About this book

This book contains three sets of write-in, mock exam papers for the AQA A Level Maths exam (7367).

Full details of this exam specification can be for on the AQA website.

http://web.aqa.org.uk/7367

There are three papers in each exam set. Paper 1 covers Pure, paper 2 covers Pure and Mechanics and Paper 3 covers Pure and Statistics. All three papers are 120 minutes long and are each worth 100 marks.

The Large data set

The A Level examination will assume that you are familiar with a Large data set (LDS). In the exam, some questions will be based on the LDS and may include some extracts from it. It is AQA's intention that you should be taught using the LDS as this will give you a material advantage in the exam.

The LDS is part of the data set originally used to produce the UK government’s report 'Family Food Statistic 2014' (DEFRA, 2015). The LDS contains data on household purchases of food and drink between 2001 and 2014, subdivided by government office region. An Excel spreadsheet containing the LDS is available from the AQA website at the address given above.

Answers

The back of this book contains short answers to all the questions.

Full mark schemes for each mock paper can be found online.

https://global.oup.com/education/content/secondary/series/aqa-alevel-maths/aqaalevelmaths-answers

Formulae

In the exam, you will be provided with a 'Formulae for A Level Mathematics' booklet that is for use in AS Level and A Level Maths qualifications. These are provided at the end of this book. The statistical tables for A Level Maths are also at the end of this book.

Calculators

All papers are calculator papers. Make sure that you know how to use your calculator, particularly for statistical functions. The rules on which calculators are allowed can be found in the Joint Council for General Qualifications document 'Instructions for conducting examinations' (ICE).
Materials
You should have
• the booklet of formulae and statistical tables
• a graphical calculator.

Instructions
• Use a black pen for your working.
  Use a pencil for drawings.
• Answer all questions.
• Answer each question in the space provided for it; do not use the space provided for a different question. If you need extra space, ask for an additional answer book.
• All working should be inside the box drawn around each page.
• To avoid losing marks, show all necessary working.
• Include all rough working in this paper. If you do not want some work marked then cross it out.

Information
• Questions marks are shown in square brackets.
• There is a maximum of 100 marks available for this paper.

Advice
• Unless asked for a proof, you may quote any of the formulae in the booklet.
• You may not have to use all the answer space provided.
Answer all questions in the spaces provided.

1 Which of the following expressions have been simplified correctly? [1 mark]

Circle your answer(s).

\[
\frac{\cos^2 x - \sin^2 x}{\sin x} = \cos^2 x - \sin x \quad \frac{3 \cos x}{\cos x (\sin x \cos x - \cos^2 x)} = \frac{3}{\sin x - \cos x}
\]

\[
\frac{\cos^2 x - \sin^7 x}{\sin x} = 1 - 2 \sin x \quad \frac{3 \cos x}{\cos x (\sin x \cos x - \cos^2 x)} = \frac{3}{\cos x (\sin x - \cos x)}
\]

2 Evaluate \( \frac{d}{dx} (e^{x^2}) \) [1 mark]

Circle the correct answer.

\[ e^{x^2}, \quad 2e^x, \quad e^{2x}, \quad 2xe^{x^2} \]
3 Find \( \int \ln 2x \, dx \) \hspace{1cm} [1 mark]

Circle the correct answer.
\[
\frac{1}{x} + c \quad x \ln x - x + c \quad \frac{1}{2x} + c \quad x \ln 2x - x + c
\]

4 The diagram shows a sector \( ABC \) with radius \( r \) and angle \( \theta \), where \( \theta \) is in radians.

The arc length \( BC \) is \( P \) cm and the sector area \( ABC \) is \( Q \) cm\(^2\).

It is given that \( Q = 3P \)

a Find the length \( r \) \hspace{1cm} [3 marks]
4 b It is also given that the triangle $ABC$ is equilateral.
Find the exact value of the area of the shaded segment.
You must fully justify your working. [5 marks]
A quadrilateral $ABCD$ is formed by joining the points of intersection of the lines with equations

\[
\begin{align*}
y &= 2x + 1 \\
y - 2x &= -10 \\
2y &= 1 - 4x \\
y + 2x - 6 &= 0
\end{align*}
\]

a i Write down the gradients of each of the four straight lines. \hspace{1cm} [2 marks]

ii What can you deduce about the shape of the quadrilateral?

You must justify your answer. \hspace{1cm} [2 marks]

b i Describe how you would find the coordinates of the four vertices of the quadrilateral.

Do not include any calculations at this stage. \hspace{1cm} [2 marks]
Find the exact values of the coordinates of each of the four vertices of the quadrilateral. [4 marks]

What are the lengths, in cm, of the shortest and longest sides of the quadrilateral? [4 marks]
6 a  Prove, by contradiction, that $\sqrt{2}$ is irrational. [6 marks]

6 b  Simplify $\frac{\sqrt{2} \sqrt[2]{\sqrt{2}}}{\sqrt{2} \sqrt{\sqrt{2}}}$, giving your answer in the form $\sqrt{a}$, where $a$ is an integer. [3 marks]
A geometric sequence has first three terms 8, b and 4

i Find the exact value of b in the form \(m\sqrt{n}\), where \(m\) and \(n\) are integers. [3 marks]

ii Find the sum to infinity of the geometric sequence, showing all of your working.
Give your answer in the form \(f + g\sqrt{h}\), where \(f\), \(g\) and \(h\) are integers. [5 marks]
7 a Find the values of \( k \) such that \( kx^2 + 4x + 5 = k \) has no real solutions.

You must show all your working. [5 marks]

7 b \((x - p)\) is a factor of \(3x^2 - (p+8)x - (p+18)\), where \( p \) is an integer.

i Use the factor theorem to find the possible value(s) of \( p \)

You must show all your working. [6 marks]
7 b ii For each value of $p$ found in part b i, find the other factor of the quadratic expression. [2 marks]

8 a Solve the equation $\frac{14}{x} - x = 5$
   You must show each step of your working. [3 marks]

b Write down the equation of the line $l$ shown in the diagram below. [2 marks]
8 c  By considering your answers to a and b, use calculus to find the area of the region labelled R.
Give your answer in the form \( \frac{a}{b} + c \ln 2 \), where \( a, b \) and \( c \) are integers.  

[11 marks]
Starting with the identity \(\cos^2 \theta + \sin^2 \theta = 1\), prove that \(1 + \tan^2 \theta = \sec^2 x\) [2 marks]

By using the identity from part a, or otherwise, solve the equation

\[\sec^2 \theta - \sec \theta = 1\] for \(-\pi \leq \theta \leq 2\pi\)

Give all values of \(\theta\) in radians correct to three significant figures.

You must show every step of your working. [5 marks]
9 c Hence solve, for $-\pi \leq x \leq 2\pi$, the equation $\sec^2\left(\sin\frac{1}{2}x\right) - \sec\left(\sin\frac{1}{2}x\right) = 1$

Give your answers to three significant figures. [4 marks]

10 a Show that the equation $x^2 - 6 = 0$ has a root between $x = 2.4$ and $x = 2.5$ [3 marks]
10 b  Hence, starting with $x_0 = 2.4$, use the Newton–Raphson method **once** to find an approximate value of $\sqrt{6}$  

[3 marks]

---

10 c  By defining a suitable function and then using the Newton–Raphson method (starting with $x_0 = 1.3$), find an approximation to the value of $\sqrt{7}$ correct to six decimal places.

[5 marks]
Jolene wishes to use the Newton–Raphson method to find an approximation to the positive root, \( \alpha \), of the curve \( y = f(x) \) shown in the diagram.

She proposes starting the procedure at the point \( x_0 \), as shown in the diagram.

Will Jolene’s method prove to be successful?

Justify your answer. [2 marks]

---

Given that \( x = \tan y \), find \( \frac{dx}{dy} \) as a function of \( y \). [1 mark]
11 b Hence find \( \frac{d}{dx} (\tan^{-1} x) \) as a function of \( x \) 
You must fully justify your working. [4 marks]