

# **OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**A2 GCE**

**4724**

## **MATHEMATICS**

**Core Mathematics 4**

**QUESTION PAPER**

**THURSDAY 21 JUNE 2012: Afternoon**

**DURATION: 1 hour 30 minutes  
plus your additional time allowance**

**MODIFIED ENLARGED**

**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 4724**

**List of Formulae (MF1)**

### **OTHER MATERIALS REQUIRED:**

**Scientific or graphical calculator**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

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

- **The Question Paper will be found in the centre of the Printed Answer Book.**
- **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 permitted to use a scientific or graphical 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**

- **Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.**

**1 Simplify**

(i)  $\frac{1-x}{x^2-3x+2}$ , [2]

(ii)  $\frac{(x+1)}{(x-1)(x-3)} - \frac{(x-5)}{(x-3)(x-4)}$ . [4]

**2 Use integration by parts to find  $\int \ln(x+2) \, dx$ . [5]**

**3 (i) Expand  $\frac{1+x^2}{\sqrt{1+4x}}$  in ascending powers of  $x$ , up to and including the term in  $x^3$ . [6]**

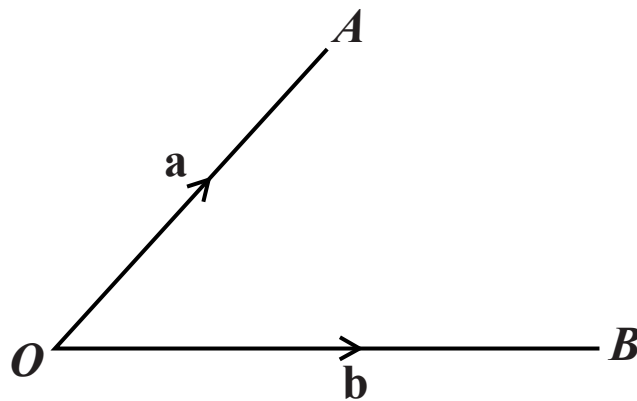
**(ii) State the set of values of  $x$  for which this expansion is valid. [1]**

**4 Solve the differential equation**

$$e^{2y} \frac{dy}{dx} + \tan x = 0,$$

**given that  $x = 0$  when  $y = 0$ . Give your answer in the form  $y = f(x)$ . [6]**

**5 Look at the following diagram.**



**In the diagram above the points  $A$  and  $B$  have position vectors  $\mathbf{a}$  and  $\mathbf{b}$  with respect to the origin  $O$ . Given that  $|\mathbf{a}| = 3$ ,  $|\mathbf{b}| = 4$  and  $\mathbf{a} \cdot \mathbf{b} = 6$ , find**

**(i) the angle  $AOB$ , [2]**

**(ii)  $|\mathbf{a} - \mathbf{b}|$ . [3]**

**6 Use the substitution  $u = 1 + \sqrt{x}$  to show that**

$$\int_4^9 \frac{1}{1 + \sqrt{x}} \, dx = 2 + 2 \ln \frac{3}{4}. \quad [7]$$

**7 Find the exact value of  $\int_0^{\frac{1}{6}\pi} (1 - \sin 3x)^2 \, dx$ . [7]**

8 (a) Find the gradient of the curve  $x^2 + xy + y^2 = 3$  at the point  $(-1, -1)$ . [4]

(b) A curve  $C$  has parametric equations

$$x = 2t^2 - 1, \quad y = t^3 + t.$$

(i) Find the coordinates of the point on  $C$  at which the tangent is parallel to the  $y$ -axis. [3]

(ii) Find the values of  $t$  for which  $x$  and  $y$  have the same rate of change with respect to  $t$ . [3]

9 (i) Express  $\frac{x^2 - x - 11}{(x + 1)(x - 2)^2}$  in partial fractions. [5]

(ii) Find the exact value of  $\int_3^4 \frac{x^2 - x - 11}{(x + 1)(x - 2)^2} dx$ , giving your answer in the form  $a + \ln b$ , where  $a$  and  $b$  are rational numbers. [4]

10 Lines  $l_1$  and  $l_2$  have vector equations

$\mathbf{r} = -\mathbf{i} + 2\mathbf{j} + 7\mathbf{k} + t(2\mathbf{i} + 2\mathbf{j} + \mathbf{k})$  and  $\mathbf{r} = 2\mathbf{i} + 9\mathbf{j} - 4\mathbf{k} + s(\mathbf{i} + 3\mathbf{j} - 2\mathbf{k})$  respectively. The point  $A$  has coordinates  $(-3, 0, 6)$  relative to the origin  $O$ .

(i) Show that  $A$  lies on  $l_1$  and that  $OA$  is perpendicular to  $l_1$ . [3]

(ii) Show that the line through  $O$  and  $A$  intersects  $l_2$ . [4]

(iii) Given that the point of intersection in part (ii) is  $B$ , find the ratio  $|\overrightarrow{OA}| : |\overrightarrow{BA}|$ . [3]

**BLANK PAGE**

### **Copyright Information**

**OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.**

**If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.**

**For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.**

**OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.**