

**STUDENT'S NAME:** \_\_\_\_\_

**DATE:** Monday 7<sup>th</sup> August

**TIME:** 35 minutes

**MARKS:** 38

**ASSESSMENT %:** 10

**INSTRUCTIONS:**

Standard Items: Pens, pencils, drawing templates, eraser

Special Items:

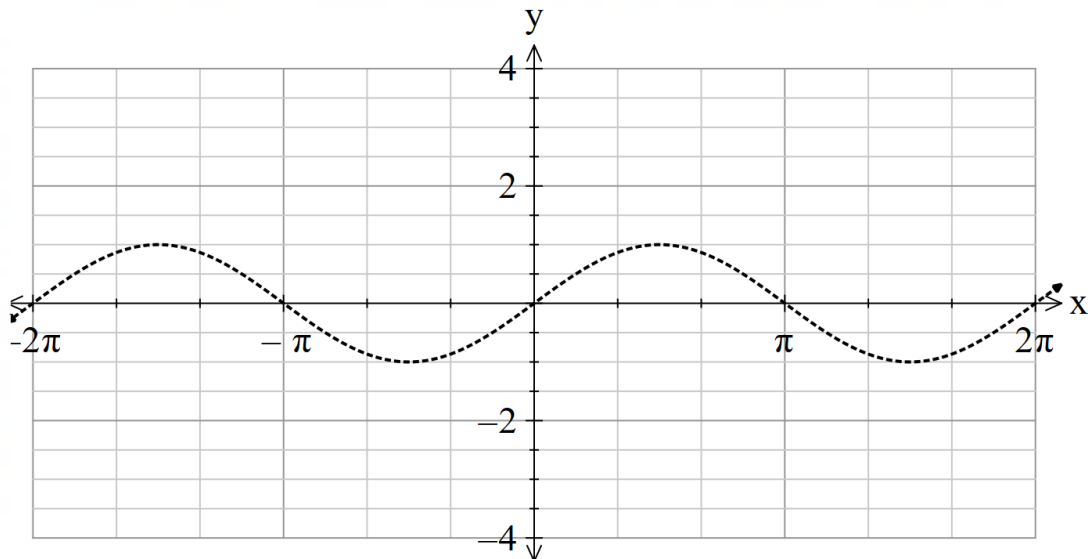
Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

**Question 1**

**(6 marks)**

- (a) The graph of  $y = \sin(x)$  is shown below. On the same set of axes draw the graph  $y = 2\csc(x)$ .

**(3 marks)**



- (b) State the amplitude, period and the coordinates of the y-intercept for  $y = 3\sec\left(\frac{x}{2}\right)$

(i) Amplitude: (1 mark)

(ii) Period: (1 mark)

(iii) Coordinates of y-intercept: (1 mark)

## Question 2

(8 marks)

Consider the following matrices.

$$A = [2 \quad 6], B = \begin{bmatrix} x & 1 \\ x-1 & 1 \end{bmatrix}, C = \begin{bmatrix} 4 & 3 \\ 2 & 1 \end{bmatrix}, D = \begin{bmatrix} -1 & 2 \\ 5 & 4 \end{bmatrix}$$

Using these matrices, determine matrices P, Q and R below. If it is not possible to calculate a matrix, explain why.

(a)  $P = CD$  (2 marks)

(b)  $Q = AC + AD$  (3 marks)

(c) Calculate  $\det(B)$ . (1 mark)

(d) Show that there exists a value of  $x$  such that  $B^{-1} = -B$  (2 marks)

## Question 3

(7 marks)

(a) Prove that  $\cos 2\theta = 2\cos^2\theta - 1$

(3 marks)

(b) Solve  $3\csc 2\theta = -2\sqrt{3}$  over the domain  $-\pi \leq \theta \leq \pi$

(4 marks)

**Question 4****(5 marks)**

Prove  $1 + 2\cos 2A + \cos 4A = 8\cos^4 A - 4\cos^2 A$ .

Hint:  $\cos 4A = \cos(2(2A))$

## Question 5

(4 marks)

Prove  $\tan \theta + \cot \theta = \frac{2}{\sin 2\theta}$

## Question 6

(8 marks)

(a) Express  $\sin \theta + \sqrt{3} \cos \theta$  in the form  $a \sin(\theta + b)$

(4 marks)

(b) Evaluate  $\cos 15^\circ - \cos 105^\circ$  as an exact value.

(4 marks)

**END OF QUESTIONS**



**YEAR 11  
MATHEMATICS  
SPECIALIST**

**Test 3, 2023  
Section Two: Calculator Allowed  
Trigonometry & Matrices**

**STUDENT'S NAME:** \_\_\_\_\_

**DATE:** Monday 7<sup>th</sup> August

**TIME:** 15 minutes

**MARKS:** 11  
**ASSESSMENT %:** 10

**INSTRUCTIONS:**

Standard Items: Pens, pencils, drawing templates, eraser

Special Items: 1 A4 page notes, Classpad, Scientific Calculator

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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**Question 7**

**(3 marks)**

Determine all the values of  $k$  for which the matrix  $\mathbf{M}^{-1}$  exists, where:

$$\mathbf{M} = \begin{bmatrix} -4 & -2 \\ 3 & 1 \end{bmatrix} + k \begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix}$$

## Question 8

(8 marks)

(a) Let matrix  $A = \begin{bmatrix} 2 & -2 \\ 7 & -6 \end{bmatrix}$

(i) Determine  $A^{-1}$ . (1 mark)

(ii) Express the equations  $7a - 6b = 23$  and  $2a - 2b = 7$  as a matrices equation. (1 mark)

(iii) By using your answer from part (i) use matrix algebra to solve the equations in part (ii). (2 marks)

(b) Solve the equation  $\begin{bmatrix} 3 & 0 \\ 5 & 0 \end{bmatrix} B = B + \begin{bmatrix} 2 & 4 \\ 6 & 7 \end{bmatrix}$  for the  $2 \times 2$  matrix  $B$  (4 marks)

END OF QUESTIONS