

ADVANCED General Certificate of Education 2022

Mathematics

Assessment Unit A2 1 assessing Pure Mathematics

Centre Number

Candidate Number

AMT11

MONDAY 6 JUNE, MORNING

TIME

[AMT11]

2 hours 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer all eleven questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. Do not write with a gel pen.

Questions which require drawing or sketching should be completed using an HB pencil. Show clearly the full development of your answers. **Answers without working may not** gain full credit.

Answers should be given to three significant figures unless otherwise stated.

You are permitted to use a graphic or scientific calculator in this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 150

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

A copy of the Mathematical Formulae and Tables booklet is provided.

Throughout the paper the logarithmic notation used is $\ln z$ where it is noted that $\ln z \equiv \log_e z$ 12948.06 R

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| (ii | i) Find the sum to infinity for this series. | [2] |
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| i) $y = 3x(2x+5)^4$ | |
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(iii) $y = (1 + \ln 3x)^5$

(ii) $y = \frac{x-7}{5x^2+4}$

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[4]

| [3] | $\frac{\cos\theta}{2\cos^2\theta-1}$ | $\sec 2\theta \cos \theta$ | |
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(ii) Hence find the exact solutions of

 $\sec 2\theta \cos \theta = 1 \qquad 0 \le \theta \le 2\pi$ [5]

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- (b) A new ice cream shop is opening and a designer has created a logo as shown in Fig. 1 below.

The logo consists of two congruent triangles, AOD and BOC, together with a sector of a circle centred at O.



 $AD = BC = 6\sqrt{21} \text{ cm}, \quad OC = OD = 6 \text{ cm}, \quad AB = 60 \text{ cm}$

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| (ii) | Find the exact area represented by the ice cream as shown in Fig. 1 [6] |
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(ii) On the axes below, sketch the graph of

y = 2f(x) + 1

Clearly identify the image of A and the location of the asymptote. [3]



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(iii) On the axes below, sketch the graph of

$$y = f\left(\frac{x}{2} - 1\right)$$

Clearly identify the image of A and the location of the asymptote.



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[3]

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| | $f(x) = -x^2 + 3x + 10, x \in \mathbb{R}$ | |
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| (i) | Express $f(x)$ in the form $-(x - a)^2 + b$ | [3] |
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| (II) | Hence state the range of the function $f(x)$ | [1] |
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| (;;:) | State the domain for which $f(x)$ is a decreasing function | F17 |
| (III) | State the domain for which $I(x)$ is a decreasing function. | L ¹ . |
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(iv) Given

 $f(x) = -x^2 + 3x + 10, x \in \mathbb{R} \text{ and}$ $g(x) = |x|, x \in \mathbb{R}$

sketch the composite function gf(x) on the axes below, showing clearly any key points. [5]



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| $\frac{x+3}{(3-x)(1+x)^2}$ |
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(ii) Hence, using the binomial theorem, expand $\frac{x+5}{(3-x)(1+x)^2}$ in ascending powers of x, up to and including the term in x^2 [10] [Turn over 12948.06 R



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| (i) | $\int \sin^2 x dx$ [5] |
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| ii) | $\int xe^{3x} dx$ |
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| ···) | $\sqrt{x-2}$ and using the substitution $u = x - 2$ |
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The ambient temperature of a restaurant remains constant at 20°C.

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 θ is the temperature of food *t* minutes after leaving the kitchen and the rate of change in temperature can be modelled by the following differential equation

$$\frac{\mathrm{d}\theta}{\mathrm{d}t} = -k(\theta - 20)$$

(i) Given that food leaves the kitchen with a temperature of 140°C, find θ in terms of *k* and *t*. [7]

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| - | Find the equation of the normal to the curve at the point $(32, 0)$. |
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| | Leave your answer in the form $y = -\sqrt{a}x + b$ where a and b are integer values. |
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| (11) | Determine the values of θ for the four stationary points. [5] | |
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| (ii | i) Hence find the exact Cartesian coordinates of the four stationary points. |
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| The ne curestan equation of the curve shown in Fig. 5 | Ľ |
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| (ii) | Find the area enclosed between these two curves, using the approximation you | |
| (ii) | Find the area enclosed between these two curves, using the approximation you have found in (i). | |
| (ii) | Find the area enclosed between these two curves, using the approximation you have found in (i). Give your answer correct to three significant figures. | 71 |
| (ii) | Find the area enclosed between these two curves, using the approximation you have found in (i).Give your answer correct to three significant figures. | [7] |
| (ii) | Find the area enclosed between these two curves, using the approximation you have found in (i).Give your answer correct to three significant figures. | [7] |
| (ii) | Find the area enclosed between these two curves, using the approximation you have found in (i).Give your answer correct to three significant figures. | [7] |
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| (ii) | Find the area enclosed between these two curves, using the approximation you have found in (i). Give your answer correct to three significant figures. | [7] |
| (ii) | Find the area enclosed between these two curves, using the approximation you have found in (i). Give your answer correct to three significant figures. | [7] |
| (ii) | Find the area enclosed between these two curves, using the approximation you have found in (i). Give your answer correct to three significant figures. | [7] |
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