

A Level Mathematics B (MEI)

H640/02 MEI Pure Mathematics and Statistics

Pure

Question Set 1

- 1 Fig. 1 shows triangle ABC .

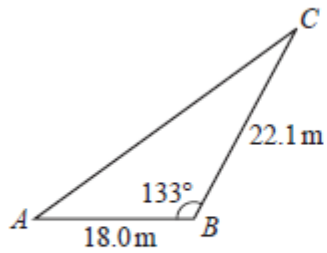


Fig. 1

Calculate the area of triangle ABC , giving your answer correct to 3 significant figures. [2]

- 2 Fig. 2 shows a sector of a circle of radius 8 cm.

The angle of the sector is 2.1 radians.

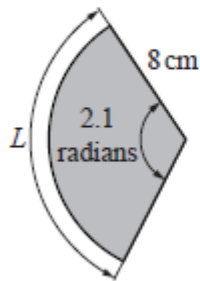


Fig. 2

- (a) Calculate the length of the arc L . [1]
(b) Calculate the area of the sector. [2]

- 3 You are given that $y = 4x + \sin 8x$.

- (a) Find $\frac{dy}{dx}$. [2]
(b) Find the smallest positive value of x for which $\frac{dy}{dx} = 0$, giving your answer in an exact form. [2]

- 4 The first n terms of an arithmetic series are

$$17 + 28 + 39 + \dots + 281 + 292.$$

- (a) Find the value of n . [1]
(b) Find the sum of these n terms. [2]

- 5 (a) Find the first three terms in ascending powers of x of the binomial expansion of $(1 + 4x)^{\frac{1}{2}}$. [3]
- (b) State the range of values of x for which this expansion is valid. [1]

6 In this question you must show detailed reasoning.

The equation of a curve is

$$y = \frac{\sin 2x - x}{x \sin x}.$$

- (a) Use the small angle approximation given in the list of formulae on pages 2–3 of this question paper to show that

$$\int_{0.01}^{0.05} y \, dx \approx \ln 5. \quad [4]$$

- (b) Use the same small angle approximation to show that

$$\frac{dy}{dx} \approx -10000 \text{ at the point where } x = 0.01. \quad [2]$$

The equation $y = 0$ has a root near $x = 1$. Joan uses the Newton-Raphson method to find this root. The output from the spreadsheet she uses is shown in Fig. 6.1.

| n | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------|---|----------|----------|----------|---------|----------|----------|----------|
| x_n | 1 | 0.958509 | 0.950084 | 0.948261 | 0.94786 | 0.947772 | 0.947753 | 0.947748 |

Fig. 6.1

Joan carries out some analysis of this output. The results are shown in Fig. 6.2.

| | |
|-----------|--------------|
| x | y |
| 0.9477475 | -7.79967E-07 |
| 0.9477485 | -2.90821E-06 |
| x | y |
| 0.947745 | 4.54066E-06 |
| 0.947755 | -1.67417E-05 |

Fig. 6.2

- (c) Consider the information in Fig. 6.1 and Fig. 6.2.
- Write 4.54066E-06 in standard mathematical notation.
 - State the value of the root as accurately as you can, justifying your answer. [3]

7

In this question you must show detailed reasoning.

Fig. 7 shows the graphs of $y = \sin x \cos 2x$ and $y = \frac{1}{2} - \sin 2x \cos x$.

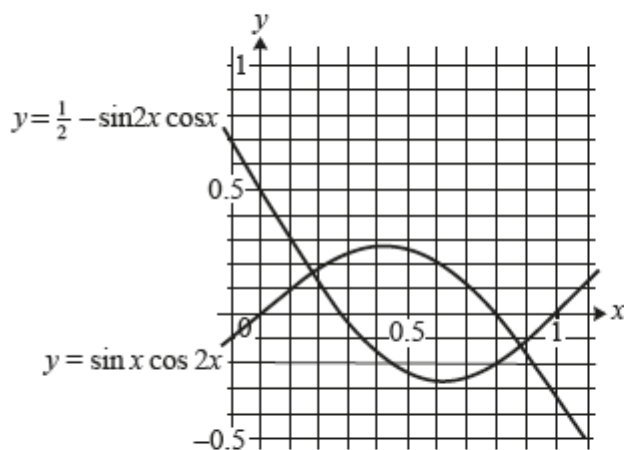


Fig. 7

Use integration to find the area between the two curves, giving your answer in an exact form. [8]

8

Functions $f(x)$ and $g(x)$ are defined as follows.

$$f(x) = \sqrt{x} \text{ for } x > 0 \text{ and } g(x) = x^3 - x - 6 \text{ for } x > 2.$$

The function $h(x)$ is defined as

$$h(x) = fg(x).$$

- (a) Find $h(x)$ in terms of x and state its domain. [2]
- (b) Find $h(3)$. [1]

Fig. 8 shows $h(x)$ and $h^{-1}(x)$, together with the straight line $y = x$.

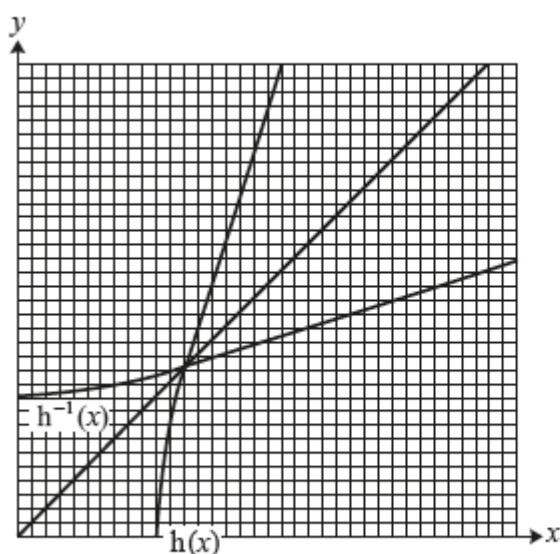


Fig. 8

(c) Determine the gradient of $y = h^{-1}(x)$ at the point where $y = 3$.

[4]

Total Marks for Question Set 1: 40

Resource Materials

Question Set No: 1

Fig. 1

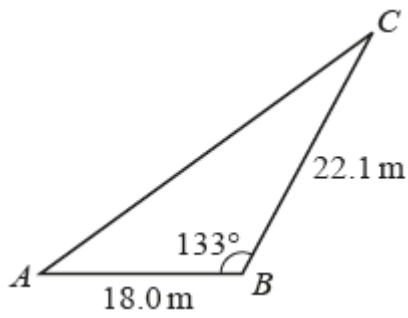


Fig. 2

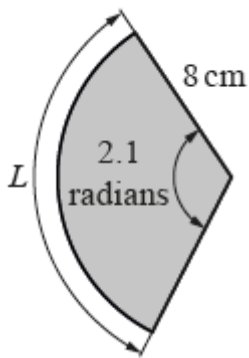


Fig. 6.1

| n | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------|---|----------|----------|----------|---------|----------|----------|----------|
| x_n | 1 | 0.958509 | 0.950084 | 0.948261 | 0.94786 | 0.947772 | 0.947753 | 0.947748 |

Fig. 6.2

| | |
|-----------|--------------|
| x | y |
| 0.9477475 | -7.79967E-07 |
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Fig. 7

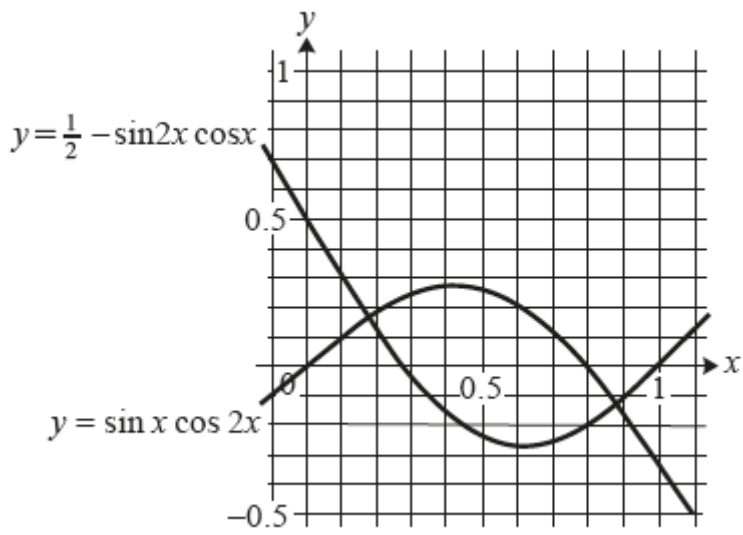
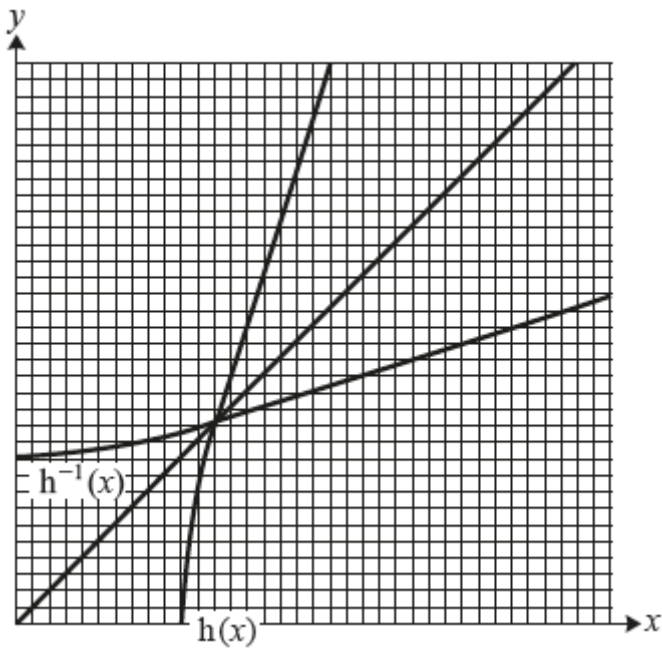


Fig. 8



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