

MARKER CODE


 Pacific
Community
Communauté
du Pacifique
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.

Major Learning Outcomes (Achievement Standards)	Skill Level & Number of Questions				Weight/ Time
	Level 1 <i>Uni- structural</i>	Level 2 <i>Multi- structural</i>	Level 3 <i>Relational</i>	Level 4 <i>Extended Abstract</i>	
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.

STRAND 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**.

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1.2 Solve the inequation $3(2 - x) \leq -18$

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1.5	Solve the quadratic equation $x^2 - 7x - 44 = 0$ <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1"> <thead> <tr> <th colspan="2">Unistructural</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </tbody> </table>	Unistructural		1		0		NR	
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1.6	Simplify $(xy^2)^4 \times (3x^2y)^2$ <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1"> <thead> <tr> <th colspan="2">Unistructural</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </tbody> </table>	Unistructural		1		0		NR	
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1.7	Use the rules of logarithms to simplify $\frac{3\log 2 + \log 4}{\log 8}$	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="background-color: #cccccc;">Unistructural</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="width: 20px;"></td> </tr> <tr> <td style="text-align: center;">0</td> <td></td> </tr> <tr> <td style="text-align: center;">NR</td> <td></td> </tr> </tbody> </table>	Unistructural		1		0		NR	
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1.8	Divide $x^3 + 4x^2 - x + 3$ by $(x + 2)$, writing the answer in quotient plus remainder form.	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="background-color: #cccccc;">Unistructural</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="width: 20px;"></td> </tr> <tr> <td style="text-align: center;">0</td> <td></td> </tr> <tr> <td style="text-align: center;">NR</td> <td></td> </tr> </tbody> </table>	Unistructural		1		0		NR	
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1.9

Calculate the remainder when $x^3 + 3x^2 - x + 7$ is divided by $(x - 2)$.

Unistructural

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1.10

Expand and simplify $3\sqrt{2}(\sqrt{2} - \sqrt{8})$

Unistructural

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<p>1.11</p>	<p>Solve $\frac{12x-4}{5} = 3x + 1$</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1"> <thead> <tr> <th colspan="2">Unistructural</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </tbody> </table>	Unistructural		1		0		NR	
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<p>1.12</p>	<p>Use the Binomial Theorem to expand $(2x + y)^3$</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1"> <thead> <tr> <th colspan="2">Unistructural</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </tbody> </table>	Unistructural		1		0		NR	
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1.13 Given below are two complex numbers:

$$z = (-1 + i) \quad \text{and} \quad w = (2 - i)$$

a. Find $z + \bar{w}$

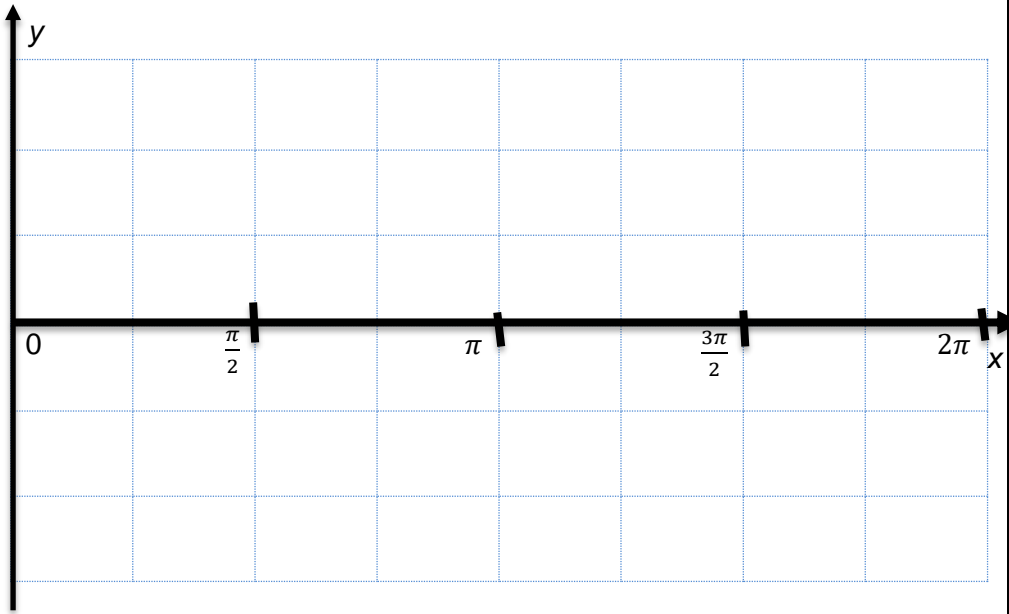
b. Express z in polar form, i.e. $z = r(\cos\theta + i\sin\theta)$ or $z = rcis\theta$.

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2.3

Use the grid below to sketch the graph of $y = 3 \sin 2x$ for $0 \leq x \leq 2\pi$



Unistruktural

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2.4

If $\tan A = \frac{1}{5}$ and $\tan B = \frac{3}{5}$, calculate the value of $\tan(A + B)$ using the

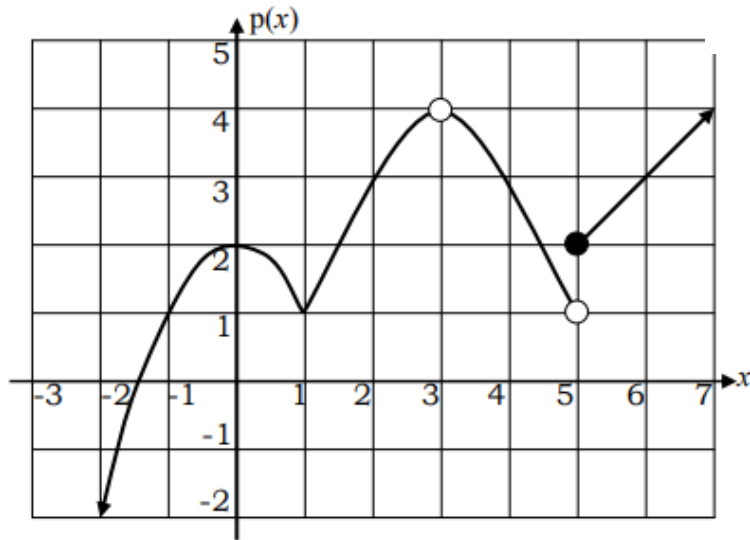
Compound Angle Formula: $\tan(A + B) = \frac{\tan(A) + \tan(B)}{1 - \tan(A)\tan(B)}$

Multistruktural

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STRAND 3: DIFFERENTIATION*Assessor's use only*

- 3.1 The graph of a piece-wise function, $p(x)$ is given below. Use the graph to answer the questions that follow.



At which value(s) of x is $p(x)$ not differentiable?

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- 3.2 Evaluate $\lim_{x \rightarrow 3} \frac{x^2-9}{x-3}$

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3.3	Evaluate $\lim_{x \rightarrow \infty} \frac{x^2 - 4x^3 + x - 3}{x^3 - 6x}$	<table border="1"><thead><tr><th colspan="2">Multi-structural</th></tr></thead><tbody><tr><td>2</td><td></td></tr><tr><td>1</td><td></td></tr><tr><td>0</td><td></td></tr><tr><td>NR</td><td></td></tr></tbody></table>	Multi-structural		2		1		0		NR	
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3.4	Find the derivative of the given function: $f(x) = x^7 + 5e^{3x} - 2x^{-2} + x - 17$	<table border="1"><thead><tr><th colspan="2">Multistructural</th></tr></thead><tbody><tr><td>2</td><td></td></tr><tr><td>1</td><td></td></tr><tr><td>0</td><td></td></tr><tr><td>NR</td><td></td></tr></tbody></table>	Multistructural		2		1		0		NR	
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STRAND 4: INTEGRATION

Assessor's use only

4.1 Find $\int (12x^5 + \frac{1}{2}x^2 - x) dx$

Unistructural	
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4.2 Find $\int \frac{1}{2}e^{4x+3} dx$

Unistructural	
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4.3	<p>Evaluate $\int_{-1}^4 (3x^2 - 2) dx$</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1"><thead><tr><th colspan="2">Multistructural</th></tr></thead><tbody><tr><td>2</td><td></td></tr><tr><td>1</td><td></td></tr><tr><td>0</td><td></td></tr><tr><td>NR</td><td></td></tr></tbody></table>	Multistructural		2		1		0		NR	
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4.4	<p>Find the indefinite integral of $\int 8x \cos 4x^2 dx$</p> <p>[Hint: Let $u = 4x^2$]</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<table border="1"><thead><tr><th colspan="2">Multistructural</th></tr></thead><tbody><tr><td>2</td><td></td></tr><tr><td>1</td><td></td></tr><tr><td>0</td><td></td></tr><tr><td>NR</td><td></td></tr></tbody></table>	Multistructural		2		1		0		NR	
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4.5 A mechanical rabbit starts moving from a fixed point in a straight line, and its velocity is given by the equation:

$v = 3t^2 - 4t - 8 \text{ m/s}$

a. What is the **velocity** of the rabbit when $t = 3 \text{ seconds}$?

b. Find the **distance** from the rabbit to the point after 1 s, given that the initial displacement = 0 m.

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Relational	
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