta3.1.3.1	3	Illustration of Scatter plot is clear, and appropriate with line of best fit drawn	Scatter plot partially correct with no line of best fit or incorrect line of best fit. Statistical tool is used	Scatter plot fully correct with no line or partially correct line of best fit Statistical tool is used	Scatter plot, and appropriate line of best fit are correct and labelled Statistical tool is used	



1g	**Sta3.1.3.4**	3	Equation of the line of the best fit is determined and related to the data set	Equation of line of best fit is partially correct Statistical tool is used	Equation of line of best fit is correctly determined with no relation to the data set Statistical tool is used	Equation of line of best fit is correctly determined and related appropriately to the data set. Statistical tool is used	
1h	**Sta3.1.3.3**	**3**	Pearson's correlation coefficient is calculated and related to the data set Statistical tool is used	Evidence of some calculations shown with incorrect correlation coefficient Statistical tool is used	Correlation coefficient is correct with no relation to the data set Statistical tool is used	Correlation coefficient is correct with relation to the data set Statistical tool is used	
1i	**sta3.1.4.2**	**4**	Clear conclusion supported with evidence.	Incorrect conclusion	Partially correct conclusion with no evidence	Correct conclusion with incorrect evidence	Clear conclusion, with correct evidence in context
1j	**Sta3.1.4.3**	**4**	Strengths and limitations of the investigation design and/or process evaluated	Either strength or limitations identified	Both strength and limitations identified	Both strength and limitations identified and either one of it is evaluated	Both strength and limitations identified and evaluated



8.4.2 IA Task 2 Scoring Rubric

COMPARISON PROJECT (20%)

ITEM #	SLO CODE	SKILL LEVEL	EVIDENCE	STUDENT RESPONSE LEVEL			
				Level 1	Level 2	Level 3	Level 4
3a	sta3.2.1.8	1	Comparison question clearly stated	Question clearly stated			
3b	Sta3.2.1.5	1	The two populations under study are named	Populations are named correctly			
3c	sta3.2.2.2	2	Methods of collecting and recording data cleary stated	Either one clearly stated (methods of collecting or recording).	Both method of collecting and recording data clearly stated.		
3d	sta3.2.2.1	2	Sampling method clearly described	Sampling method identified.	Sampling method clearly described clearly.,.		
3e	sta3.2.2.5	2	Data collected, clearly recorded and cleaned where appropriate.	Data collected but not clearly recorded or cleaned. Statistical tool (e.g. Excel) is used for recording data	Data collected, recorded and cleaned. Statistical tool (e.g. Excel) is used for recording data		

ITEM #	SLO CODE	SKILL LEVEL	EVIDENCE	STUDENT RESPONSE LEVEL			
				Level 1	Level 2	Level 3	Level 4
3f	**Sta3.2.3.1**	3	Summary of data with appropriate measures of central tendency and spread;	An appropriate measure of central tendency or an appropriate measure of spread is povided. Statistical tool (e.g. Excel) is used for data analysis.	Two or more measures are provided correctly; Statistical tool (e.g. Excel) is used for data analysis.	Two or more measures are provided and related appropriately to the data set and the investigation purpose. Statistical tool (e.g. Excel) is used for data analysis.	
3g	**sta3.2.3.2**	**3**	Appropriate display/s provided and labelled	Presented data through an appropriate display, but very limited. Statistical tool (e.g. Excel) is used for graphing.	An appropriate display is provided and labelled but with some minor mistakes or ommisions. Statistical tool (e.g. Excel) is used for graphing.	Appropriate display is fully provided and and correctly labelled. Statistical tool (e.g. Excel) is used for graphing.	
	sta3.2.3.6	**3**	**Develop** inferences using confidence interval (difference of two means or proportions).	State or shows evidence: -confidence interval formula -% error -one mean	Able to describe one terminal end of the confidence interval.either LHS/RHS	Explain the CI inferences by developing the correct error which is added to the right & subtracted on the left.	

ITEM #	SLO CODE	SKILL LEVEL	EVIDENCE	STUDENT RESPONSE LEVEL			
				Level 1	Level 2	Level 3	Level 4
3h	sta3.2.4.2	4	Clear conclusion that answers the investigative question, making a clear and justified inference back in the population.	A concluding statement is given without any justification	At least one concluding statement is provided with two unrelated ideas.	Concluding statements are provided that had appropriate ideas that are related well.	Clear conclusion that answers the investigative question, making a clear and justified inference back in the population.
3i	Sta3.2.4.1	4	Discussion of limitations in their data study, and discussing any possible further investigation that the data may have highlighted.	One limitation stated	States two or more limitations or describe a limitation, using two or more ideas.	Explains why the limitation influences the results.	The limitation is discussed in relation to possible further investigation that the data may have highlighted.

MATHEMATICS WITH STATISTICS — USEFUL FORMULAE AND TABLES

Straight Line

Gradient $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Equation $y - y_1 = m(x - x_1)$

Quadratic Equations

If $ax^2 + bx + c = 0$

then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Bisection Method

$x_2 = \dfrac{x_0 + x_1}{2}$

Newton-Raphson Method

$x_1 = x_0 - \dfrac{f(x_0)}{f'(x_0)}$

Differentiation

$y = f(x)$	$\dfrac{dy}{dx} = f'(x)$
x^n	nx^{n-1}
$\ln x$	$\dfrac{1}{x}$
e^{ax}	ae^{ax}

Differential Equation

If $\dfrac{dy}{dx} = ky$ then $y = Ae^{kx}$

Arithmetic Sequences and Series

$t_n = a + (n-1)d$

$S_n = \dfrac{n}{2}\left[2a + (n-1)d\right]$

Geometric Sequences and Series

$t_n = ar^{n-1}$

$S_n = \dfrac{a(1-r^n)}{1-r}$ for $r \neq 1$

$S_\infty = \dfrac{a}{1-r}$ for $|r| < 1$

Exponential Series

$e^x = 1 + x + \dfrac{x^2}{2!} + \dfrac{x^3}{3!} + \ldots$ (for all x)

Logarithms

$\ln x = \log_e x$

If $y = b^x$ then $\log_b y = x$

If $y = e^x$ then $x = \ln y = \log_e y$

$\log_b x + \log_b y = \log_b xy$

$\log_b x - \log_b y = \log_b \dfrac{x}{y}$

$\log_b x^n = n \log_b x$

Binomial Theorem

$$(a+b)^n = \binom{n}{0}a^n + \binom{n}{1}a^{n-1}b^1 + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + \binom{n}{n}b^n$$

where $\binom{n}{r} = {}^nC_r = \dfrac{n!}{(n-r)!\,r!}$ Note: ${}^nP_r = \dfrac{n!}{(n-r)!}$

Some values of $\binom{n}{r}$ are given in the table below.

Binomial Coefficients

n \ r	0	1	2	3	4	5	6	7	8	9	10
0	1										
1	1	1									
2	1	2	1								
3	1	3	3	1							
4	1	4	6	4	1						
5	1	5	10	10	5	1					
6	1	6	15	20	15	6	1				
7	1	7	21	35	35	21	7	1			
8	1	8	28	56	70	56	28	8	1		
9	1	9	36	84	126	126	84	36	9	1	
10	1	10	45	120	210	252	210	120	45	10	1
11	1	11	55	165	330	462	462	330	165	55	11
12	1	12	66	220	495	792	924	792	495	220	66
13	1	13	78	286	715	1287	1716	1716	1287	715	286
14	1	14	91	364	1001	2002	3003	3432	3003	2002	1001
15	1	15	105	455	1365	3003	5005	6435	6435	5005	3003

Probability

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

Expectation Algebra

$$E(aX + b) = aE(X) + b$$

$$Var(aX + b) = a^2 Var(X)$$

$$E(aX + bY) = aE(X) + bE(Y)$$

$$Var(aX + bY) = a^2 Var(X) + b^2 Var(Y),$$

(if X, Y are independent)

Mean and Variance of Data

$$\bar{x} = \frac{\Sigma fx}{n} \qquad s^2 = \frac{\Sigma fx^2 - \frac{(\Sigma fx)^2}{n}}{n}$$

Mean and Variance of a Random Variable

$\mu = E(X)$ $\quad = \Sigma x.P(X = x)$

$\sigma^2 = Var(X)$ $\quad = E(X^2) - [E(X)]^2$

Distribution of Sample Statistics

Statistic	Mean	Standard Deviation
Sample Mean	$E(\bar{X}) = \mu$	$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$ (std. error of the mean)
Sample Proportion	$E(P) = \pi$	$\sigma_P = \sqrt{\frac{\pi(1-\pi)}{n}}$ (std. error of the proportion)
Difference of Means (of two independent samples)	$E(\bar{X}_1 - \bar{X}_2) = \mu_1 - \mu_2$	$\sigma_{\bar{X}_1 - \bar{X}_2} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$

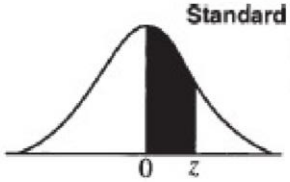
Confidence Intervals

Mean $\quad \bar{X} - z.\sigma_{\bar{X}} < \mu < \bar{X} + z.\sigma_{\bar{X}}$

Proportion $\quad P - z.\sigma_P < \pi < P + z.\sigma_P$

Difference of two means $\quad (\bar{X}_1 - \bar{X}_2) - z.\sigma_{\bar{X}_1 - \bar{X}_2} < \mu_1 - \mu_2 < (\bar{X}_1 - \bar{X}_2) + z.\sigma_{\bar{X}_1 - \bar{X}_2}$

Standard Normal Distribution



$$\left(Z = \frac{X - \mu}{\sigma}\right)$$

Each entry gives the probability that the standardised normal random variable Z lies between 0 and z.

z	0	1	2	3	4	5	6	7	8	9	Differences 1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359	4	8	12	16	20	24	28	32	36
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754	4	8	12	16	20	24	28	32	36
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141	4	8	12	15	19	22	27	31	35
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517	4	8	11	15	19	22	26	30	34
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879	4	7	11	14	18	22	25	29	32
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224	3	7	10	14	17	21	24	27	31
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549	3	6	10	13	16	19	23	26	29
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852	3	6	9	12	15	18	21	24	27
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133	3	6	8	11	14	17	19	22	25
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389	3	5	8	10	13	15	18	20	23
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621	2	5	7	9	12	14	16	18	21
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830	2	4	6	8	10	12	14	16	19
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015	2	4	5	7	9	11	13	15	16
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177	2	3	5	6	8	10	11	13	14
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319	1	3	4	6	7	8	10	11	13
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441	1	2	4	5	6	7	8	10	11
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545	1	2	3	4	5	6	7	8	9
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633	1	2	3	3	4	5	6	7	8
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706	1	1	2	3	4	4	5	6	6
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767	1	1	2	2	3	4	4	5	5
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817	0	1	1	2	2	3	3	4	4
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857	0	1	1	2	2	2	3	3	4
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890	0	1	1	1	2	2	2	3	3
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916	0	0	1	1	1	2	2	2	2
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936	0	0	1	1	1	1	1	2	2
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952	0	0	0	1	1	1	1	1	1
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964	0	0	0	0	1	1	1	1	1
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974	0	0	0	0	0	1	1	1	1
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981	0	0	0	0	0	0	0	0	1
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986	0	0	0	0	0	0	0	0	1
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990	0	0	0	0	0	0	0	0	0
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993	0	0	0	0	0	0	0	0	0
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995	0	0	0	0	0	0	0	0	0
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997	0	0	0	0	0	0	0	0	0
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998	.4998	0	0	0	0	0	0	0	0	0
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	0	0	0	0	0	0	0	0	0
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	0	0	0	0	0	0	0	0	0
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	0	0	0	0	0	0	0	0	0
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.5000	.5000	.5000	0	0	0	0	0	0	0	0	0
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	0	0	0	0	0	0	0	0	0

Binomial Distribution

Each entry gives the probability that a binomial random variable X, with the parameters n and π, has the value x.

$$P(X = x) = \binom{n}{x} \pi^x (1-\pi)^{n-x}$$

$$\mu = n\pi, \qquad \sigma = \sqrt{n\pi(1-\pi)}$$

n	x	π = 0.05	0.1	0.15	1/6	0.2	0.25	0.3	1/3	0.35	0.4	0.45	0.5
4	0	0.8145	0.6561	0.5220	0.4823	0.4096	0.3164	0.2401	0.1975	0.1785	0.1296	0.0915	0.0625
	1	0.1715	0.2916	0.3685	0.3858	0.4096	0.4219	0.4116	0.3951	0.3845	0.3456	0.2995	0.2500
	2	0.0135	0.0486	0.0975	0.1157	0.1536	0.2109	0.2646	0.2963	0.3105	0.3456	0.3675	0.3750
	3	0.0005	0.0036	0.0115	0.0154	0.0256	0.0469	0.0756	0.0988	0.1115	0.1536	0.2005	0.2500
	4		0.0001	0.0005	0.0008	0.0016	0.0039	0.0081	0.0123	0.0150	0.0256	0.0410	0.0625
5	0	0.7738	0.5905	0.4437	0.4019	0.3277	0.2373	0.1681	0.1317	0.1160	0.0778	0.0503	0.0313
	1	0.2036	0.3281	0.3915	0.4019	0.4096	0.3955	0.3602	0.3292	0.3124	0.2592	0.2059	0.1563
	2	0.0214	0.0729	0.1382	0.1608	0.2048	0.2637	0.3087	0.3292	0.3364	0.3456	0.3369	0.3125
	3	0.0011	0.0081	0.0244	0.0322	0.0512	0.0879	0.1323	0.1646	0.1811	0.2304	0.2757	0.3125
	4		0.0005	0.0022	0.0032	0.0064	0.0146	0.0284	0.0412	0.0488	0.0768	0.1128	0.1563
	5			0.0001	0.0001	0.0003	0.0010	0.0024	0.0041	0.0053	0.0102	0.0185	0.0313
6	0	0.7351	0.5314	0.3771	0.3349	0.2621	0.1780	0.1176	0.0878	0.0754	0.0467	0.0277	0.0156
	1	0.2321	0.3543	0.3993	0.4019	0.3932	0.3560	0.3025	0.2634	0.2437	0.1866	0.1359	0.0938
	2	0.0305	0.0984	0.1762	0.2009	0.2458	0.2966	0.3241	0.3292	0.3280	0.3110	0.2780	0.2344
	3	0.0021	0.0146	0.0415	0.0536	0.0819	0.1318	0.1852	0.2195	0.2355	0.2765	0.3032	0.3125
	4	0.0001	0.0012	0.0055	0.0080	0.0154	0.0330	0.0595	0.0823	0.0951	0.1382	0.1861	0.2344
	5		0.0001	0.0004	0.0006	0.0015	0.0044	0.0102	0.0165	0.0205	0.0369	0.0609	0.0938
	6					0.0001	0.0002	0.0007	0.0014	0.0018	0.0041	0.0083	0.0156
7	0	0.6983	0.4783	0.3206	0.2791	0.2097	0.1335	0.0824	0.0585	0.0490	0.0280	0.0152	0.0078
	1	0.2573	0.3720	0.3960	0.3907	0.3670	0.3115	0.2471	0.2048	0.1848	0.1306	0.0872	0.0547
	2	0.0406	0.1240	0.2097	0.2344	0.2753	0.3115	0.3177	0.3073	0.2985	0.2613	0.2140	0.1641
	3	0.0036	0.0230	0.0617	0.0781	0.1147	0.1730	0.2269	0.2561	0.2679	0.2903	0.2918	0.2734
	4	0.0002	0.0026	0.0109	0.0156	0.0287	0.0577	0.0972	0.1280	0.1442	0.1935	0.2388	0.2734
	5		0.0002	0.0012	0.0019	0.0043	0.0115	0.0250	0.0384	0.0466	0.0774	0.1172	0.1641
	6			0.0001	0.0001	0.0004	0.0013	0.0036	0.0064	0.0084	0.0172	0.0320	0.0547
	7						0.0001	0.0002	0.0005	0.0006	0.0016	0.0037	0.0078
8	0	0.6634	0.4305	0.2725	0.2326	0.1678	0.1001	0.0576	0.0390	0.0319	0.0168	0.0084	0.0039
	1	0.2793	0.3826	0.3847	0.3721	0.3355	0.2670	0.1977	0.1561	0.1373	0.0896	0.0548	0.0313
	2	0.0515	0.1488	0.2376	0.2605	0.2936	0.3115	0.2965	0.2731	0.2587	0.2090	0.1569	0.1094
	3	0.0054	0.0331	0.0839	0.1042	0.1468	0.2076	0.2541	0.2731	0.2786	0.2787	0.2568	0.2188
	4	0.0004	0.0046	0.0185	0.0260	0.0459	0.0865	0.1361	0.1707	0.1875	0.2322	0.2627	0.2734
	5		0.0004	0.0026	0.0042	0.0092	0.0231	0.0467	0.0683	0.0808	0.1239	0.1719	0.2188
	6			0.0002	0.0004	0.0011	0.0038	0.0100	0.0171	0.0217	0.0413	0.0703	0.1094
	7					0.0001	0.0004	0.0012	0.0024	0.0033	0.0079	0.0164	0.0313
	8							0.0001	0.0002	0.0002	0.0007	0.0017	0.0039
9	0	0.6302	0.3874	0.2316	0.1938	0.1342	0.0751	0.0404	0.0260	0.0207	0.0101	0.0046	0.0020
	1	0.2985	0.3874	0.3679	0.3489	0.3020	0.2253	0.1556	0.1171	0.1004	0.0605	0.0339	0.0176
	2	0.0629	0.1722	0.2597	0.2791	0.3020	0.3003	0.2668	0.2341	0.2162	0.1612	0.1110	0.0703
	3	0.0077	0.0446	0.1069	0.1302	0.1762	0.2336	0.2668	0.2731	0.2716	0.2508	0.2119	0.1641
	4	0.0006	0.0074	0.0283	0.0391	0.0661	0.1168	0.1715	0.2048	0.2194	0.2508	0.2600	0.2461
	5		0.0008	0.0050	0.0078	0.0165	0.0389	0.0735	0.1024	0.1181	0.1672	0.2128	0.2461
	6		0.0001	0.0006	0.0010	0.0028	0.0087	0.0210	0.0341	0.0424	0.0743	0.1160	0.1641
	7				0.0001	0.0003	0.0012	0.0039	0.0073	0.0098	0.0212	0.0407	0.0703
	8						0.0001	0.0004	0.0009	0.0013	0.0035	0.0083	0.0176
	9								0.0001	0.0001	0.0003	0.0008	0.0020
10	0	0.5987	0.3487	0.1969	0.1615	0.1074	0.0563	0.0282	0.0173	0.0135	0.0060	0.0025	0.0010
	1	0.3151	0.3874	0.3474	0.3230	0.2684	0.1877	0.1211	0.0867	0.0725	0.0403	0.0207	0.0098
	2	0.0746	0.1937	0.2759	0.2907	0.3020	0.2816	0.2335	0.1951	0.1757	0.1209	0.0763	0.0439
	3	0.0105	0.0574	0.1298	0.1550	0.2013	0.2503	0.2668	0.2601	0.2522	0.2150	0.1665	0.1172
	4	0.0010	0.0112	0.0401	0.0543	0.0881	0.1460	0.2001	0.2276	0.2377	0.2508	0.2384	0.2051
	5	0.0001	0.0015	0.0085	0.0130	0.0264	0.0584	0.1029	0.1366	0.1536	0.2007	0.2340	0.2461
	6		0.0001	0.0012	0.0022	0.0055	0.0162	0.0368	0.0569	0.0689	0.1115	0.1596	0.2051
	7			0.0001	0.0002	0.0008	0.0031	0.0090	0.0163	0.0212	0.0425	0.0746	0.1172
	8					0.0001	0.0004	0.0014	0.0030	0.0043	0.0106	0.0229	0.0439
	9							0.0001	0.0003	0.0005	0.0016	0.0042	0.0098
	10	(all other entries < 0.0001)									0.0001	0.0003	0.0010

Poisson Distribution

Each entry gives the probability that a Poisson random variable X, with parameter λ, has the value x.

$$P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

$$\mu = \lambda, \qquad \sigma = \sqrt{\lambda}$$

x \ λ	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
0	0.9048	0.8187	0.7408	0.6703	0.6065	0.5488	0.4966	0.4493	0.4066	0.3679
1	0.0905	0.1637	0.2222	0.2681	0.3033	0.3293	0.3476	0.3595	0.3659	0.3679
2	0.0045	0.0164	0.0333	0.0536	0.0758	0.0988	0.1217	0.1438	0.1647	0.1839
3	0.0002	0.0011	0.0033	0.0072	0.0126	0.0198	0.0284	0.0383	0.0494	0.0613
4		0.0001	0.0003	0.0007	0.0016	0.0030	0.0050	0.0077	0.0111	0.0153
5				0.0001	0.0002	0.0004	0.0007	0.0012	0.0020	0.0031
6							0.0001	0.0002	0.0003	0.0005
7										0.0001

x \ λ	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
0	0.3329	0.3012	0.2725	0.2466	0.2231	0.2019	0.1827	0.1653	0.1496	0.1353
1	0.3662	0.3614	0.3543	0.3452	0.3347	0.3230	0.3106	0.2975	0.2842	0.2707
2	0.2014	0.2169	0.2303	0.2417	0.2510	0.2584	0.2640	0.2678	0.2700	0.2707
3	0.0738	0.0867	0.0998	0.1128	0.1255	0.1378	0.1496	0.1607	0.1710	0.1804
4	0.0203	0.0260	0.0324	0.0395	0.0471	0.0551	0.0636	0.0723	0.0812	0.0902
5	0.0045	0.0062	0.0084	0.0111	0.0141	0.0176	0.0216	0.0260	0.0309	0.0361
6	0.0008	0.0012	0.0018	0.0026	0.0035	0.0047	0.0061	0.0078	0.0098	0.0120
7	0.0001	0.0002	0.0003	0.0005	0.0008	0.0011	0.0015	0.0020	0.0027	0.0034
8			0.0001	0.0001	0.0001	0.0002	0.0003	0.0005	0.0006	0.0009
9							0.0001	0.0001	0.0001	0.0002

x \ λ	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
0	0.1108	0.0907	0.0743	0.0608	0.0498	0.0408	0.0334	0.0273	0.0224	0.0183
1	0.2438	0.2177	0.1931	0.1703	0.1494	0.1304	0.1135	0.0984	0.0850	0.0733
2	0.2681	0.2613	0.2510	0.2384	0.2240	0.2087	0.1929	0.1771	0.1615	0.1465
3	0.1966	0.2090	0.2176	0.2225	0.2240	0.2226	0.2186	0.2125	0.2046	0.1954
4	0.1082	0.1254	0.1414	0.1557	0.1680	0.1781	0.1858	0.1912	0.1944	0.1954
5	0.0476	0.0602	0.0735	0.0872	0.1008	0.1140	0.1264	0.1377	0.1477	0.1563
6	0.0174	0.0241	0.0319	0.0407	0.0504	0.0608	0.0716	0.0826	0.0936	0.1042
7	0.0055	0.0083	0.0118	0.0163	0.0216	0.0278	0.0348	0.0425	0.0508	0.0595
8	0.0015	0.0025	0.0038	0.0057	0.0081	0.0111	0.0148	0.0191	0.0241	0.0298
9	0.0004	0.0007	0.0011	0.0018	0.0027	0.0040	0.0056	0.0076	0.0102	0.0132
10	0.0001	0.0002	0.0003	0.0005	0.0008	0.0013	0.0019	0.0028	0.0039	0.0053
11			0.0001	0.0001	0.0002	0.0004	0.0006	0.0009	0.0013	0.0019
12					0.0001	0.0001	0.0002	0.0003	0.0004	0.0006
13								0.0001	0.0001	0.0002
14										0.0001

x \ λ	4.2	4.4	4.6	4.8	5.0	5.2	5.4	5.6	5.8	6.0
0	0.0150	0.0123	0.0101	0.0082	0.0067	0.0055	0.0045	0.0037	0.0030	0.0025
1	0.0630	0.0540	0.0462	0.0395	0.0337	0.0287	0.0244	0.0207	0.0176	0.0149
2	0.1323	0.1188	0.1063	0.0948	0.0842	0.0746	0.0659	0.0580	0.0509	0.0446
3	0.1852	0.1743	0.1631	0.1517	0.1404	0.1293	0.1185	0.1082	0.0985	0.0892
4	0.1944	0.1917	0.1875	0.1820	0.1755	0.1681	0.1600	0.1515	0.1428	0.1339
5	0.1633	0.1687	0.1725	0.1747	0.1755	0.1748	0.1728	0.1697	0.1656	0.1606
6	0.1143	0.1237	0.1323	0.1398	0.1462	0.1515	0.1555	0.1584	0.1601	0.1606
7	0.0686	0.0778	0.0869	0.0959	0.1044	0.1125	0.1200	0.1267	0.1326	0.1377
8	0.0360	0.0428	0.0500	0.0575	0.0653	0.0731	0.0810	0.0887	0.0962	0.1033
9	0.0168	0.0209	0.0255	0.0307	0.0363	0.0423	0.0486	0.0552	0.0620	0.0688
10	0.0071	0.0092	0.0118	0.0147	0.0181	0.0220	0.0262	0.0309	0.0359	0.0413
11	0.0027	0.0037	0.0049	0.0064	0.0082	0.0104	0.0129	0.0157	0.0190	0.0225
12	0.0009	0.0013	0.0019	0.0026	0.0034	0.0045	0.0058	0.0073	0.0092	0.0113
13	0.0003	0.0005	0.0007	0.0009	0.0013	0.0018	0.0024	0.0032	0.0041	0.0052
14	0.0001	0.0001	0.0002	0.0003	0.0005	0.0007	0.0009	0.0013	0.0017	0.0022
15			0.0001	0.0001	0.0002	0.0002	0.0003	0.0005	0.0007	0.0009
16						0.0001	0.0001	0.0002	0.0002	0.0003
17	(all other entries < 0.0001)							0.0001	0.0001	0.0001

9.2 Appendix 2: Verb Taxonomy

BLOOMS TAXONOMY	SOLO TAXONOMY	SKILL LEVEL SCORE	DESCRIPTORS
Knowledge	Unistructural • students make simple and obvious connections between pieces of information	1	Mastery of the basic knowledge and skills that are fundamental for proficient work.
Comprehension	Multistructural • a number of connections are made, but not the meta connections between them	2	
Application	Relational • students see the significance of how the various pieces of information relate to one another	3	Solid academic performance for the given learning outcome and competency over challenging subject matter including subject-matter knowledge, application of such knowledge to real world situations.
Synthesis, Analysis, Evaluation	Extended Abstract • at this level students can make connections beyond the scope of the problem or question, to generalise or transfer learning into a new situation	4	Presumes mastery of both the Basic and Proficient levels and represents superior academic performance.

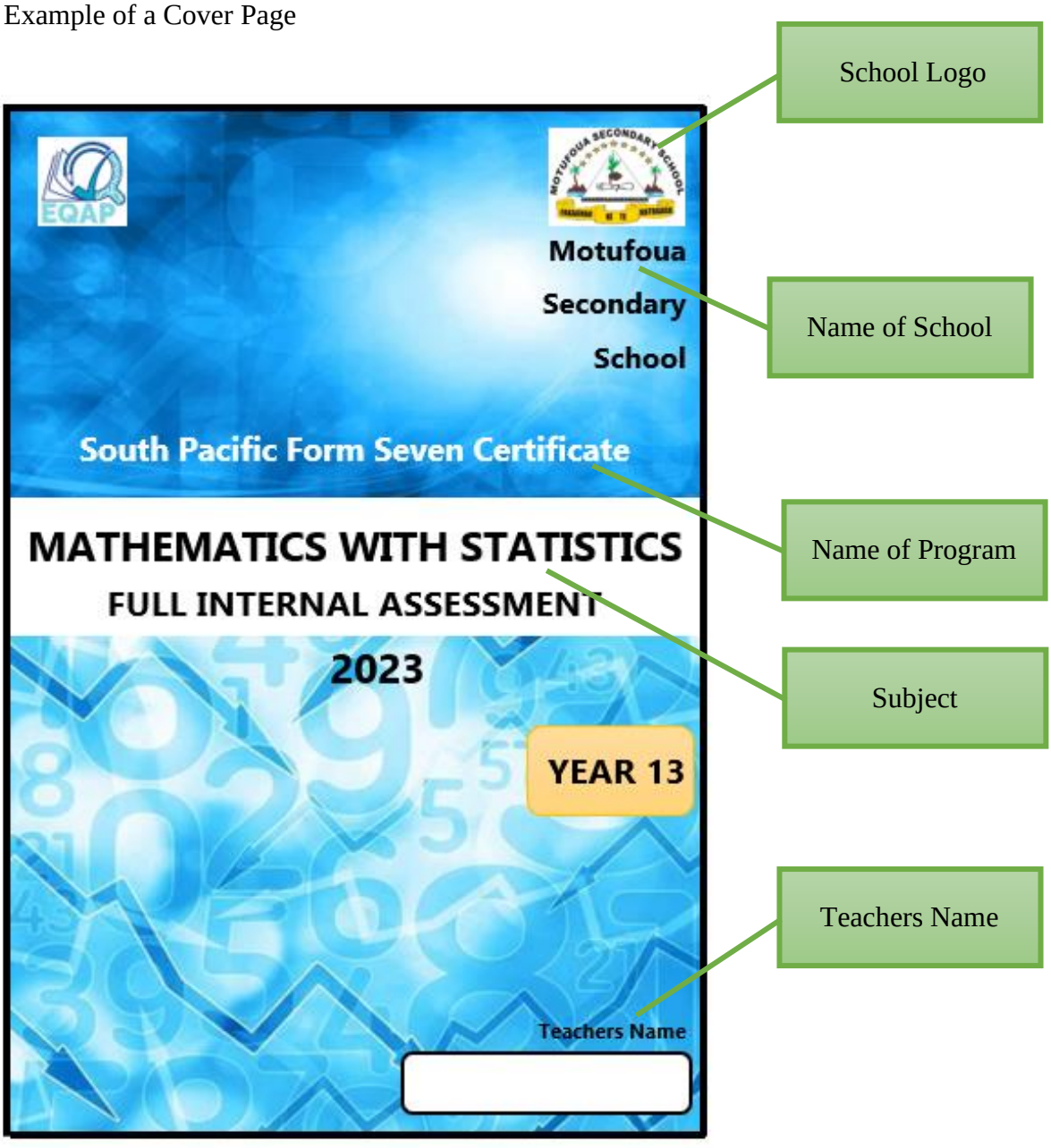
9.3 Appendix 3: IA Programme Proposal Template

Page 1 : Cover Page

The Cover Page will have the name of the:

- School
- Subject : FULL IA PROGRAM
- Teachers Name:

An Example of a Cover Page

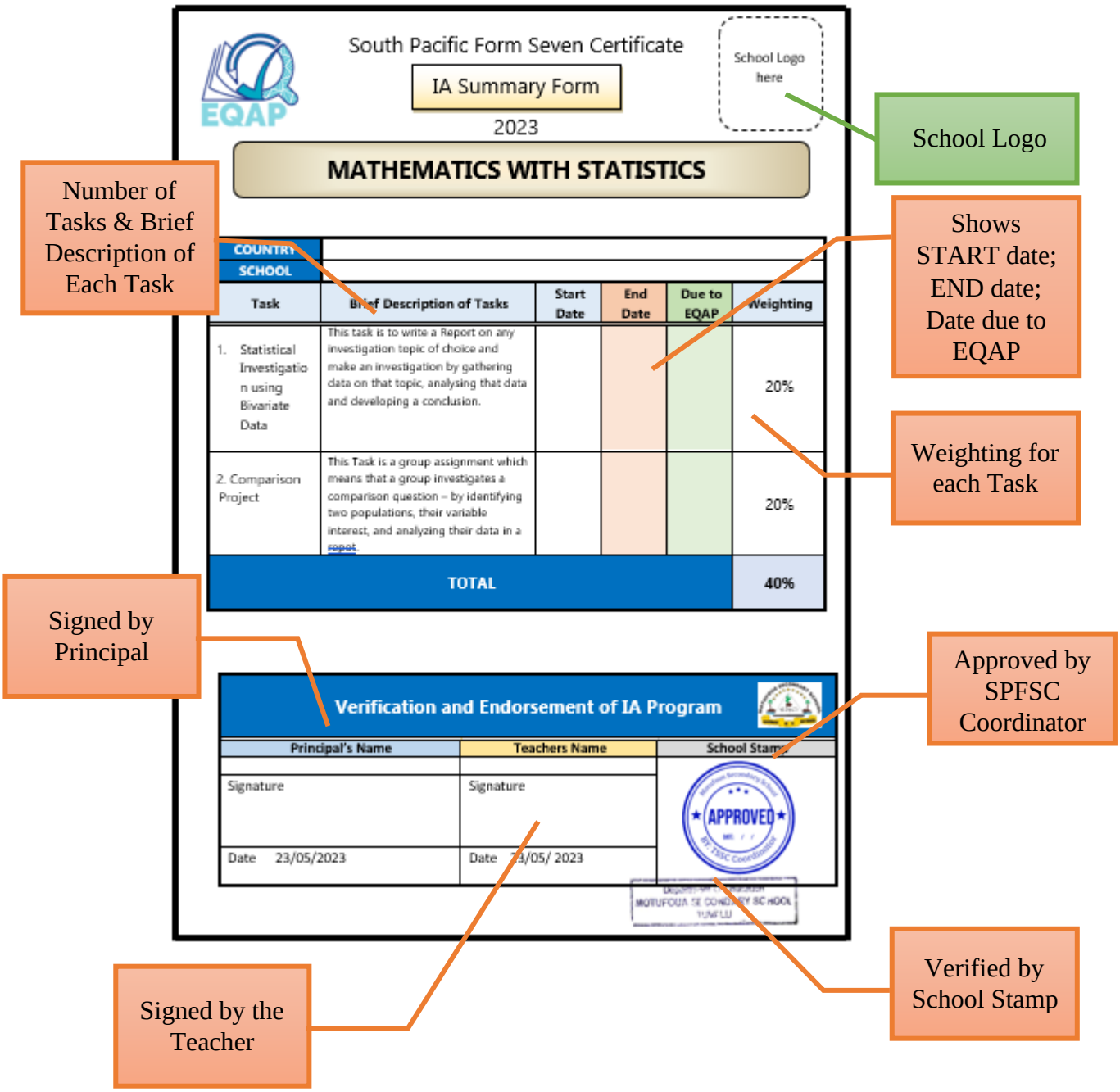


Page 2 : IA SUMMARY FORM

The IA Summary Form must have the following:

- Number of Tasks
- Brief Description of the Tasks
- Start and End Dates
- Signature of Principal and Teacher
- School Stamp/Date

An Example of an IA Summary Form



Page 3 - 6 :

1 Task Title: Task 1:_____

The title should be brief and include a reference to the particular syllabus topic or skill which is being assessed by the task.

Example: *"Research Topic – Investigation of a Social Issue."*

2 Learning Outcomes: List the Specific Learning Outcomes (SLOs) to be assessed by the task

These are found in the syllabus and need to be identified before the tasks are constructed.

Example: *Describe a feature of ….*

(Copy and paste directly from the aligned Syllabus: it must show strand, sub strand and SLOs)

3. Assessment/Task:

Describe the task as a form of assessment to measure student achievements of the above learning outcomes at different stages of the lesson/task implementation.

(Think of what are the best types of assessment for the above LOs so that your students can demonstrate they have achieved the learning outcomes. Also include how you will pre-assess their knowledge at the beginning of the lesson and how you will continuously assess them throughout the strand/topic to monitor their learning progress. The summative assessments are the final IA tasks.)

e.g. Diagnostic: *(can be oral questions/short tests/ surveys/questionnaires to find out what students already know before the lesson)*

Formative: 1. This is the formative use of the summative assessment such as the drafts submitted, self-assessment, peer assessment, teacher assessment of the drafts and specific feedback provided to improve the task. 2. For CATs – this can be similar items prepared by teachers using the SLOs and given to students for practice. After scoring, the feedback needs to be given to improve learning. If majority students not doing well then re-teach using another strategy, assess and monitor learning.

Summative: (these are the final IA tasks or the CATs to measure how much the students have learnt/achieved after the learning period)

4 Resources: List materials required for completing the task (for learning & demonstrating the achievement for the SLOs.

This must specify any material items such as books, documents, maps, stimulus material, equipment required by the task, including use of technology.

5 Guidelines for the teacher on advance preparation requirements

a) **time required** by the student for task completion (monitoring progress)
b) recommended dates/date range for task completion
c) organization of room and hardware to facilitate task completion (learning assessment).

(After the task has been completed and scored, teachers will need an IA score capture sheet to record the performance of all students in the class.)

6 Guidelines for the teacher on task completion and task control

This must specify:

- the role of the teacher during the period of task completion
- instructions that are to be given by the teacher to the students
- actions that are required of the teacher during task completion

7 Preparation by the students beforehand

If students are required to prepare in advance of the task date, preparatory notes must indicate the requirements. For example, students may need to collect support materials for a task that is supervised in a classroom.

8 Task outline for the student

This outline is a brief description of the task that the student is to complete. It is a general description without specific detail.

Example: *Your task is to focus on an important social issue. After investigating that issue, you need to process information collected and suggest possible courses of action that authorities could take.*

9 Task detail for the student

This must provide a detailed description of the task in the sequence that the student would be expected to follow during task completion. This must clearly state:

- what the student is expected to do
- what the student is expected to record and present for assessment.

10. Feedback & Support

Allocate time for:

i. Student's self-assessment and correction
ii. Peer assessment, feedback, and time for improvement
iii. Teacher assessment, feedback, and time for time improvement

(NB: State how this will be carried out)

11. Final submission & scoring

State when the final task is due and how it will be assessed. State how the school (HOD/SPFSC Coordinator) will monitor the scoring of the tasks.

12 Scoring Rubric

Copy and paste directly from the aligned Syllabus the relevant scoring rubrics

13 Assessment score capture sheet for the task

This will be provided by EQAP

(Repeat 1-13 for other tasks)

9.4 Appendix 4: IA Summary Form

South Pacific Form Seven Certificate

Internal Assessment Summary Form

2023

STA – IA

MATHEMATICS WITH STATISTICS

COUNTRY	
SCHOOL	

Task	Brief Description of Tasks	Start Date	End Date	Due to EQAP	Weighting
1. Statistical Investigation using Bivariate Data	This task is to write a Report on any investigation topic of choice and make an investigation by gathering data on that topic, analysing that data and developing a conclusion.				20%
2.Comparison Project	This Task is a group assignment which means that a group investigates a comparison question – by identifying two populations, their variable interest, and analyzing their data in a report.				20%
TOTAL					**40%**

Note:
1. Be specific about the dates, not just Week 3, Term 1, etc
2. Scoring rubrics/assessment schedules for the tasks are provided in Appendix 3, 4 and 5. Teachers must use these when assessing students' IA tasks.
3. All IA Score Capture Sheets will be provided by EQAP to schools.

Verification and Endorsement of IA Program

Principal's Name	Teachers Name	School Stamp
Signature	Signature	
Date	Date	

A full IA program is to be submitted together with this IA Summary Form.

10.0 ADVISORY SECTION

10.1 Recommended Texts & Resources

This is a list of only some Mathematics texts that are available and have been used for teaching courses for Mathematics with Statistics. It is important teachers use this as only a guide and check current book lists available through publishers and book retailers.

A. Suggested Text

1. Sigma Mathematics - Barton, D. Longman, 1998 (2nd Edition)
2. Sigma Mathematics - Barton, D. Longman, 2006 (3rd Edition)

B. Supplementary Texts

1. Sigma mathematics Workbook - David Barton, 2007
2. Achieving in Statistics - W. Geldof, 2006
3. Statistics Workbook - Lakeland, R & Nugent, C, Nulake, 1998
4. Year 13 Study Guide, *Mathematics with Statistics* - Barrett, ESA
5. Longman write-on Notes – *Statistics* - Barton, D.
6. Bursary Statistics – Questions from the last 8 bursary papers with suggested answers.

   Really Useful Resources
   Box 19-939
   Woolston
   Christchurch
7. Schaum's Outlines, Probability and Statistics, 2nd education, Speigal et al, McGraw Hill – a metal teacher resource.
8. Study Pass reference notes: Year 13 Statistics, info@studypass.co.nz
9. Some Statistics Websites:
   - NZ Ministry of Education resources www.tki.org.nz
   - Census at schools data, analysis tools and resources www.censusatschool.org.nz
   - University of Auckland www.stat.auckland.ac.nz
   - Secretariat of the Pacific Community website www.spc.int
   - Tonga Statistics department www.spc.int/prism/country/to/stats/ - Statistics New Zealand www.stats.govt.nz

10.2 Sample Teaching Programme

It is important that teachers recognize that while this course is divided up into 4 specific objectives, the teaching programme should not necessarily have each objective taught as one big chunk.

Below is one example of a teaching programme that splits the objectives into smaller topics of learning. This is merely an example of what could be done, it is not intended that schools will be expected to follow this format. Schools need to be flexible to the needs of their school and community when planning the teaching order of this syllabus.

Teaching Programme Example – Form 7 Mathematics with Statistics

Week	Learning Outcome	Syllabus Reference	Assessment
Term I			
1 - 3	Solve probability problems.	1.1	
4 - 5	Solve problems involving expected values and variance from discrete probability distributions.	1.2	
6 - 8	Use statistical processes to investigate bivariate data.	3.1	Internal assessment #1
9 - 10	Understanding simple piecewise functions to model data.	2.1	
11 - 13	Model real data using power and exponential functions to solve problems.	2.2	
Term II			
1 - 3	Using probability distributions to model a given situation and solve problems.	1.3	
4	Exam Revision		
5	**Exam Time**		**Exam**
6	Review of exam responses		Review
7 - 9	Use statistical processes to investigate numerical data to make a comparison between two populations.	3.2	Internal assessment #2
10 - 12	Using statistical processes	3.3	
13 - 14	Systems of Linear equations.	4.1	
Term III			
1 - 2	Model situations using linear programming techniques to obtain an optimum solution.	2.3	
3 - 4	Use the bisection or Newton-Raphson or Secant method to solve non-linear equations to a given precision.	4.2	
5 - 6	Answer other questions related to statistical processes.		
7	Revision.		
8	**Exam Time**		**Exam**
9	Go over Exam.		
10 - 11	Revision/exam preparation.		

10.3 Issues & Recommendations for Assessment Governing Bodies

1. ***Technology:***

At the present time the prevalent calculators being used by students are scientific ones. A growing trend in Asian markets is to produce low cost scientific calculators with extra chips that allow some algebraic manipulation. There is also potential for graphical calculators to become more prevalent as the prices of these drop. It is important that the examiner has an awareness of what calculator technology is being used by students and that question styles are adapted so that students who do not have the more advanced technology are not penalized. This is particularly of importance in the topics covered by learning objectives 2 and 4, where the use of a graphics calculator could potentially advantage a student both in simplifying a problem and in saving them a lot of time. While the temptation may be to just ban such technology, we cannot ignore its development and also the maintenance of an exclusion list becomes impractical as the market starts to become flooded with so many new brands. The onus on ensuring fairness must stand with the examiner structuring questions in a way that minimizes the advantages of one calculator over another.

It is also important that students are able to access suitable computer technology and statistical packages to deal with the analysis of data. To understand data students need to be able to deal with a suitable volume of data and a wide variety of variables. It is impractical for students to manage that volume of data by hand and suitable packages need to be provided. The use of such packages also will help keep students up to date with international trends in data analysis.
Teachers will also need professional development in using such packages.

2. ***Development of Statistical Thinking****:*

Statistics and the development of statistical thinking in our students is becoming of increasing importance in our world. We are now in a data driven world. Technology has allowed us to deal with large amounts of data to get clearer pictures to assist societies in our economic and social development. We need students who understand the whole statistical process, not just the mechanics. They need to be able to gather, manage, analyse and interpret data, while considering variation. These understandings take time, so it is important that a greater emphasis on Statistics is given throughout all years of secondary education. This is a trend that is starting to occur internationally, and it is important that the Pacific Islands region gives it some careful consideration.

3. ***Professional Development***

There has been a new topic added to the scheme, analysis of bivariate data. Teachers will need resources and professional development in this area. There is also a changing trend internationally starting to come about on how Statistics is taught. In the past, Statistics syllabus were based on a mathematical perspective on statistics. Currently the emphasis has changed to developing an understanding of how statistics are dealt with in the real world. There is less importance placed on the actual performance of calculations (which become trivialized with technology) and more importance placed on understanding what the measures calculated are actually telling us about the data and how it relates back to the population. With this change in thinking it is very important that teachers are provided support and professional development to help them understand the impact of this change on what has to happen in the teaching and learning of Statistics in the classroom.

The End