OCR
Oxford Cambridge and RSA

A Level Mathematics B (MEI)

H640/02 MEI Pure Mathematics and Statistics

Pure

Question Set 1

1 Fig. 1 shows triangle ABC.

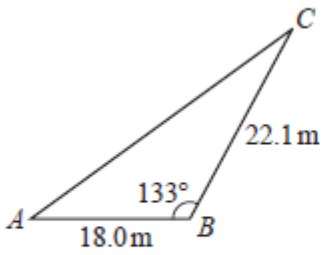

Fig. 1

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.

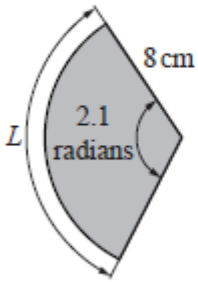

Fig. 2

(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

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

(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

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

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

$\frac{dy}{dx} \approx -10000$ at the point where $x = 0.01$. **[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 $y = \frac{1}{2} - \sin 2x \cos x$.

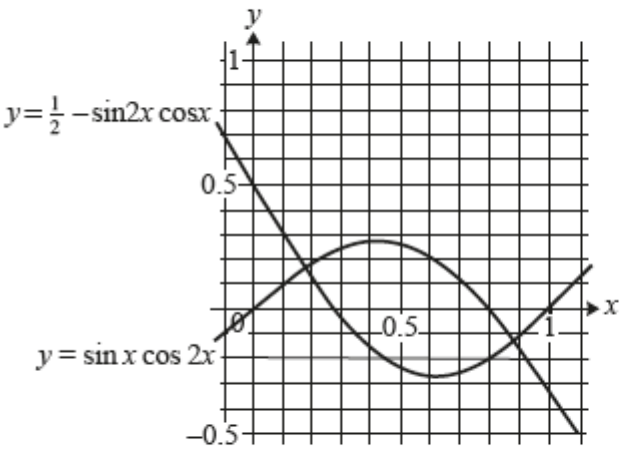

Fig. 7

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.

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

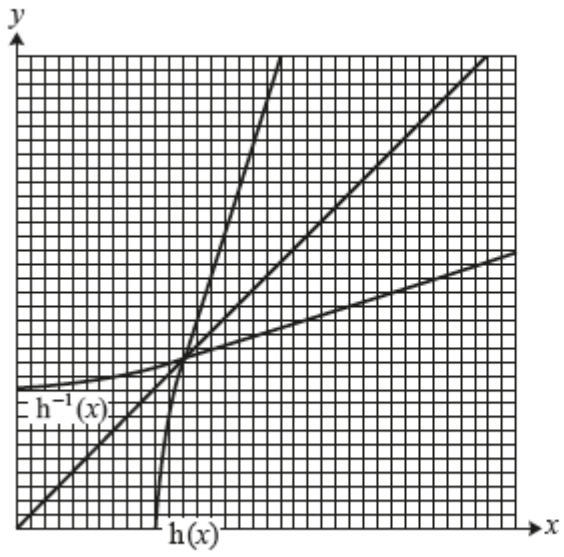

Fig. 8

(c) Determine the gradient of $y = \mathrm{h}^{-1}(x)$ at the point where $y = 3$. **[4]**

Total Marks for Question Set 1: 40

Resource Materials

Question Set No: 1

Fig. 1

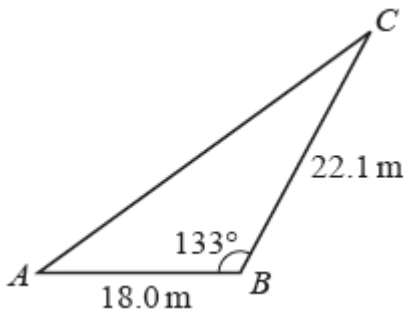

Fig. 2

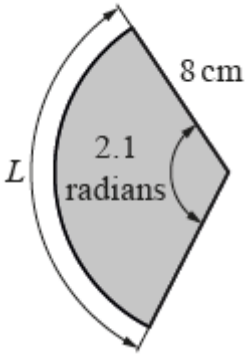

Fig. 6.1

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Fig. 6.2

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Fig. 7

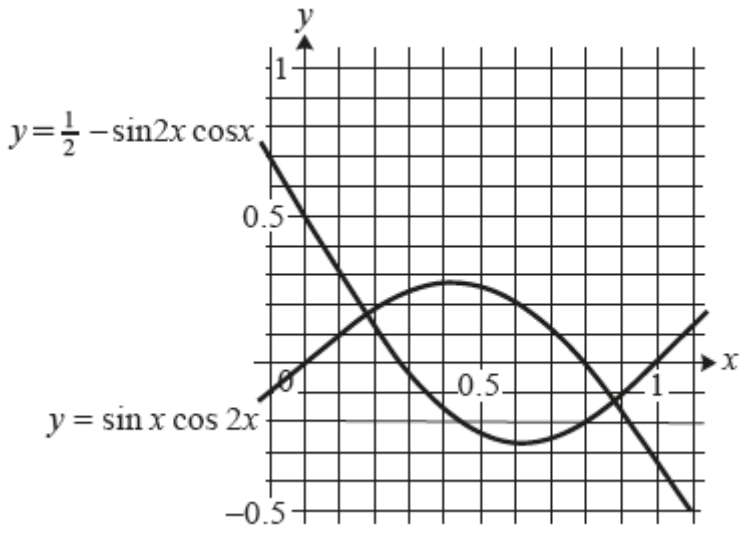

Fig. 8