SOHOKMATHS

13Ma Pre January Exams Mini Test
Trigonometry (Harmonic Forms)
Implicit Differentiation
Sector, Radians, Numerical Methods

Surname _____ Other names _____

☐ B Mr Chan/Mr Phillips ☐ M2E Mr Chan/Ms Esteban

Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill at the top of this page with your name, and tick the box with the class you belong to.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Question	Marks	Score
1	11	
2	8	
3	11	
Total:	30	

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 3 questions in this question paper. The total mark for this paper is 30.
- The marks for **each** question are shown in brackets – use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

1. (a) Express $7\cos\theta + 24\sin\theta$ in the form $R\cos(\theta - \alpha)$, where $R > 0$ and $0° < \alpha < 90°$.
Give the value of α correct to 2 decimal places.

(3)

(b) Solve the equation $7\cos\theta + 24\sin\theta = 18$ for $0° < \theta < 360°$.

(4)

As β varies, the greatest possible value of

$$\frac{150}{7\cos\frac{1}{2}\beta + 24\sin\frac{1}{2}\beta + 50}$$

is denoted by V,

(c) (i) find the value of V,

(ii) determine the smallest positive value of β (in degrees) for which the value of V occurs.

(4)

Question 1 continued

(Total for Question 1 is 11 marks)

2. The equation of a curve is $x^2y - ay^2 = 4a^3$, where a is a non-zero constant.

(a) Show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{2xy}{2ay - x^2}$.

(4)

(b) Hence find the coordinates of the points where the tangent to the curve is parallel to the y-axis.

(4)

Question 2 continued

(Total for Question 2 is 8 marks)

3.

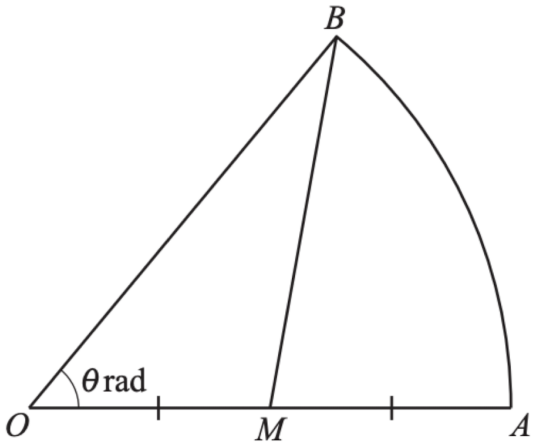


Figure 1

Figure 1 shows a sector OAB of a circle with centre O and radius OA.

The angle AOB is θ radians.

M is the mid-point of OA.

The ratio of areas $OMB : MAB$ is 2:3.

(a) Show that $\theta = 1.25 \sin \theta$.

(4)

The equation $x = 1.25 \sin x$ has only one root for $x > 0$.

This root can be found by using the iterative formula $x_{n+1} = 1.25 \sin x$.

(b) Using a starting value of $x_1 = 0.5$,

(i) write down the values of x_2, x_3 and x_4.

(ii) find the value of this root correct to 3 significant figures.

(iii) show, using a change in sign method, that this root is accurate to 3 significant figures.

(4)

Diagram 1 in the next page shows the graphs of $y = 1.25 \sin x$ and $y = x$ sketched on a graphical calculator.

(c) Use this diagram to show how the iterative process used in (b) converges to this root, you should state the type of convergence, and the values of x_2, x_3 and x_4 in the diagram.

(3)

Question 3 continued

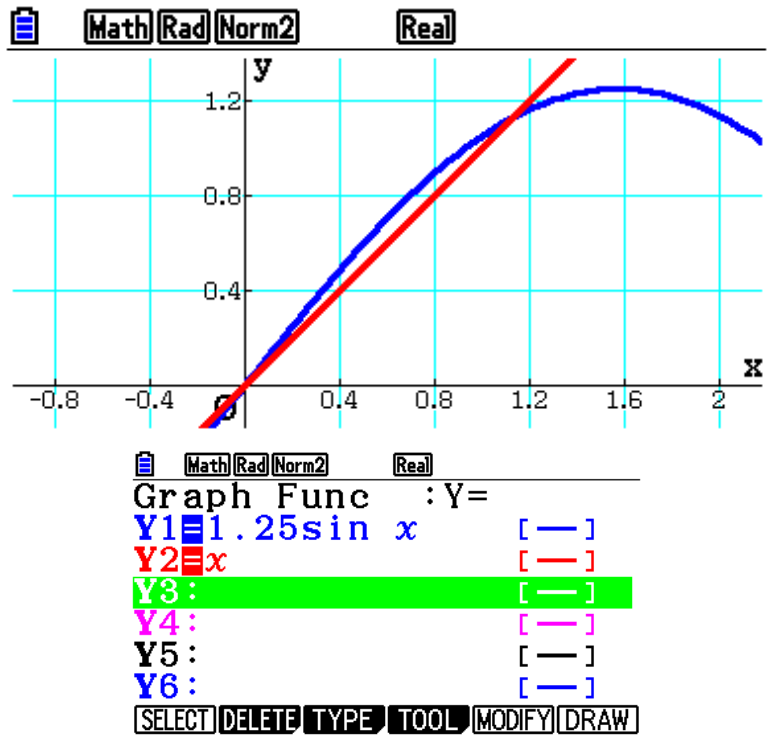
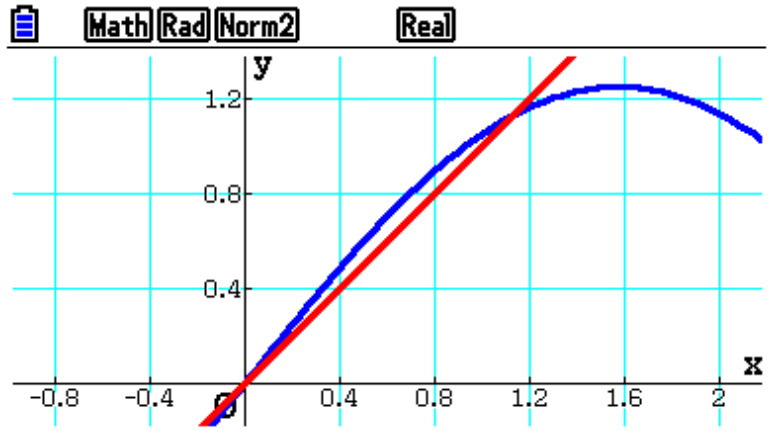


Diagram 1

A copy of Diagram 1, in case you need to redraw your sketch:



Copy of Diagram 1

Question 3 continued

Question 3 continued

Question 3 continued

(Total for Question 3 is 11 marks)

Total for paper is 30 marks