141/1

MARKER CODE

Student Personal Identification Number

South Pacific Form Seven Certificate

MATHEMATICS WITH STATISTICS
2021

QUESTION and ANSWER BOOKLET

Time allowed: Three hours

(An extra 10 minutes is allowed for reading this paper.)

INSTRUCTIONS

Write your **Student Personal Identification Number (SPIN)** in the space provided on the top right-hand corner of this page.

Answer **ALL QUESTIONS**. Write your answers in the spaces provided in this booklet.

Show all working. Unless otherwise stated, numerical answers correct to **three significant figures** will be adequate.

If you need more space for answers, ask the Supervisor for extra paper. Write your SPIN on all extra sheets used and clearly number the questions. Attach the extra sheets at the appropriate places in this booklet.

Major Learning Outcomes (Achievement Standards)	Skill Level & Number of Questions				Weight/ Time
	Level 1 *Uni-structural*	Level 2 *Multi-structural*	Level 3 *Relational*	Level 4 *Extended Abstract*	
Strand 1: Probability Develop knowledge and skills related to probability in order to solve problems and to investigate situations involving elements of chance.	6	2	2	1	20% 60 min
Strand 2: Modelling Using Graphical Methods Model situations using graphical methods in order to solve problems.	6	4	1	0	17% 51 min
Strand 3: Statistical Investigations Carry out statistical investigations and understand statistical processes.	3	2	1	0	10% 30 min
Strand 4: Numerical and Algebraic Methods Use numeric and algebraic methods to solve problems.	2	2	1	1	13% 39 min
TOTAL	**17**	**10**	**5**	**2**	**60% 180 min**

Check that this booklet contains pages 2–17 in the correct order and that none of these pages are blank.

HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

STRAND 1: PROBABILITY

Assessor's use only

1.1 **For question 1.1, circle the letter of the BEST answer.**

The set of all possible outcomes of an experiment is called

A.	a trial.
B.	an event.
C.	a population.
D.	the sample space.

Unistructural	
1	
0	
NR	

1.2 Define the term **independent events**.

Unistructural	
1	
0	
NR	

1.3 The probability that a person owns a mobile phone is 0.75, that a person owns an iPad is 0.25 and that a person owns both a mobile phone and an iPad is 0.18.

Draw a Venn diagram to find the probability that the person owns either a mobile phone or an iPad but not both.

Relational	
3	
2	
1	
0	
NR	

Assessor's use only

1.4a State **one** property of a **normal distribution**.

Unistructural	
1	
0	
NR	

1.4b **For question 1.4b, circle the letter of the BEST answer.**

A binomial distribution has **two** parameters. One of the parameters is the number of trials, n.

Which of the following is the other parameter?

A.	the mean, μ
B.	the standard deviation, σ.
C.	the probability of success, p.
D.	the probability of failure, q.

Unistructural	
1	
0	
NR	

1.4c The probability that a bean seed germinates is 0.8.

If five such seeds are planted, what is the probability that **three or more** seeds germinate?

Relational	
3	
2	
1	
0	
NR	

Assessor's use only

1.5a

For question 1.5a, circle the letter of the BEST answer.

A random variable that assumes only a finite number of values is called a

A.	constant.
B.	random variable.
C.	discrete random variable.
D.	continuous random variable.

Unistructural	
1	
0	
NR	

1.5b

Define the term **standard deviation**.

Unistructural	
1	
0	
NR	

1.5c

Use the following table to answer questions 1.5c and 1.5d.

A random variable X has probability distribution as shown in the table.

X	1	2	3	4	5
P(X)	0.1	0.3	0.2	0.3	0.1

Calculate the **expected value** of **X**.

Multistructural	
2	
1	
0	
NR	

Assessor's use only

1.5d	Calculate the **standard deviation** of **X.**	**Multistructural** 2 1 0 NR
1.6	The lifetime of a particular brand of television is normally distributed with a mean of 7.2 years and standard deviation of 2.2 years. If the manufacturer is willing to replace 1.5% of all televisions due to early failure, what should be the guarantee period?	**Extended Abstract** 4 3 2 1 0 NR

STRAND 2: MODELLING USING GRAPHICAL METHODS

Assessor's use only

2.1 State **one** feature of a quadratic function.

Unistructural	
1	
0	
NR	

2.2 A function can be either continuous or discontinuous.

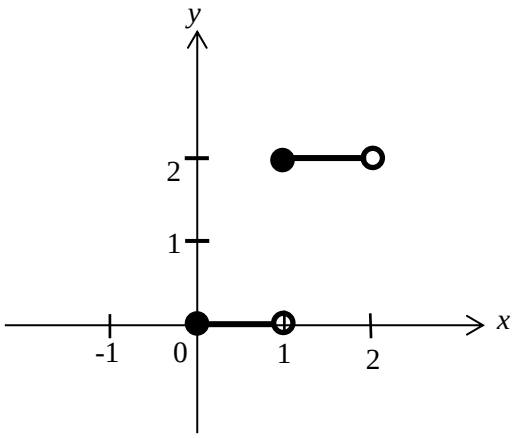
Define **discontinuous** function.

Unistructural	
1	
0	
NR	

2.3a State the general form of a **power** function.

Unistructural	
1	
0	
NR	

2.3b The graph of a piece-wise function, $f(x)$ is shown below.

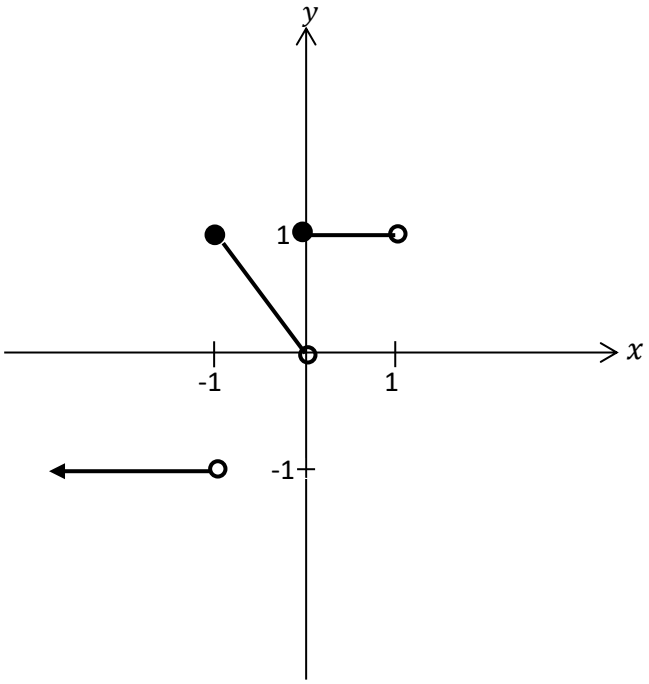


Determine the value of $f(1)+1$.

Multistructural	
2	
1	
0	
NR	

Assessor's use only

2.4 Consider the piecewise function given below.

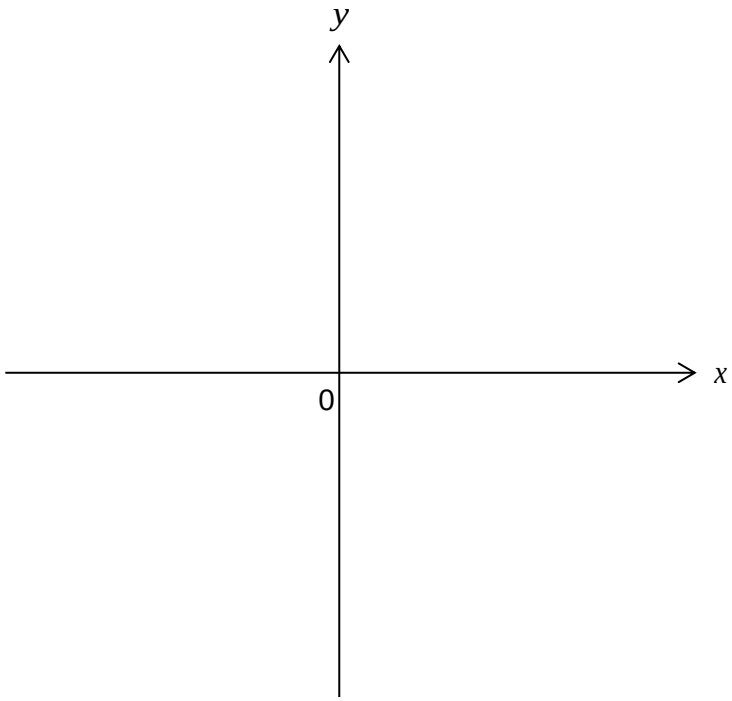


Write the equation of the function.

Relational	
3	
2	
1	
0	
NR	

Assessor's use only

2.5a Sketch the graph of $y = \left(\frac{1}{2}\right)^x$ clearly showing all relevant intercepts.



Unistructural	
1	
0	
NR	

2.5b Solve the equation $2^x = 32$

Multistructural	
2	
1	
0	
NR	

Assessor's use only

2.6a	A bacteria culture grows according to the equation $N = 10e^{1.5t}$ where *N* is the number of bacteria after *t* hours. Calculate the time (in hours) when the number of bacteria reaches 100.	**Multistructural** 2 1 0 NR
2.6b	Define the term **objective function** as used in linear programming problems.	**Unistructural** 1 0 NR

Assessor's use only

2.7a	Define the term **vertex** as used in a linear programming problem.	**Unistructural** 1 0 NR
2.7b	A woman started making handmade paintings and cards to earn a living. She sells the painting for \$40 and the card for \$15. It takes 2 hours to complete 1 painting and 30 minutes to make a single card. She spends at most 15 hours a week on making paintings and cards and she should not make more than 10 paintings and cards in a week. She makes a profit of \$20 on each painting and \$10 on each card. Let: x = number of paintings; and y = number of cards Write down **two** constraints for the above situation.	**Multistructural** 2 1 0 NR

STRAND 3: STATISTICAL INVESTIGATIONS

Assessor's use only

3.1a

For question 3.1a, circle the letter of the BEST answer.

The type of data that uses two sets of variables that can change is called

A.	bivariate.
B.	univariate.
C.	dependent.
D.	independent.

Unistructural	
1	
0	
NR	

3.1b

Pearson's correlation coefficient, r, is given as:

$$r = \frac{n(\sum xy) - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

State **one** property of the Pearson's correlation coefficient, r.

Unistructural	
1	
0	
NR	

3.2

State the **central limit theorem** as used in statistics.

Unistructural	
1	
0	
NR	

Assessor's use only

3.3 Eight students, randomly selected from a large class size were asked to keep a record of the hours they spent on studying before the midterm examination. The table given below shows the number of hours these eight students studied before the midterm exam and their respective scores.

Hours studied	12	7	15	8	18	6	9	11
Midterm score	87	78	97	80	95	57	74	67

The Pearson's correlation coefficient, r, was found to be 0.80.

Write a concluding statement about the data, based on the given value of the correlation coefficient, r.

Multistructural	
2	
1	
0	
NR	

Assessor's use only

3.4	Calculate the **minimum** sample size that is required from a population with a standard deviation of 7 cm and margin of error of 1 cm for a 95% confidence level.	**Multistructural** 2 1 0 NR
3.5	A random sample of 144 coconuts has a mean weight of 680 grams with a standard deviation of 44 grams. Calculate the 90% confidence interval for the population mean.	**Relational** 3 2 1 0 NR

STRAND 4: NUMERICAL AND ALGEBRAIC METHODS

Assessor's use only

4.1 State **one** type of solution when solving systems of linear equations.

Unistructural	
1	
0	
NR	

4.2 Give **one** advantage of using the bisection method to approximate the root of a function.

Unistructural	
1	
0	
NR	

4.3 The cost of admission to a local dance concert was \$180 for 12 children and 3 adults. The admission to another dance concert was \$124 for 8 children and 3 adults.

Let: x = the cost of admission for a child; and

y = the cost of admission for an adult.

Write a linear system of equations for the above situation.

Multistructural	
2	
1	
0	
NR	

Assessor's use only

4.4 A system of linear equations is given below.

$$5x + y = 4$$

$$2x - 3y = 5$$

Describe the nature of the solutions.

Multistructural	
2	
1	
0	
NR	

Assessor's use only

4.5 Solve the following system of linear equations.

$$x + y - z = 4$$
$$x - 2y + 3z = -6$$
$$2x + 3y + z = 7$$

Relational	
3	
2	
1	
0	
NR	

Assessor's use only

4.6 Given that $f(x) = x^4 - 5x^3 + 9x + 3$ and the starting point $x_0 = 5$, use the Newton-Raphson method to compute x_1, x_2, x_3 and x_4.

Extended Abstract	
4	
3	
2	
1	
0	
NR	

THE END