MARKER CODE





Student Personal Identification Number

South Pacific Form Seven Certificate MATHEMATICS WITH CALCULUS 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.

	Skill	Level & Num	ber of Quest	ions	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 2–22 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.

STRA	ND 1: ALGEBRA	Assessor'	's use only
1.1	Two straight lines $2x + y = 4$ and $y = x - 5$ intersect at point P. Find the coordinates of P.	Assessor'	<u>s use onl</u> y
		Unistr 1 0 NR	uctural
1.2	Solve the inequation $3(2 - x) \le -18$	Unistr 1	ructural
		0 NR	

		Assessor's use only
1.3	Make x the subject of the relation $y = \frac{3x}{2} + h$	
		Unistructural
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		0
		NR
1.4	Factorise $3x^2 + 11x + 10$	
		Unistructural
		1
		0
		NR

	Assessor's	use	only
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1.5	Solve the quadratic equation $x^2 - 7x - 44 = 0$		
		Unistru 1 0 NR	ctural
1.6	Simplify $(xy^2)^4 \times (3x^2y)^2$		
		Unistru 1 0 NR	ctural

1.7	Use the rules of logarithms to simplify $\frac{3log2+log4}{log8}$		
		Unistru	ictural
		1	
		0	
		NR	
1.8	Divide $x^3 + 4x^2 - x + 3$ by $(x + 2)$, writing the answer in quotient plus remainder form.		
		Unistru	ictural
		1	
		0	
		NR	

1.9	Calculate the remainder when $x^3 + 3x^2 - x + 7$ is divided by $(x - 2)$.		
		Unistru 1 0 NR	Ictural
1.10	Expand and simplify $3\sqrt{2}(\sqrt{2} - \sqrt{8})$		
		Unistru 1 0 NR	Ictural

	Assessor's	use	only
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1.11	Solve $\frac{12x-4}{5} = 3x + 1$		
		Unistru 1 0 NR	Ictural
1.12	Use the Binomial Theorem to expand $(2x + y)^3$		
		Unistru 1 0 NR	Ictural

Given below are two complex numbers: $z = (-1+i)$ and $w = (2-i)$ a. Find $z + \overline{w}$			Assessor's u	ise only
a. Find $z + \overline{w}$.13	Given below are two complex numbers:		
		z = (-1+i) and $w = (2-i)$		
1 0 NR b. Express z in polar form, i.e. z = r(cosθ + isinθ) or z = rcisθ.		a. Find $z + \overline{w}$		
1 0 NR b. Express z in polar form, i.e. z = r(cosθ + isinθ) or z = rcisθ.				
1 0 NR b. Express z in polar form, i.e. z = r(cosθ + isinθ) or z = rcisθ.				
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1 0 NR b. Express z in polar form, i.e. z = r(cosθ + isinθ) or z = rcisθ.			Unistruct	tural
b. Express z in polar form, i.e. z = r(cosθ + isinθ) or z = rcisθ.				
b. Express z in polar form, i.e. z = r(cosθ + isinθ) or z = rcisθ.			0	
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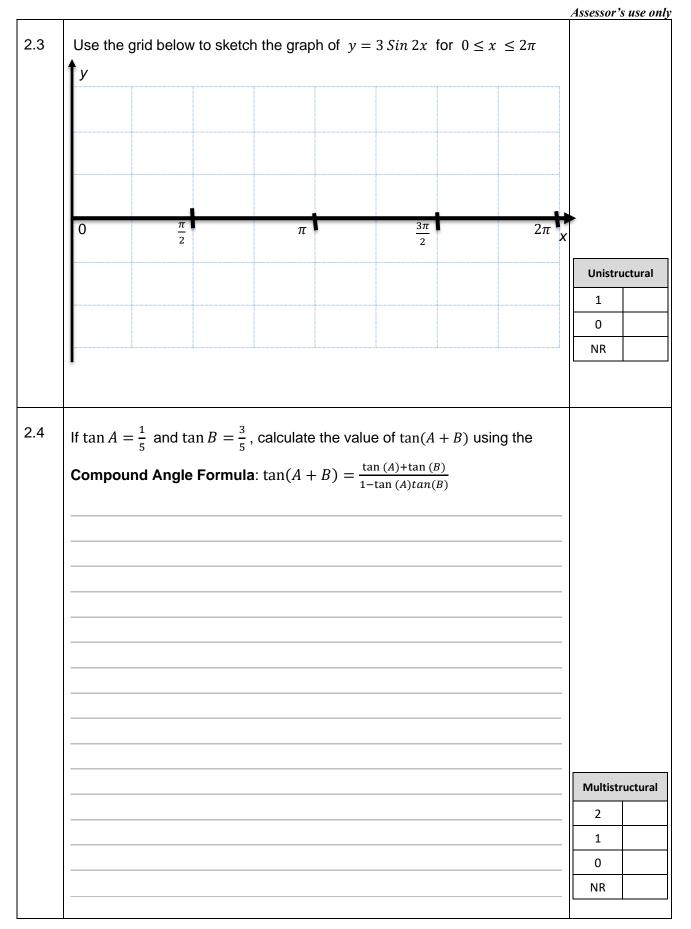
Assessor's use only

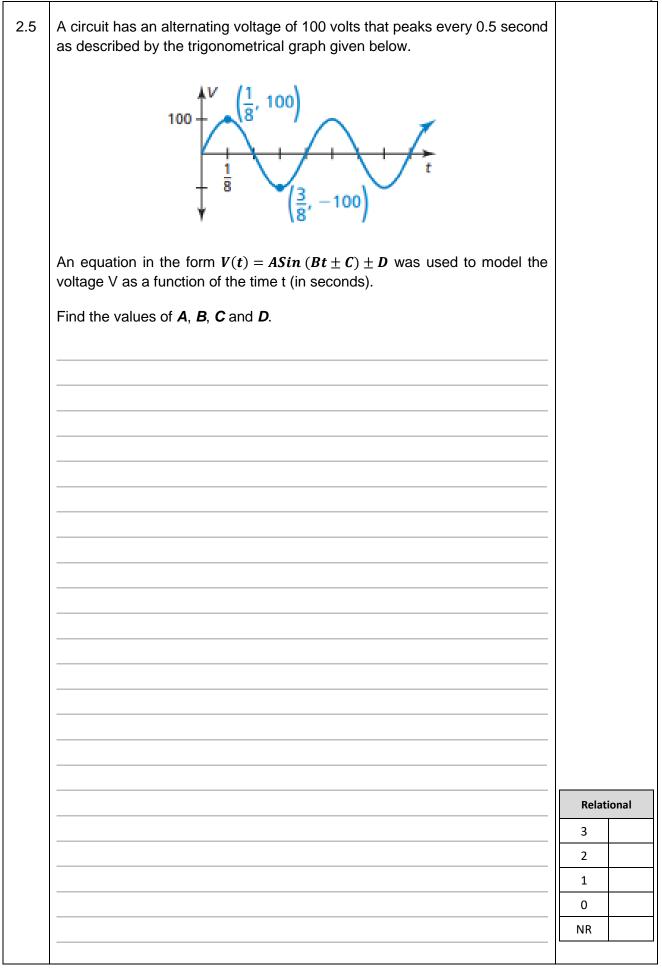
c. Find $\frac{z}{w}$		
W		
	Multist	tructural
	2	
	1	
	0	
	NR	+

Th	The polar form of a complex number Z is given as: $Z = (A (x + z))^{2} + i x + z = 0$		
	$Z = 64 \left(\cos 60^\circ + i \sin 60^\circ\right)$		
	se De Moivre's Theorem to find the three roots of the above equation and represent these roots on the Argand diagram.		
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		Abs	ended stract
		4	
		2	
		1	
			_

Assessor's use only Prove the following identities: 2.1 a. $tan\theta.csc\theta = sec\theta$ Unistructural 1 0 NR b. $\sin^2 \theta \cdot \cot^2 \theta + \sin^2 \theta = 1$ Multi-structural 2 1 0 NR Find the solution set for $2\cos\theta = -\sqrt{3}$ where $0^{\circ} \le \theta \le 360^{\circ}$. 2.2 Unistructural 1 0 NR

STRAND 2: TRIGONOMETRY





3.1 The graph of a piece-wise function, p(x) is given below. Use the graph to answer the questions that follow. p(x)5 4 3 2 1 X -3 4 -1 3 5 6 2 7 2 -1 Unistructural -2 1 0 At which value(s) of x is p(x) not differentiable? NR Evaluate $lim_{x \to 3} \frac{x^2 - 9}{x - 3}$ 3.2 Multi-structural 2 1 0 NR

STRAND 3: DIFFERENTIATION

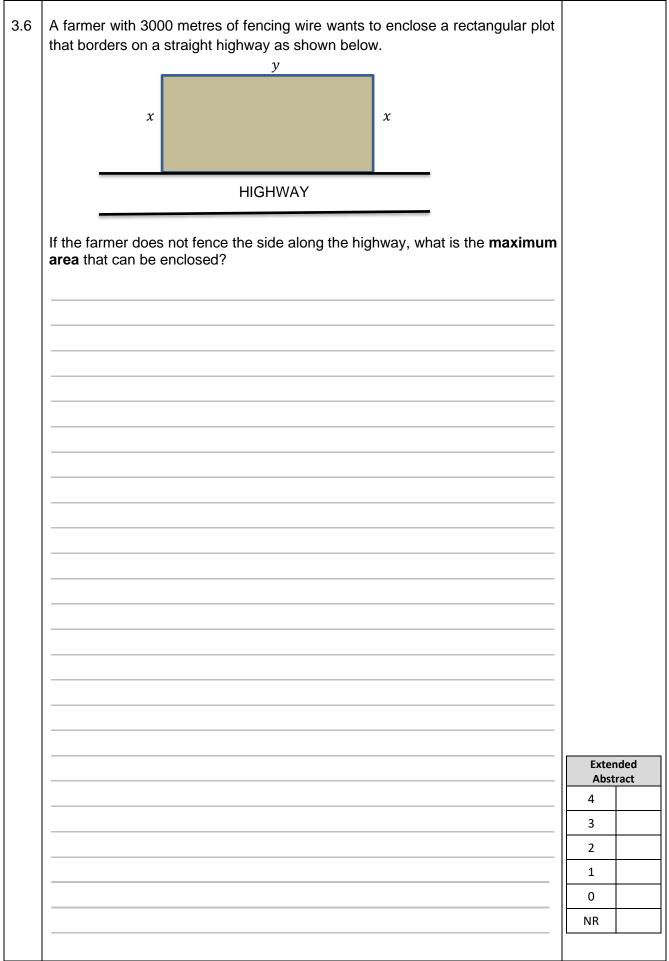
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Assessor's use only

Assessor's	use	onlv
1000000000000	nsc	Unity

3.3	Evaluate $lim_{x \to \infty} \frac{x^2 - 4x^3 + x - 3}{x^3 - 6x}$		
		Multi-str	uctural
		2	
		1	
		0	
		NR	
3.4	Find the derivative of the given function: $f(x) = x^7 + 5e^{3x} - 2x^{-2} + x - 17$		
		Multistr	uctural
		2	
		1	
		NR	

			Assessor's use only
3.5	starting point with respec	th line and its displacement, <i>s</i> , in metres from the st to time, <i>t</i> , is given by the equation below. $s(t) = -t^3 + 3t^2 - 3t + 12$	
	What is the <i>acceleration</i>	of the body at $t = 3$ seconds?	
			Extended Abstract
			4 3
			2
			0 NR



	STRAND 4: INTEGRATION	Assessor's use only
4.1	Find $\int \left(12x^5 + \frac{1}{2}x^2 - x\right) dx$	
		Unistructural 1 0 NR
4.2	Find $\int \frac{1}{2} e^{4x+3} dx$	
		Unistructural 1 0 NR

		Assessor'	s use only
4.3	Evaluate $\int_{-1}^{4} (3x^2 - 2) dx$		
		Multistr	uctural
		2	
		1	
		0	
		NR	
4.4	Find the indefinite integral of $\int 8x \cos 4x^2 dx$		
	[Hint: Let $u = 4x^2$]		
		Multist	ructural
		2	
		1	
		0 NR	
			<u> </u>

		Assessor's use only
4.5	A mechanical rabbit starts moving from a fixed point in a straight line, and its velocity is given by the equation:	
	$v = 3t^2 - 4t - 8 m/s$	
	a. What is the velocity of the rabbit when <i>t</i> = 3 <i>seconds</i> ?	
		Multistructural
		2
		1
		0
		NR
	b. Find the distance from the rabbit to the point after 1 <i>s</i> , given that the initial displacement = 0 <i>m</i> .	
		Relational
		3
		1
		0
		NR

		Assessor's	s use onl
1.6	The population growth of a colony of mosquitoes obeys the uninhibited growth equation:		
	$\frac{dP}{dt} \alpha P$		
	If there are 1500 mosquitoes initially, and 2500 mosquitoes after 1 day, show		
	that the amount present (P) at any time, t, is given by the expression $P = P_0 e^{kt}$,		
	and hence, find the size of the mosquito population after 3 days.		
		Exter	
		Abst	ract
		4	
		3	
		1	
		0	
		NR	
			<u> </u>

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