

South Pacific Form Seven Certificate MATHEMATICS WITH CALCULUS 2022

QUESTION and ANSWER BOOKLET

Time allowed: Three hours (An extra 10 minutes is allowed for reading this paper.)

INSTRUCTIONS

- 1. Write your **Student Personal Identification Number (SPIN)** in the space provided on the top righthand corner of this page.
- 2. Answer **ALL QUESTIONS**. Write your answers in the spaces provided in this booklet.
- 3. Show all your working. Unless otherwise stated, numerical answers correct to **three significant figures** will be adequate.
- 4. 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.

	Skill Level & Number of Questions				Weight/
Major Learning Outcomes (Achievement Standards)	Level 1 Uni- structural	Level 2 Multi- structural	Level 3 Relational	Level 4 Extended Abstract	Time
Strand 1: Algebra Apply algebraic techniques to real and complex numbers.	14	1	-	1	20% 60 min
Strand 2: Trigonometry Use and manipulate trigonometric functions and expressions.	3	2	1	-	10% 30 min
Strand 3: Differentiation Demonstrate knowledge of advanced concepts and techniques of differentiation.	1	3	-	2	15% 45 min
Strand 4: Integration Demonstrate knowledge of advanced concepts and techniques of integration.	2	3	1	1	15% 45 min
TOTAL	20	9	2	4	60% 180 min

Check that this booklet contains pages 2–23 in the correct order and that none of these pages are blank. A four-page booklet (No. 108/2) containing mathematical formulae and tables is provided.

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

		Assessor's use onl
1.1	Simplify $\frac{2y}{3} - \frac{y}{4}$	
		Unistructural
		0
		NR
1.2	Solve this pair of simultaneous equations: 2x - y = 7 $3x + y = 13$	
		Unistructural
		1
		0
		NR

STRAND 1: ALGEBRA

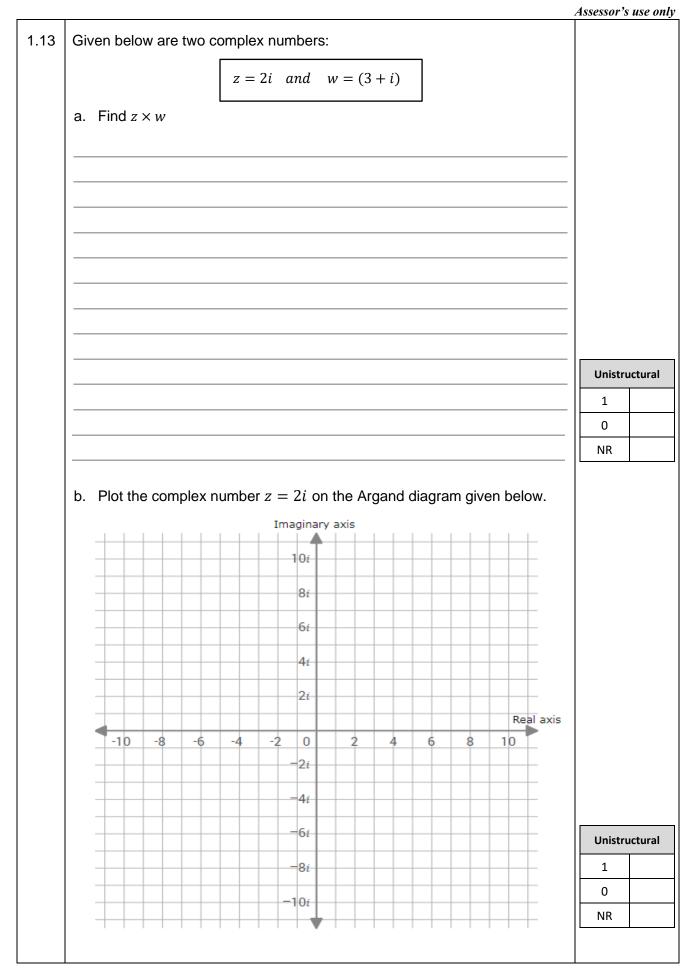
1.3	In the formula $T = a + (n - 1)d$, make d as the subject.		
		Unistru	ictural
		1	
		0	
		NR	
1.4	Factorise $x^2 + 9x - 70$		
		Unistru	ictural
		1	
		0 NR	

		Assessor's use only
1.5	Solve the equation, $log_{16} x = \frac{3}{2}$	
		Unistructural
		1 0
		NR
1.6	Simplify $\frac{24x^4y^{11}z}{3x^2yz^7}$	
	3x²yz'	
		Unistructural
		0 NR

1.7	Simplify 3log4 – 2log2 by writing as a log of a single number.	
		Unistructural 1 0 NR
1.8	Determine the remainder when $2x^3 + 5x - 6$ is divided by $x - 1$	Unistructural
		1 0 NR

		Assessor's use only
1.9	Use the Binomial Theorem to expand and simplify $(1 - 2x)^4$	Assessor's use only
		Unistructural
		1
		0
		NR
1.10	Simplify $\sqrt{8} + \sqrt{32}$	
		Unistructural
		0
		NR

	7	Assessor's use only
4 4 4	Solve $\frac{1+x}{8} = \frac{2+x}{4}$	
1.11	Solve $\frac{-1}{8} = \frac{-1}{4}$	
		Unistructural
		1
		0
		NR
1.12	Solve $2^{x-3} = 32$	
		Unistructural
		1
		0
		NR



1.14	Use the factor theorem to factorise $x^3 + 2x^2 - 5x - 6$ completely.	
		Multistructural
		2
		0
		NR

1.15	Solve the equation		
	$Z^4 = 256 (\cos 120^\circ + i \sin 120^\circ)$		
	using De Moivre's Theorem to obtain the four distinct complex roots and represent these roots on an Argand diagram.		
		F. A I	
		Extend Abstra	
		4	
		2	
		1	
		NR	

-		Assessor's	s use only
2.1	Evaluate $\cot\left(\frac{\pi}{4}\right)$		
		Unistru 1	ctural
		0 NR	
2.2	Prove that $(1 + \cot^2 \theta)(1 - \cos^2 \theta) = 1$		
		Multi-str	uctural
		2	
		0	
		NR	

STRAND 2: TRIGONOMETRY

Assessor's	use	only	

						Assessor's use only
2.3	Solve the ed	$\sqrt{2} \sin \theta$	$\theta = 1$ where $0^{\circ} \leq$	$\leq \theta \leq 360^{\circ}$		
						Unistructural
						1
						0
						NR
2.4	Use the grid	below to sketo	the graph of y	$= -2 \cos x$ for ($0 \le x \le 2\pi$	
	tу					
					~	
	0	π	π	3π	χ 2π	
		$\frac{\pi}{2}$	n	$\frac{3\pi}{2}$	211	
						Unistructural
	1					1
						0
						NR

npound Angle Formula. [Show your working]
Mu
2

2.6 Two people swing jump ropes, as shown in the diagram below. The highest point of the middle of each rope is 75 inches above the ground, and the lowest point is 3 inches. The rope makes 2 revolutions per second. 75 in. above-ground 3 in. above ground. Not drawn to scale A model equation for the height h (in inches) of a rope as a function of the time t (in seconds) given that the rope is at its highest point when t = 0 is in the form: $h(t) = ACos (Bt \pm C) \pm D$ Find the values of A, B, C and D. Relational 3 2 1 0 NR

3.1 The graph of a piece-wise function, g(x) is given below. Use the graph to answer the question that follows. э 4 3 2 1 5 -3 -2 2 3 4 -1

STRAND 3: DIFFERENTIATION

3.2

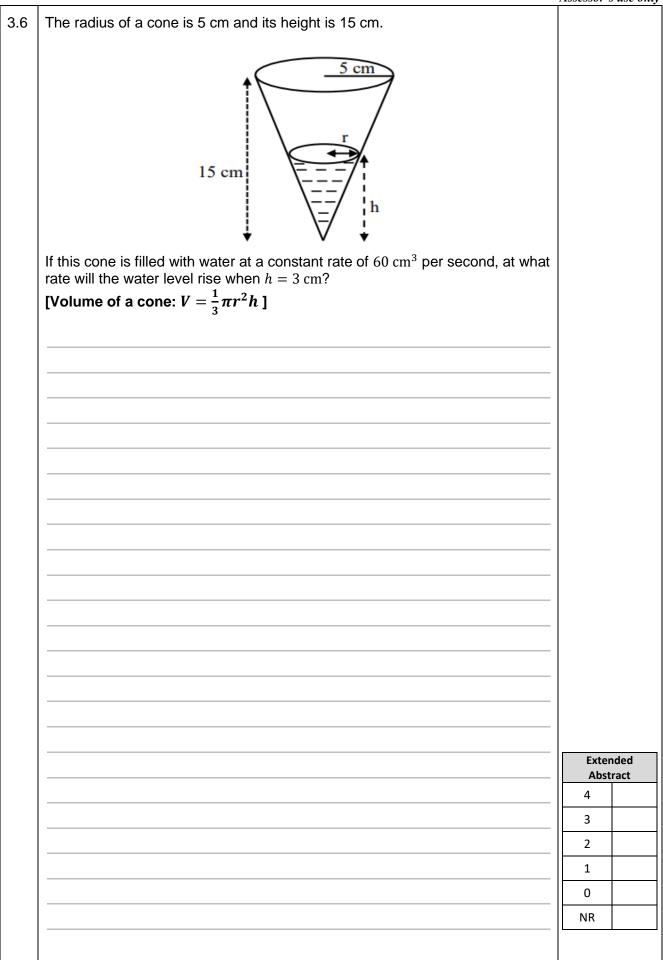
	1	
Find the value(s) of x for which $g(x)$ is discontinuous?	0	
	NR	
Evaluate $\lim_{x \to -3} \frac{x^2 + 5x + 6}{x + 3}$		
	Multi-st	ructural
	2	
	1	
	0	
	NR	
	1	

Assessor's use only

Unistructural

	10	Assessor's use only
3.3	Evaluate $\lim_{x \to \infty} \frac{5x(x-2)}{3x^2 - 2x + 1}$	Assessor's use only
		Multi-structural 2 1 0 NR
3.4	Find the second derivative of the function $f(x)$ given that: $f(x) = 4x^3 - 3x + e^x - 1$	
		Multistructural 2 1 0 NR

3.5	The displacement, <i>s</i> metres, of a particle moving in a straight line in <i>t</i> seconds		
	is given by the formula:		
	$s(t) = t^3 + 3t^2 + 2t$		
	Find the initial acceleration of the particle.		
		Exten Abst	
		4	
		3	
		2	
		0	
		NR	



	STRAND 4:	INTEGRATION	Assessor's use only
4.1	Find $\int x^{1/2} dx$		
			_
			Unistructural
			1
			0
			NR
4.2	Find $\int 2e^{5x} dx$		
			Unistructural
			NR

Assessor's use only Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} 2\cos x \, dx$ 4.3 Multistructural 2 1 0 NR The region bounded by the curve $y = x^2 - 4$ and the x-axis between x = 24.4 and x = 3 is shown in the graph below. у $y = x^2 - 4$ 5 4 3 2-1-0 -1 4 -4 -3 2 1 2 3 -1--2 --3 -2 -5 -Find the area of the shaded region. Multistructural 2 1 0 NR

	Assessor's use only
.5 The velocity, $v m/s$, of a stone fired vertically upwards from the catapult high is given by the formula: v = 180 - 10t a. When is the stone at rest?	20 m
a. When is the stone at rest?	
	Multistructural 2
	1 0 NR
b. Calculate the height of the stone above the ground after 5 seconds.	
	Relational
	3 2
	0
	NR

4.6	The Covid-19 virus spreads through a town of 12000 people at a rate proportional to the number of people infected by the virus, which can be shown mathematically by the expression: $\frac{dN}{dt} \alpha N$		
	whereby \boldsymbol{N} is the number of people infected and \boldsymbol{t} is the time in days.		
	Initially one person has the virus. If half the population is infected after 10 days, when will three-quarters of the population be infected?		
		Exten	
		Abst 4	raci
		3	
		2	
		1	
		0	
		NR	

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