

South Pacific Board For Educational Assessment



SOUTH PACIFIC FORM SEVEN CERTIFICATE

MATHEMATICS with STATISTICS

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MATHEMATICS with STATISTICS

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MATHEMATICS with STATISTICS

Preamble

This prescription defines the requirements for the South Pacific Form Seven Certificate Mathematics (with Statistics) examination.

Each of the student outcomes for the course is to be read in conjunction with the Explanatory Notes given for each outcome in this prescription.

Students also require knowledge and understanding of outcomes from the Pacific Senior Secondary Certificate (PSSC) or its equivalent, which are related to the specific outcomes of this prescription.

This prescription is derived from the New Zealand University Entrance, Bursaries and Scholarships (NZUEBS) Mathematics (with Statistics) as well as the National Certificate of Educational Assessment (NCEA) Level 3 Mathematics (with Statistics) Achievement Standards as published by New Zealand Qualifications Authority (NZQA).

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 Form 7.

General Objectives

Students will be expected to:

- demonstrate mathematical skills, concepts and understandings in the Mathematical Processes, Measurement and Calculus, Algebra and Statistics at a level equivalent to that required at any Form 7 qualification including the NZ Universities Entrance Bursaries & Scholarships (NZUEBS), NCEA Level 3, University of the South Pacific (USP) Foundation, etc
- apply these skills, concepts, and understandings to familiar and unfamiliar problems arising in real and simulated situations
- demonstrate the ability to perform and report on investigations, which use statistical methods
- demonstrate the ability to select and use appropriate mathematical, statistical and probability techniques in problem solving
- demonstrate the ability to reason logically and systematically
- demonstrate the ability to communicate mathematical ideas.

Outcomes

Students are able to:

1. solve problems involving calculation of probabilities and expected values, and use probability distribution models to solve problems in context.
2. make selections and arrangements leading to combination and permutation and use combination to expand binomial expressions
3. undertake an investigation using statistical concepts and techniques.
4. solve systems of linear equations and solve problems that can be modeled by a system of linear equations
5. use graphical techniques to illustrate functions and model situations
6. use differentiation to solve problems in context.
7. use sequence and series to solve problems in context.
8. analyze time series data.

OUTCOMES

1. PROBABILITY

Solve problems involving calculation of probabilities and expected values, and use probability distribution models to solve problems in context.

Outcome 1.1

Solve probability problems

Explanatory Notes

- Students are expected to be able to explain the basic terms and concepts of probability, and use such concepts to solve problems.
- Solving problems would involve the use of any of the following techniques:
 - theoretical and experimental probability
 - tree diagrams
 - Venn diagrams
 - formulae
 - permutations and combinations.
- Problems to be solved will involve a selection from:
 - mutually exclusive events
 - independent events
 - complementary events
 - conditional events.

Outcome 1.2

Calculate and interpret expected values and variance for practical situations

Explanatory Notes

- A selection will be made from calculating and interpreting the expected value of (given the probability function):
 - discrete random variables
 - linear functions of random variables
 - sums of independent random variables.

This includes the derivation of the identity $E(X-\mu)^2 = E(X^2) - \mu^2$.
- Selection will be made from calculating and interpreting the variance of:
 - discrete random variables
 - linear functions of random variables
 - sums of independent random variables.

Outcome 1.3

Use appropriate probability distribution to model a given situation, solve problems and make predictions using the model.

Explanatory Notes

- Probability distribution to be used will include a selection from:

- Rectangular or Uniform.
 - Binomial.
 - Poisson.
 - Normal.
 - Approximations.
- Students may be required to:
 - calculate parameters
 - calculate probabilities and expected values using formulae
 - solve inverse normal type problems.

Outcome 1.4

Use a variety of techniques to solve problems in context.

Explanatory Notes

- Students are expected to be able to use any of the skills covered in Outcomes 1.1 to 1.3 to solve probability problems.

2. COMBINATIONS & BINOMIAL THEOREM

Make selections and arrangements leading to combination and permutation, and use combination to expand binomial expressions.

Outcome 2.1

Find numbers of distinct arrangements or selections from a given number of objects (permutations and combinations)

Explanatory Notes

Finding numbers of distinct arrangements will involve problems of the following type:

- straight forward applications such as choosing a sample of 3 girls and 4 boys from a class of 16 girls and 12 boys
- cases where repetition is permissible such as selecting the two letters for vehicle number plates.

Outcome 2.2

Expand binomial expressions for positive integral exponents

Explanatory Notes

For the expansion, students are required to use either of the techniques:

- Pascal's triangle
- factorials and the notation ${}^n C_r$ or $\binom{n}{r}$.

3. STATISTICS

Complete a statistical investigation, interpret and analyze data, calculate and interpret sample statistics and calculate estimation for population parameters.

Outcome 3.1

Undertake an investigation using statistical concepts and techniques

Explanatory Notes

Undertaking the investigation involves:

- planning the investigation (identify the problem to be investigated, purpose of the investigation, method to be used, population to be investigated, the data to be collected, etc).
- designing and conducting investigation involves; deciding on a suitable sampling method (especially simple random sampling) and recognizing potential sources of bias in sampling, defining factors involved and level of importance, defining response variables, carrying out the investigation
- analyzing the data
- presenting (include graphical) and discussing the findings (relate findings to the context and address the purpose of investigation). Findings consistent with analysis leading to recommendations where appropriate.

Outcome 3.2

Interpret and critically analyze data and statistical reports

Explanatory Notes

Critical analysis of data and report include, where appropriate, discussion of:

- any comments on relevancy of data to purpose of investigation
- any comments on quality of data collected (easily analyzed and presented).
- any recommendations on the investigation
- any comments on the limitations of the data and report
- a justification of the method used
- alternative approaches that could have been considered
- any assumptions made
- validity and reliability of findings
- sources of bias
- relevance and usefulness of evidence
- how widely can findings be applied.

Outcome 3.3

Calculate and interpret sample statistics

Explanatory Notes

Calculation involves calculating:

- measures of centre and spread
- deriving the identity $\sum(x - \bar{x})^2 = \sum x^2 - n(\bar{x})^2$
- the sample size required for a given precision estimate of a population parameter.

Interpretation involves:

- explaining the meaning of sampling distribution of the mean and sampling distribution of a proportion
- explaining the difference between sample statistics and population parameters
- explain and use the Central Limit Theorem.

Outcome 3.4

Calculate point and interval (confidence interval) estimates for a population parameter, and explain the meaning of confidence intervals

Explanatory Notes

Calculation of the following would be necessary:

- the mean of a population
- a population proportion
- the difference between the means of two populations (using independent samples from those populations)
- interpreting “margin of error” in survey reports and opinion polls.
- although formal hypothesis testing has been removed from the prescription, this does not preclude candidates having to interpret confidence intervals in the context of population parameters.

4. EQUATIONS

Solve systems of linear equations and solve problems that can be modeled by systems of linear equations.

Outcome 4.1

Solve systems of linear equations and problems that can be modeled by a system of linear equations

Explanatory Notes

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

- solving 2x2 and 3x3 linear systems (use of matrices is accepted).
- modeling and solving problems.

Outcome 4.2

Use bisection method or Newton-Raphson method to solve non-linear equations

Explanatory Notes

Assessment will focus on:

- use a suitable method to find an approximate location of a root (graphical, table of values, calculator etc)
- use of the Newton-Raphson or the Bisection Method (the Newton-Raphson includes derivatives of polynomials only, otherwise derivatives of other functions will be given)
- use of either the Newton-Raphson or the Bisection Method, including a geometric understanding of the method, to improve the approximation to a given precision.

Outcome 4.3

Determine and interpret the nature of solutions

Explanatory Notes

The determination and interpretation could include:

- consistency (either unique or dependent) of solutions to systems of equations, including geometric representations
- identify advantages and disadvantages of bisection and Newton-Raphson methods including explanation of the process of the Bisection method.

5. GRAPHS

Use graphical techniques to illustrate functions and model situations.

Outcome 5.1

Use graphical techniques to illustrate functions

Explanatory Notes

Illustration will be based on functions of the form:

- $y = x^a$ for a real. (illustration of different shapes especially the three cases where $a < 0$, $0 < a < 1$, and $a > 1$). Includes comparison of shapes for different values of a
- piece-wise function (includes sketching the function and finding values of function for different sets of domain, also write equation of a model for a given situation).

Outcome 5.2

Choose an appropriate model for real data, analyze and interpret results

Explanatory Notes

- transforming variables (including log-log and semi-log techniques)
- Log-log situation relates to power functions of the form ax^n where n is a positive integer (use of special log-log and semi-log papers will not be examined)
- Semi-log situation relates to index functions of the form Aa^{px} (where p can be any base) as well as exponential functions of the form Ae^{px} .

Outcome 5.3

Model situations using linear programming techniques, and obtain the optimal solution

Explanatory Notes

Modeling process involves:

- Representing a problem as an equation or inequation
- Sketching and shading (applying constraints) to obtain the feasible region.

6. CALCULUS

Use differentiation to solve problems in context.

Outcome 6.1

Differentiate functions

Explanatory Notes

Differentiation will be limited to functions of the following forms:

- polynomials of the type x^n where $n \in$ rational numbers
- exponentials of the type Ae^{px} where $p \in$ real numbers.

It is assumed that students are competent in:

- differentiating polynomials of the type x^n using the power rule
- sketching of growth and decay curves
- identifying features of exponential functions.

Rules such as Product, Quotient, Chain Rule, etc will not be required.

Outcome 6.2

Solve problems in context requiring differentiation of functions in 6.1

Explanatory Notes

Problems will be limited to the following:

- where rates of change limit to situations involving two variables only
- maxima and minima
- rate of change of a quantity is proportional to the value of the quantity ($y' = ky$)
- showing by differentiating that $y = Ae^{px}$ is the solution to $y' = ky$
- exponential growth and decay (eg. Population growth, radioactivity, decay, rate of interest).

7. SEQUENCES AND SERIES

Use sequence and series to solve problems in context.

Outcome 7.1

Describe behaviour of sequence and series

Explanatory Notes

Description to include:

- use of graph and calculator techniques
- include the exponential series in description.

Students may need to revise work on sequence and series covered at earlier level including arithmetic and geometric series (Form 6 for PSSC).

Note that specific knowledge of index numbers is not required.

Outcome 7.2

Solve problems involving sequence and series

Explanatory Notes

Problems will be selected from those relating to:

- arithmetic and geometric sequences and series
- informal treatment of convergence
- use of sequences and series to model situations and interpret the finding
- exponential sequences and series.

8. TIME SERIES

Analyse time series data.

Outcome 8.1

Identify and describe specific features of time series data

Explanatory Notes

Features to be identified could include:

- long-term trends
- cyclical variations
- seasonal variations
- random error
- permanent shift.

Students are expected to:

- be able to apply an additive model to analyze time series data which contain the above features
- be aware of the limitations of the additive model for some data types
- be aware of the multiplicative model, but use of it is not required.

Outcome 8.2

Apply smoothing to describe trends

Explanatory Notes

Application could include calculation and use of the following for both an odd or even order:

- moving means.
- moving medians.

This also involves:

- choosing and justifying a moving average appropriate to the time series
- knowing the order that should be used to smooth out the seasonal cycle (from the natural period of the cycle).

Outcome 8.3

Predict or forecast future values in a time series

Explanatory Notes

Before making predictions students should be able to:

- seasonally adjusting data in a time series.
- interpret the results.

ASSESSMENT

Students will be assessed by a three-hour written examination worth 80% of the final mark and an internally assessed component worth 20% of the final mark.

The composite percentage mark for each student will be obtained by using the written component of the South Pacific Form Seven Certificate Mathematics (with Statistics) examination as a group reference standard for moderating the set of internally assessed marks for the candidates from each school.

The school principal (or his/her nominee) shall forward the internally assessed mark (out of 20) for each candidate, on the Mark Capture Form (**MAS-1**), to reach SPBEA by the date specified by the Director. The principal, or his/her nominee, will certify that the prescription requirements have been fulfilled.

Outcomes	Suggested Time Spend	Approximate Weighting
1. Probability – the student is able to solve problems involving calculation of probabilities and expected values, and use probability distribution models to solve problems.	6 weeks	21%
2. Combinations and Binomial Theorem – the student is able to make selections and arrangements leading to combination and permutation, and use combination to expand binomial expressions.	2 weeks	7%
3. Statistics – the student is able to complete a statistical investigation.	5 weeks	18%
4. Equations – the student is able to solve systems of linear equations and solve problems that can be modeled by a system of linear equations.	3 weeks	11%
5. Graphs – the student is able to use graphical techniques to illustrate functions and model situations.	4 weeks	14%
6. Calculus – the student is able to use differentiation to solve problems.	3 week	11%
7. Sequences and Series – the student is able to use sequences and series to solve problems.	2 weeks	7%
8. Time Series – the student is able to analyse time series data	3 weeks	11%
Total	28 weeks	100%

External Examination

The prescription contains both general objectives and outcomes. Students would be expected to know, understand and apply any mathematics related to the outcomes. Examination questions, which require specific mathematical knowledge, will be based on these outcomes or on related material from lower level prescriptions. It may however, be appropriate to assess the general objectives of the prescription by choosing an unfamiliar context and supplying all background information and data necessary to solve the problem. Mathematical proofs, not mentioned specifically in the prescription, could be examined in this way.

Emphasis in the examination will reflect the time allocated to each topic.

The examination paper will have two sections, Section A and Section B:

- Section A will be a short answer section (35%)
- Section B will be a long answer section (65%). Section B will contain six questions but students will be required to do only five.

Questions in the examination may be set to combine material from different sections of the prescription. Although no question will be set on the areas covered in the Specific Outcome 3.1 (Statistical Investigation), certain aspects of this outcome could be assessed as part of questions covering other areas of the prescription.

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 an appendix to this prescription.

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 must conform to the SPBEA Rules and Procedures governing electronic calculators.

Internal Assessment

This assessment will complement that provided by the written examination. It will emphasize those specific outcomes in the prescription for which assessment by an external examination is less appropriate, for example the ability to design, implement and analyse statistical projects or simulation experiments, or the ability to use computers effectively. The assessment should include the ability to present such work accurately, concisely and appropriately.

To meet the internally assessed component requirement, students will submit one or more pieces of written work, reporting on practical work undertaken by the student. While practical work is not restricted to any particular section or sections, every student is required to carry out the statistical investigation. The total amount of time spent on such work should be commensurate with its weight in the final assessment, i.e. about 20% of the total course time available.

The teacher has the discretion to decide whether the work should take the form of the statistical investigation only or include other additional smaller studies relating to different sections of the prescription. The statistical investigation must focus on the outcome 3.1 of the prescription. Not more than two other studies (three in all) may be conducted by any school for its internal assessment in any year.

As the statistical investigation is compulsory, outcome 3.1 will not be assessed directly in the external examination although various aspects of it can be assessed in other areas.

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 Summary Form (**MAS-IA**) and forward to SPBEA by the date set down by the Director. The form must clearly indicate the number of studies, in addition to the statistical investigation, to be undertaken by the school, the specific outcome and learning area each study will focus on, a brief outline of each study and the time (start and completion date) each study is intended to be undertaken.

The use of computers in the practical study is strongly encouraged. Possible aspects of computer use in this respect might include the development of special purpose programs and other software, the use of statistical, numerical, or graphics packages, the development or use of random number generators in simulation studies, etc.

Suitable practical topics can be found in all sections of the prescription. Some of the more obvious besides the practical statistical investigation, include practical optimization problems using linear programming or other methods, the development of special purpose software, etc.

Assessment should take cognisance of the level of initiative and originality shown by the candidate. This includes the ability to design, carry through and describe an appropriate study, and practical competence in handling computers or similar computational aids.

At the start of the year students should be given a copy of the assessment statement to be used. The assessment statement and copies of all assessment tasks and assessment schedules used, as well as a sample of candidate responses to all internal assessment work 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 SPBEA policy as specified from time to time.

Binomial Distribution

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

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

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

$n \setminus x$	0.05	0.1	0.15	$1/6$	0.2	0.25	π	0.3	$1/3$	0.35	0.4	0.45	0.5
4	0.8145	0.6561	0.5270	0.4823	0.4096	0.3164	0.2401	0.1975	0.1785	0.1296	0.0915	0.0625	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	0.2500
2	0.0133	0.0486	0.0975	0.1157	0.1536	0.2109	0.2646	0.2963	0.3105	0.3456	0.3675	0.3750	0.3750
3	0.0005	0.0036	0.0154	0.0256	0.0498	0.0756	0.1115	0.1536	0.2050	0.2500	0.2995	0.3456	0.3750
4	0.0001	0.0005	0.0015	0.0036	0.0081	0.0161	0.0309	0.0552	0.0840	0.1218	0.1665	0.2160	0.2660
5	0.7738	0.5905	0.4437	0.4019	0.3277	0.2373	0.1681	0.1317	0.1160	0.0778	0.0503	0.0313	0.0313
1	0.2036	0.3281	0.3915	0.4019	0.4096	0.3955	0.3292	0.3124	0.2592	0.2059	0.1563	0.1067	0.1067
2	0.0214	0.0729	0.1382	0.1608	0.2048	0.2637	0.3087	0.3292	0.3364	0.3369	0.3125	0.2750	0.2500
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	0.3125
4	0.0005	0.0022	0.0032	0.0032	0.0064	0.0146	0.0284	0.0412	0.0488	0.0768	0.1128	0.1563	0.1563
5	0.0001	0.0001	0.0003	0.0003	0.0003	0.0010	0.0024	0.0041	0.0053	0.0102	0.0185	0.0313	0.0313
6	0.7351	0.5314	0.3771	0.3349	0.2621	0.1780	0.1176	0.0878	0.0754	0.0467	0.0277	0.0156	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	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	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	0.3125
4	0.0001	0.0012	0.0035	0.0080	0.0154	0.0330	0.0595	0.0823	0.0951	0.1382	0.1861	0.2344	0.2344
5	0.0001	0.0004	0.0006	0.0015	0.0044	0.0102	0.0205	0.0369	0.0609	0.0938	0.1382	0.1861	0.1861
6	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0007	0.0014	0.0024	0.0041	0.0083	0.0156	0.0156
7	0.6983	0.4783	0.3206	0.2791	0.2097	0.1335	0.0824	0.0585	0.0490	0.0280	0.0152	0.0078	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	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	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	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	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	0.2188	0.2188
6	0.0001	0.0001	0.0001	0.0004	0.0013	0.0036	0.0064	0.0084	0.0172	0.0320	0.0547	0.0872	0.0872
7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0005	0.0006	0.0016	0.0037	0.0078	0.0078
8	0.6634	0.4305	0.2725	0.2326	0.1678	0.1001	0.0576	0.0390	0.0319	0.0168	0.0084	0.0039	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	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	0.1094
3	0.0054	0.0331	0.0839	0.1042	0.1468	0.2076	0.2786	0.2787	0.2786	0.2188	0.1569	0.1094	0.1094
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	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	0.2661	0.2661
6	0.0001	0.0002	0.0004	0.0011	0.0038	0.0100	0.0171	0.0217	0.0413	0.0703	0.1094	0.1569	0.1569
7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0004	0.0012	0.0024	0.0033	0.0079	0.0164	0.0313	0.0313
8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0007	0.0017	0.0039	0.0039
9	0.6302	0.3874	0.2316	0.1938	0.1342	0.0751	0.0404	0.0260	0.0207	0.0101	0.0046	0.0020	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	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	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	0.1641
4	0.0006	0.0074	0.0283	0.0391	0.0661	0.1168	0.1715	0.2048	0.2194	0.2508	0.2660	0.2461	0.2461
5	0.0001	0.0004	0.0015	0.0036	0.0081	0.0165	0.0389	0.0735	0.1024	0.1572	0.2128	0.2461	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	0.2188	0.2188
7	0.0001	0.0001	0.0001	0.0003	0.0012	0.0039	0.0073	0.0098	0.0212	0.0407	0.0703	0.1094	0.1094
8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0008	0.0020	0.0020
9	0.5987	0.3487	0.1969	0.1615	0.1074	0.0563	0.0282	0.0173	0.0135	0.0060	0.0025	0.0010	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	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	0.0439
3	0.0105	0.0374	0.0957	0.1298	0.1550	0.2013	0.2503	0.2668	0.2601	0.2522	0.1665	0.1172	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	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	0.2461
6	0.0001	0.0001	0.0002	0.0005	0.0012	0.0036	0.0068	0.0098	0.0162	0.0368	0.0689	0.1115	0.1115
7	0.0001	0.0001	0.0001	0.0002	0.0008	0.0031	0.0090	0.0163	0.0212	0.0425	0.0746	0.1172	0.1172
8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0004	0.0014	0.0030	0.0043	0.0106	0.0229	0.0439	0.0439
9	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0005	0.0016	0.0042
10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0010

(all other entries < 0.0001)

Poisson Distribution

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

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

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

$x \setminus \lambda$	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	0.3053	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	0.0001	0.0003	0.0007	0.0016	0.0030	0.0050	0.0077	0.0111	0.0153
5	0.0001	0.0001	0.0002	0.0004	0.0007	0.0012	0.0020	0.0031	0.0045	0.0061
6	0.0001	0.0001	0.0001	0.0002	0.0004	0.0007	0.0011	0.0017	0.0025	0.0035
7	0.0001	0.0001	0.0001	0.0001	0.0002	0.0004	0.0007	0.0011	0.0016	0.0022
8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0004	0.0007	0.0010	0.0015
9	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0004	0.0006	0.0009
10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002
11	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
12	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
13	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
14	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
15	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
16	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
17	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

(all other entries < 0.0001)

Appendix 2: Board's Rules and Procedures governing the use of electronic calculators in the Board's examinations

Written or printed materials (including information and routines stored in the programmable memory of calculators) are prohibited.

Due to rapid changes in calculator technology, the Board will regularly review its policy on the use of calculators in examinations. However, every effort is made to ensure that schools are given adequate notice of policy changes.

The following policy aims to compromise between rewarding the appropriate use of technology while giving consideration to associated equity issues. The Board has a responsibility to ensure fairness and equity to all candidates.

Exam setters are aware of calculator technology, and take calculator capability into account in the design of examination questions and marking schedules.

General Policy

The SPBEA *Assessment and Certification Rules and Procedures for Secondary Schools* allow candidates to use a calculator in any of its examinations provided that the calculator is silent, hand-held, non-printing and contains its own power source. However, calculators may not be used to pass information to other candidates, bring information into the examination, or as a dictionary/translator.

SPBEA encourages examiners to set papers that examine understanding of concepts in such a way that the use of sophisticated calculators is not a significant advantage. Examination questions may require details of working steps to be shown to ensure that candidates understand the key concepts being assessed.

SPBEA's policy on calculators in examinations allows the legitimate use of most types of calculator, including graphical and programmable calculators. The intention of the policy is to support the directions of curriculum development and encourage the appropriate use of calculator technology. The policy does not allow the use of calculators to contravene other examination rules and procedures.

The exception to the above paragraph is the use of any calculator that has symbolic algebraic manipulation capability. These will continue to be prohibited in all of the Board's examinations as they may offer candidates who use them a significant advantage over other candidates.

The following models have currently been identified as having this capability:

- Texas Instruments T189
- Texas Instruments T192
- Texas Instruments T192 Plus
- Casio CFX 9970G
- Casio Algebra FX 2.0
- Hewlett Packard HP48G
- Hewlett Packard HP48GX
- Hewlett Packard HP49G

SPBEA may from time to time publish more detailed rules for the use of calculators, or further add to the list of prohibited calculators.

Information For Students

The *Instructions to Candidates* booklet, which is issued to all candidates prior to the examination period, summarises the above rules and procedures and also states:

CALCULATORS

Candidates are recommended to take a calculator into the examination room for subjects where they have used a calculator during the year. For subjects where a scientific calculator has been used during the year, this should be taken to the examination.

Candidates bringing more sophisticated calculators into an examination room may be subjected to additional scrutiny by supervisors.

Any possible misuse of calculators during an examination will be handled through the Board's standard procedures for investigating possible misconduct in examinations.

ADVISORY SECTION

1. Suggested Texts

This is a list of only some Mathematics texts that are available and have been used for teaching the course for University Bursary 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)

B. Supplementary Texts

1. Statistics Workbook - Lakeland, R & Nugent, C, Nulake, 1998
2. Year 13 Study Guide, *Mathematics with Statistics* - Barrett, ESA
3. Longman write-on Notes – *Statistics* Barton, D.
4. Bursary Statistics – Questions from the last 8 bursary papers with suggested answers.

Really Useful Resources
Box 19-939
Woolston
Christchurch

5. Schaum's Outlines, Probability and Statistics, 2nd edition, Spiegel et al, McGraw Hill – a metal teacher resource.
6. Study Pass reference notes: Year 13 Statistics, info@studypass.co.nz.
7. Time Series resources - Stats NZ
 - Yearbook
 - PCINFOS online.
 - Met service
 - weather stats
 - Business Indicators – share index
 - exchange rates
 - The internet
8. Statistics Website www.tki.org.nz

2. Suggested Teaching Programme

This is an example of a teaching programme (timeline) showing the time that needs to be spent on different learning outcomes on which teachers can base their schemes of work. With countries/schools in the region having a variety of term times, teachers will need to plan their own programmes using this as a guide.

Pacific Islands High School Teaching Programme – Form 7 Mathematics with Statistics

Week	Learning Outcome	Prescription Reference	Assessment
Term I			
1	Basic Probability	1.1	
2	Basic Probability/Expected Values	1.2/1.3	
3	Expected Values	1.3	
4	Binomial/Poisson		
5	Poisson/Normal		
6	Normal/Approximations		
7	Permutations and Combinations	2.1	
8	Binomial Theorem	2.2	
9	Graphing/Sampling Methods	3.1	
10	Calculation and Interpretation of sample statistics	3.2	
11	Sampling distribution of mean and proportion/sample statistics	3.3	
12	Central Limited Theorem	3.3	
13			
Term II			
1	Confidence Interval	3.4	
2	Confidence Interval	3.4	
3	Solving equations 2x2 and 3x3	4.1	
4	Exam Revision		
5	Exam Time		Exam
6	Consistency and uniqueness of solutions/Bisection Method	4.2	
7	Newton-Raphson Method	4.3	
8	$y = x^a$ and piece-wise functions	5.1	
9	Power functions and exponentials	5.2	
10	Power functions and exponentials /Linear Programming	5.2/5.3	
11	Linear Programming	5.3	
12	Differentiation	6.1	
13	Application of differentiation	6.2	
14	Application of differentiation	6.2	
Term III			
1	Sequences and Series	7.1	
2	Sequences and Series	7.2	
3	Features of Time Series	8.1	
4	Smoothing	8.2	

5	Prediction	8.3	
6	Revision		
7	Exam Time		Exam
8	Go over Exam		
9	Revision/exam preparation		
10	Revision/exam preparation		
11	Revision/exam preparation		

South Pacific Board for Educational Assessment

MAS-IA

SOUTH PACIFIC FORM SEVEN CERTIFICATE

MATHEMATICS (with Statistics)

IA Summary Form

Country: _____

School: _____

Learning Area	Specific Outcome	Brief Outline of Study	Start Date	Finish Date	Weight (%)
Statistics	3.1	<u>Statistical Investigation</u>			
Total					20%

Teacher: _____