

MARKER CODE


 Pacific
Community
Communauté
du Pacifique


Student Personal Identification Number

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 right-hand 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.

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 2–23 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.

STRAND 1: ALGEBRA

Assessor's use only

1.1	Simplify $\frac{2y}{3} - \frac{y}{4}$ _____	<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			
Unistructural												
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1.2	Solve this pair of simultaneous equations: <table border="1" data-bbox="587 1048 884 1160"><tr><td>$2x - y = 7$</td></tr><tr><td>$3x + y = 13$</td></tr></table> _____	$2x - y = 7$	$3x + y = 13$	<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	
$2x - y = 7$												
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1.5 Solve the equation, $\log_{16} x = \frac{3}{2}$

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1.6 Simplify $\frac{24x^4y^{11}z}{3x^2yz^7}$

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1.7

Simplify $3\log 4 - 2\log 2$ by writing as a *log* of a single number.

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1.8

Determine the remainder when $2x^3 + 5x - 6$ is divided by $x - 1$

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1.9 Use the Binomial Theorem to expand and simplify $(1 - 2x)^4$

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1.10 Simplify $\sqrt{8} + \sqrt{32}$

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1.13 Given below are two complex numbers:

$$z = 2i \quad \text{and} \quad w = (3 + i)$$

a. Find $z \times w$

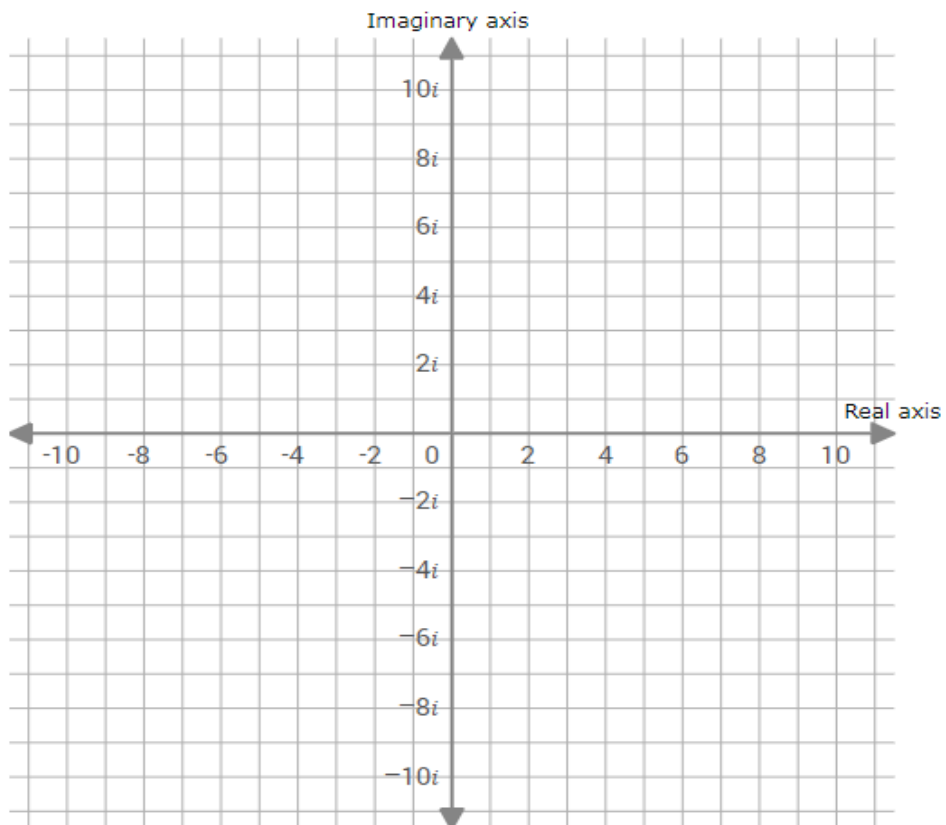
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b. Plot the complex number $z = 2i$ on the Argand diagram given below.



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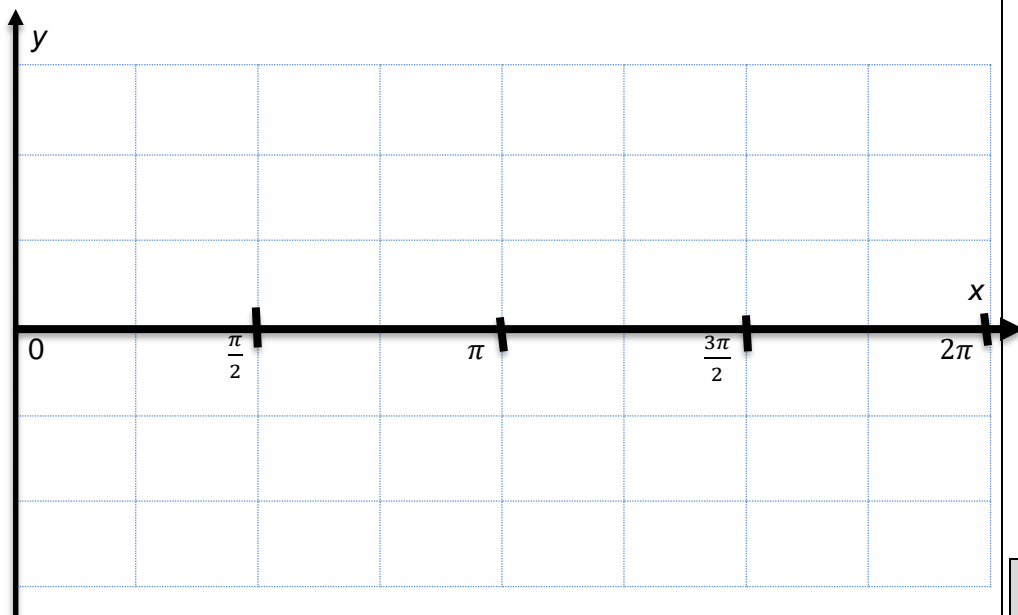
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2.3 Solve the equation $\sqrt{2} \sin \theta = 1$ where $0^\circ \leq \theta \leq 360^\circ$

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2.4 Use the grid below to sketch the graph of $y = -2 \cos x$ for $0 \leq x \leq 2\pi$



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2.5	<p>Calculate the value of $\sin 10^\circ \cos 80^\circ + \cos 10^\circ \sin 80^\circ$ using the Compound Angle Formula. [Show your working]</p> <div style="border-top: 1px solid black; border-bottom: 1px solid black; height: 500px; margin: 5px 0;"></div>	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <th colspan="2" style="background-color: #d3d3d3; padding: 5px;">Multistructural</th> </tr> <tr> <td style="width: 15%; padding: 5px;">2</td> <td style="width: 5%; padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">1</td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">0</td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">NR</td> <td style="padding: 5px;"></td> </tr> </table>	Multistructural		2		1		0		NR	
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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.



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:

$$h(t) = A \cos(Bt \pm C) \pm D$$

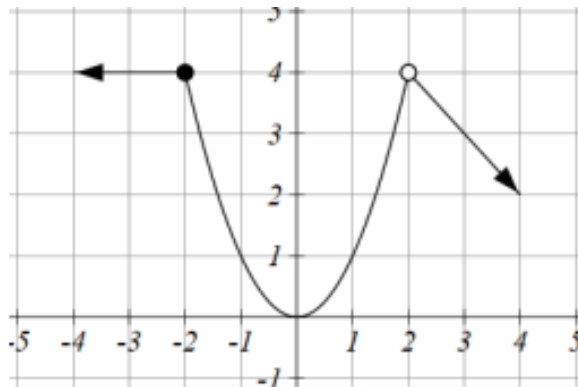
Find the values of A , B , C and D .

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STRAND 3: DIFFERENTIATION

Assessor's use only

3.1 The graph of a piece-wise function, $g(x)$ is given below. Use the graph to answer the question that follows.



Find the value(s) of x for which $g(x)$ is discontinuous?

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3.2 Evaluate $\lim_{x \rightarrow -3} \frac{x^2+5x+6}{x+3}$

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<p>3.3</p>	<p>Evaluate $\lim_{x \rightarrow \infty} \frac{5x(x-2)}{3x^2-2x+1}$</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<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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<p>3.4</p>	<p>Find the second derivative of the function $f(x)$ given that:</p> $f(x) = 4x^3 - 3x + e^x - 1$ <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<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 $\int x^{1/2} dx$

Unistructural

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4.2 Find $\int 2e^{5x} dx$

Unistructural

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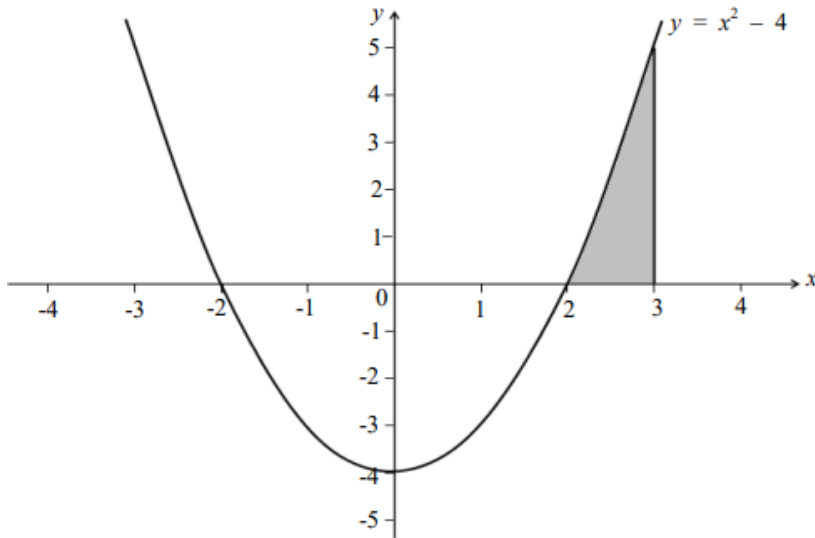
4.3

Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} 2\cos x \, dx$

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4.4

The region bounded by the curve $y = x^2 - 4$ and the x-axis between $x = 2$ and $x = 3$ is shown in the graph below.



Find the area of the shaded region.

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4.5 The velocity, v m/s, of a stone fired vertically upwards from the catapult 20 m high is given by the formula:

$$v = 180 - 10t$$

a. When is the stone at rest?

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b. Calculate the height of the stone above the ground after 5 seconds.

Relational	
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