OXFORD CAMBRIDGE AND RSA EXAMINATIONS

AS GCE

4721

MATHEMATICS

Core Mathematics 1

QUESTION PAPER

FRIDAY 13 JANUARY 2012: Morning
DURATION: 1 hour 30 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Printed Answer Book, or any suitable paper provided by the Centre. The Printed Answer Book may be enlarged by the Centre.

OCR SUPPLIED MATERIALS:

Printed Answer Book 4721
List of Formulae (MF1)

OTHER MATERIALS REQUIRED:

None

READ INSTRUCTIONS OVERLEAF

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INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- **Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.**
- **WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED IN THE PRINTED ANSWER BOOK. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**
- **Use black ink. HB pencil may be used for graphs and diagrams only.**
- **Answer ALL the questions.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **You are NOT permitted to use a calculator in this paper.**
- **Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.**

INFORMATION FOR CANDIDATES

This information is the same on the Printed Answer Book and the Question Paper.

- **The number of marks is given in brackets [ ] at the end of each question or part question on the Question Paper.**
- **YOU ARE REMINDED OF THE NEED FOR CLEAR PRESENTATION IN YOUR ANSWERS.**
- **The total number of marks for this paper is 72.**

INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

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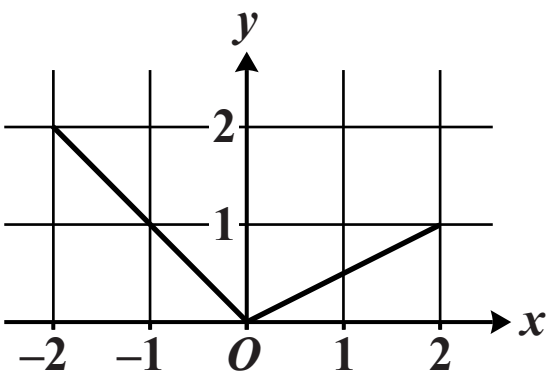
1 Express $\dfrac{15+\sqrt{3}}{3-\sqrt{3}}$ in the form $a + b\sqrt{3}$, where a and b are integers. [4]

2 Look at the following diagram.



The graph of $y = f(x)$ for $-2 \leqslant x \leqslant 2$ is shown above.

(i) Sketch the graph of $y = f(-x)$ for $-2 \leqslant x \leqslant 2$. [2]

(ii) Sketch the graph of $y = f(x) + 2$ for $-2 \leqslant x \leqslant 2$. [2]

3 Given that $5x^2 + px - 8 = q(x-1)^2 + r$

for all values of x, find the values of the constants p, q and r. [4]

4 Evaluate

(i) 3^{-2}, [1]

(ii) $16^{\frac{3}{4}}$, [2]

(iii) $\dfrac{\sqrt{200}}{\sqrt{8}}$. [2]

5 Find the real roots of the equation $\frac{3}{y^4} - \frac{10}{y^2} - 8 = 0$. [5]

6 Given that $f(x) = \frac{4}{x} - 3x + 2$,

(i) find $f'(x)$, [3]

(ii) find $f''\left(\frac{1}{2}\right)$. [4]

7 A curve has equation $y = (x + 2)(x^2 - 3x + 5)$.

(i) Find the coordinates of the minimum point, justifying that it is a minimum. [8]

(ii) Calculate the discriminant of $x^2 - 3x + 5$. [2]

(iii) Explain why $(x + 2)(x^2 - 3x + 5)$ is always positive for $x > -2$. [2]

8 The line l has gradient -2 and passes through the point $A(3, 5)$. B is a point on the line l such that the distance AB is $6\sqrt{5}$. Find the coordinates of each of the possible points B. [6]

9 (i) Sketch the curve $y = 12 - x - x^2$, giving the coordinates of all intercepts with the axes. [5]

(ii) Solve the inequality $12 - x - x^2 > 0$. [2]

(iii) Find the coordinates of the points of intersection of the curve $y = 12 - x - x^2$ and the line $3x + y = 4$. [5]

10 A circle has centre $C(-2, 4)$ and radius 5.

(i) Find the equation of the circle, giving your answer in the form $x^2 + y^2 + ax + by + c = 0$. [3]

(ii) Show that the tangent to the circle at the point $P(-5, 8)$ has equation $3x - 4y + 47 = 0$. [5]

(iii) Verify that the point $T(3, 14)$ lies on this tangent. [1]

(iv) Find the area of the triangle CPT. [4]

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