Friday 17 May 2013 – Morning

AS GCE MATHEMATICS

4722/01   Core Mathematics 2

QUESTION PAPER

Duration: 1 hour 30 minutes

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.
- Do **not** write in the bar codes.
- 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**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

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.

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Turn over

1   Use the trapezium rule, with 3 strips each of width 2, to estimate the value of

$$\int_{5}^{11} \frac{8}{x} \, dx.$$

[4]

2   Solve each of the following equations, for $0° \leqslant x \leqslant 360°$.

   (i) $\sin\frac{1}{2}x = 0.8$

[3]

   (ii) $\sin x = 3\cos x$

[3]

3   **(i)**   Find and simplify the first three terms in the expansion of $(2 + 5x)^6$ in ascending powers of x.
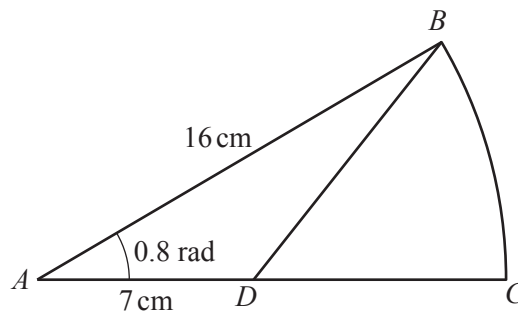
[4]

   (ii) In the expansion of $(3 + cx)^2(2 + 5x)^6$, the coefficient of x is 4416. Find the value of c.

[3]

4   **(a)** Find $\int (5x^3 - 6x + 1)\, dx$.

[3]

   (b)   **(i)** Find $\int 24x^{-3}\, dx$.

[2]

            (ii) Given that $\int_{a}^{\infty} 24x^{-3}\, dx = 3$, find the value of the positive constant a.

[3]

5

The diagram shows a sector BAC of a circle with centre A and radius 16 cm. The angle BAC is 0.8 radians. The length AD is 7 cm.

   (i)   Find the area of the region BDC.

[4]

   **(ii)** Find the perimeter of the region BDC.

[4]

6 Sarah is carrying out a series of experiments which involve using increasing amounts of a chemical. In the first experiment she uses 6 g of the chemical and in the second experiment she uses 7.8 g of the chemical.

(i) Given that the amounts of the chemical used form an arithmetic progression, find the total amount of chemical used in the first 30 experiments. **[3]**

(ii) Instead it is given that the amounts of the chemical used form a geometric progression. Sarah has a total of 1800 g of the chemical available. Show that N, the greatest number of experiments possible, satisfies the inequality

$$1.3^N \leqslant 91,$$

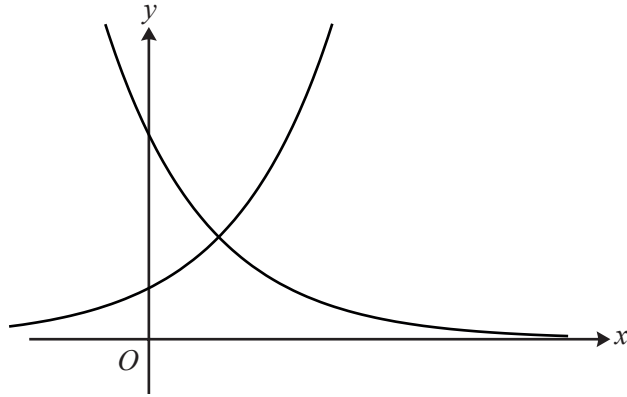and use logarithms to calculate the value of N. **[6]**

7
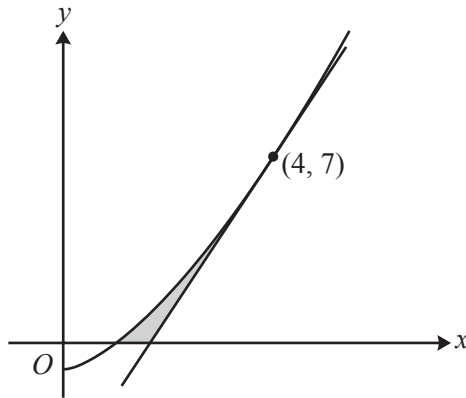
The diagram shows the curve $y = x^{\frac{3}{2}} - 1$, which crosses the x-axis at $(1, 0)$, and the tangent to the curve at the point $(4, 7)$.

(i) Show that $\int_1^4 (x^{\frac{3}{2}} - 1)\,dx = 9\frac{2}{5}$. **[4]**

(ii) Hence find the exact area of the shaded region enclosed by the curve, the tangent and the x-axis. **[5]**

8

The diagram shows the curves $y = a^x$ and $y = 4b^x$.

(i) (a) State the coordinates of the point of intersection of $y = a^x$ with the y-axis. **[1]**

   (b) State the coordinates of the point of intersection of $y = 4b^x$ with the y-axis. **[1]**

   (c) State a possible value for a and a possible value for b. **[2]**

(ii) It is now given that $ab = 2$. Show that the x-coordinate of the point of intersection of $y = a^x$ and $y = 4b^x$ can be written as

$$x = \frac{2}{2\log_2 a - 1}.$$

[5]

9 The cubic polynomial f(x) is defined by f$(x) = 4x^3 - 7x - 3$.

(i) Find the remainder when f(x) is divided by $(x - 2)$. **[2]**

(ii) Show that $(2x + 1)$ is a factor of f(x) and hence factorise f(x) completely. **[6]**

(iii) Solve the equation

$$4\cos^3\theta - 7\cos\theta - 3 = 0$$

for $0 \leqslant \theta \leqslant 2\pi$. Give each solution for θ in an exact form. **[4]**