

MARKER CODE



Pacific  
Community  
Communauté  
du Pacifique



Student Personal Identification Number

# South Pacific Form Seven Certificate

# MATHEMATICS WITH CALCULUS

## 2023

## 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>	
<b>Strand 1: Algebra</b> Demonstrate knowledge application and critical evaluation of problems, and model situations involving algebraic techniques for real and complex numbers.	7	1	1	2	20% 60 min
<b>Strand 2: Trigonometry</b> Demonstrate knowledge application and critical evaluation when using and manipulating trigonometric functions as well as applying its relationship to solve problems.	1	3	1	-	10% 30 min
<b>Strand 3: Differentiation</b> Demonstrate knowledge application and critical evaluation of advanced concepts and techniques of differentiation.	1	3	-	2	15% 45 min
<b>Strand 4: Integration</b> Demonstrate knowledge application and critical evaluation of advanced concepts and techniques of integration.	1	2	2	1	15% 45 min
<b>TOTAL</b>	<b>10</b>	<b>9</b>	<b>4</b>	<b>5</b>	<b>60% 180 min</b>

Check that this booklet contains pages 2–21 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 also provided.

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

*Assessor's use only*

1.1	Simplify $\frac{2x}{4} - \frac{x}{5}$	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="background-color: #f2f2f2; padding: 2px;">Unistructural</th> </tr> <tr> <td style="width: 50%; text-align: center; padding: 2px;">1</td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center; padding: 2px;">0</td> <td></td> </tr> <tr> <td style="text-align: center; padding: 2px;">NR</td> <td></td> </tr> </table>	Unistructural		1		0		NR	
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1.2	Simplify $2xy^2 \times (7x^2y)^3$	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="background-color: #f2f2f2; padding: 2px;">Unistructural</th> </tr> <tr> <td style="width: 50%; text-align: center; padding: 2px;">1</td> <td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center; padding: 2px;">0</td> <td></td> </tr> <tr> <td style="text-align: center; padding: 2px;">NR</td> <td></td> </tr> </table>	Unistructural		1		0		NR	
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Write  $\log 16 + \log 2 - \log 8$  as the log of a single number.

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Simplify  $6\sqrt{12} - 5\sqrt{243}$

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Solve  $\frac{x+1}{4} = \frac{2x}{5}$

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Two complex numbers are given as follows:

Evaluate  $z + 2w$

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1.7	Simplify $6i^{11}$                      	<table border="1"> <tr> <th colspan="2">Unistuctural</th> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td></td> </tr> <tr> <td>NR</td> <td></td> </tr> </table>	Unistuctural		1		0		NR			
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1.8	Simplify $\frac{2-3i}{2+i}$                      	<table border="1"> <tr> <th colspan="2">Multistuctural</th> </tr> <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> </table>	Multistuctural		2		1		0		NR	
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Use the Binomial Theorem to expand and simplify the following:

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Relational	
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Find the **coefficient** of  $x^{10}$  in the expansion of  $(2x - 3x^2)^7$

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire width, providing a guide for writing. The paper itself is a clean, off-white color. There are no margins, text, or other markings present on the page.

Extended Abstract	
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Leave your answer in polar form.

Extended Abstract	
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Assessor's use only

2.1	Evaluate $\operatorname{cosec}\left(\frac{\pi}{6}\right)$	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="background-color: #cccccc; text-align: center;">Unistuctural</th> </tr> <tr> <td style="width: 50%; text-align: center;">1</td><td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">0</td><td></td> </tr> <tr> <td style="text-align: center;">NR</td><td></td> </tr> </table>	Unistuctural		1		0		NR			
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2.2	Solve for $x$ : <div style="border: 2px solid black; width: fit-content; margin: 10px auto; padding: 10px; text-align: center;"> <math display="block">\cos (x-20^{\circ})=\frac{\sqrt{3}}{2}</math> </div> <div style="text-align: right; margin-top: 10px;">           where <math>0^{\circ} \leq x \leq 360^{\circ}</math>.         </div>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="background-color: #cccccc; text-align: center;">Multistuctural</th> </tr> <tr> <td style="width: 50%; text-align: center;">2</td><td style="width: 50%;"></td> </tr> <tr> <td style="text-align: center;">1</td><td></td> </tr> <tr> <td style="text-align: center;">0</td><td></td> </tr> <tr> <td style="text-align: center;">NR</td><td></td> </tr> </table>	Multistuctural		2		1		0		NR	
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Find the **value** of  $\sec x$  if  $\sin x = \frac{\sqrt{3}}{2}$

A right triangle is shown with a horizontal base and a vertical right side. The right angle is at the bottom-right vertex, indicated by a square symbol. The hypotenuse, connecting the bottom-left and top-right vertices, is labeled with the length 2. The vertical leg is labeled with the length  $\sqrt{3}$ . The angle at the bottom-left vertex is labeled  $x$ .

[illegible]

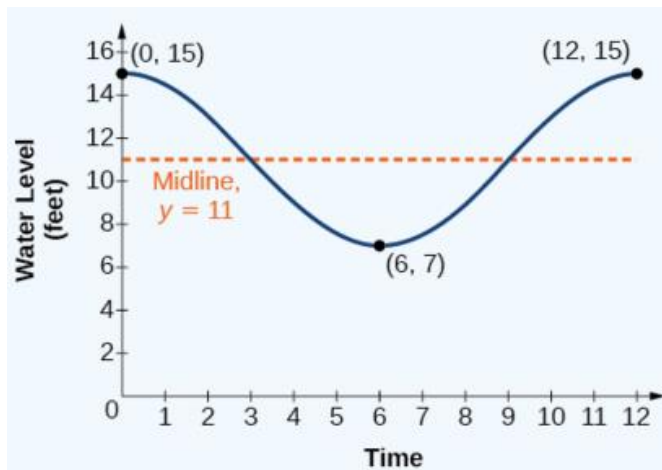
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Prove that  $\sin^2 \theta - \cos^2 \theta = 2 \sin^2 \theta - 1$

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Multistructural	
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The height of the tide in a small beach town is measured along a seawall. Water levels oscillate between 7 feet at low tide and 15 feet at high tide. On a particular day, low tide occurred at 6 AM and high tide occurred at noon. Approximately every 12 hours, the cycle repeats as shown in the graph that is given below:


$$y = A \cos(Bt \pm C) \pm D$$

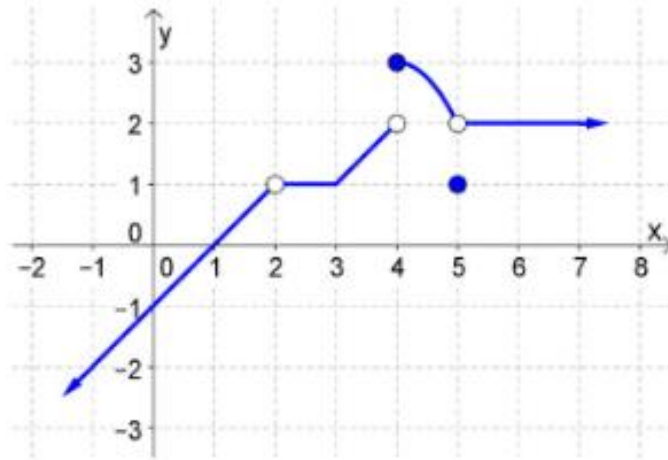
to model the water levels,  $y$  as a function of time,  $t$  (in hours).

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Relational	
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3.1 The graph of  $f(x)$  is given below. Use the graph to answer question 3.1.

Evaluate  $\lim_{x \rightarrow 5} f(x) =$  \_\_\_\_\_



Evaluate  $\lim_{x \rightarrow 5} f(x) =$  \_\_\_\_\_

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Multistructural	
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$$s(t) = e^{3t} + 2t^3 + 5$$

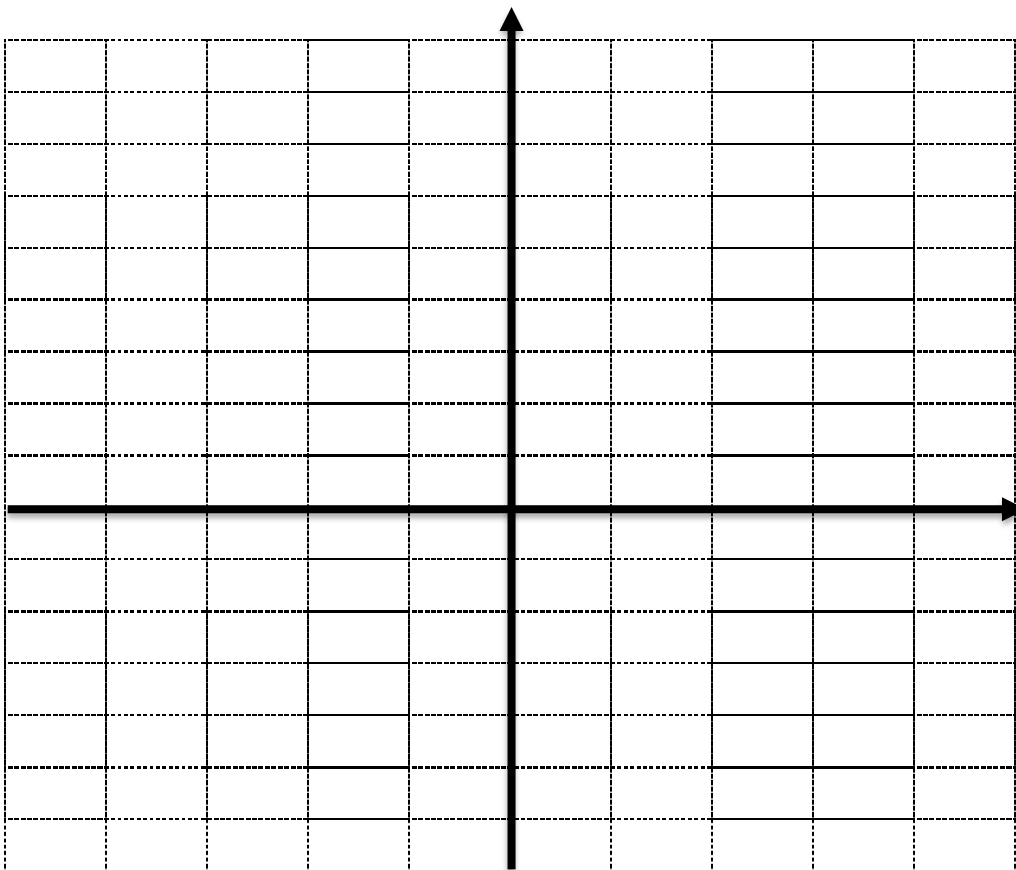
Find the **initial acceleration** of the particle.

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Extended Abstract	
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This image shows a full page of blank, lined paper. It features approximately 28 horizontal grey lines spaced evenly apart, typical of standard notebook paper. The lines extend across the entire width of the page, leaving small margins at the top and bottom. There are no vertical lines, text, or other markings present.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.



Extended Abstract	
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A ball is thrown vertically upwards with an initial velocity of  $40 \text{ m/s}$  from a point  $5 \text{ m}$  above ground level. The speed of the ball after  $t$  seconds is given by the formula:

a. Find an expression for the **height** of the ball above ground level at time  $t$ .

- a. Find an expression for the **height** of the ball above ground level at time  $t$ .

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Relational	
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Relational	
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$$g(t) = Ae^{kt}$$

When will the goat population double?

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Extended Abstract	
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