Pearson Edexcel Level 3

GCE Mathematics

Advanced Level

Paper 1: Pure Mathematics

Practice Paper 14a	**Paper Reference(s)**
Time: 2 hours	**9MA0/01**

You must have:
Mathematical Formulae and Statistical Tables, calculator

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need*.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- The marks for each question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

1. Find the set of values of x for which

(a) $3x - 7 > 3 - x$,

(2)

(b) $x^2 - 9x \leq 36$,

(4)

(c) **both** $3x - 7 > 3 - x$ **and** $x^2 - 9x \leq 36$.

(1)

2.

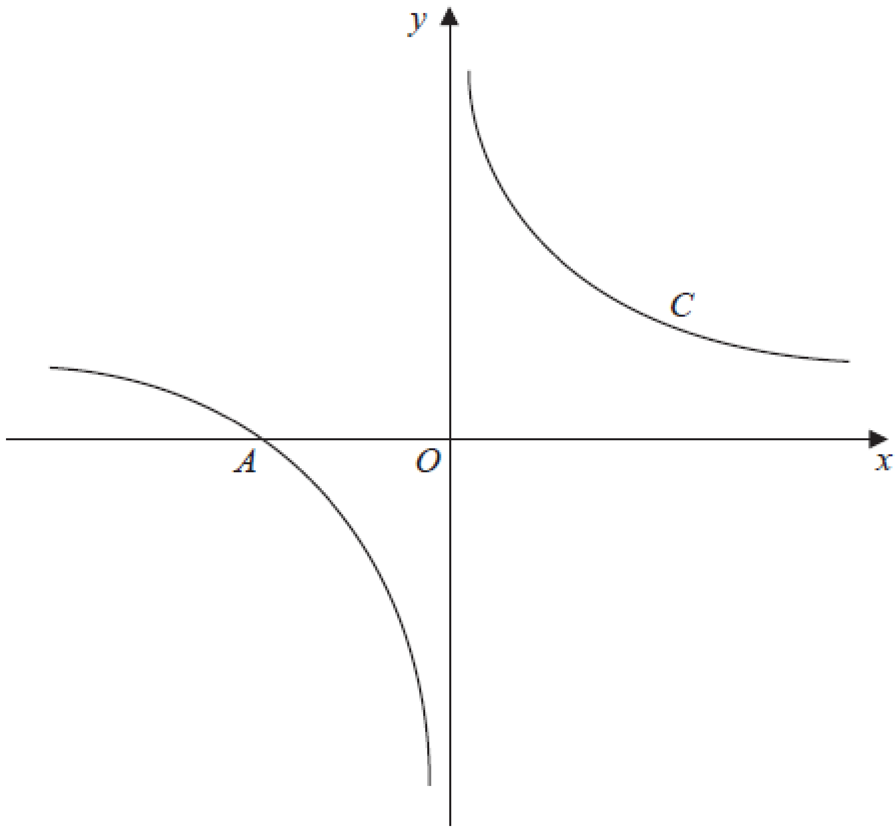

Figure 1

Figure 1 shows a sketch of the curve C with equation

$$y = \frac{1}{x} + 1, \qquad x \neq 0.$$

The curve C crosses the x-axis at the point A.

(a) State the x-coordinate of the point A.

(1)

The curve D has equation $y = x^2(x - 2)$, for all real values of x.

(b) On a copy of Figure 1, sketch a graph of curve D. Show the coordinates of each point where the curve D crosses the coordinate axes.

(3)

(c) Using your sketch, state, giving a reason, the number of real solutions to the equation

$$x^2(x - 2) = \frac{1}{x} + 1.$$

(1)

3. A sequence of numbers $a_1, a_2, a_3 \ldots$ is defined by

$$a_{n+1} = 5a_n - 3, \qquad n \geq 1.$$

Given that $a_2 = 7$,

(*a*) find the value of a_1.

(2)

(*b*) Find the value of $\sum_{r=1}^{4} a_r$.

(3)

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4. (*a*) Write $\sqrt{80}$ in the form $c\sqrt{5}$, where c is a positive constant.

(1)

A rectangle R has a length of $(1 + \sqrt{5})$ cm and an area of $\sqrt{80}$ cm^2.

(*b*) Calculate the width of R in cm. Express your answer in the form $p + q\sqrt{5}$, where p and q are integers to be found.

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(4)

5. In the year 2000 a shop sold 150 computers. Each year the shop sold 10 more computers than the year before, so that the shop sold 160 computers in 2001, 170 computers in 2002, and so on forming an arithmetic sequence.

(*a*) Show that the shop sold 220 computers in 2007.

(2)

(*b*) Calculate the total number of computers the shop sold from 2000 to 2013 inclusive.

(3)

In the year 2000, the selling price of each computer was £900. The selling price fell by £20 each year, so that in 2001 the selling price was £880, in 2002 the selling price was £860, and so on forming an arithmetic sequence.

(*c*) In a particular year, the selling price of each computer in £s was equal to three times the number of computers the shop sold in that year. By forming and solving an equation, find the year in which this occurred.

(4)

6.

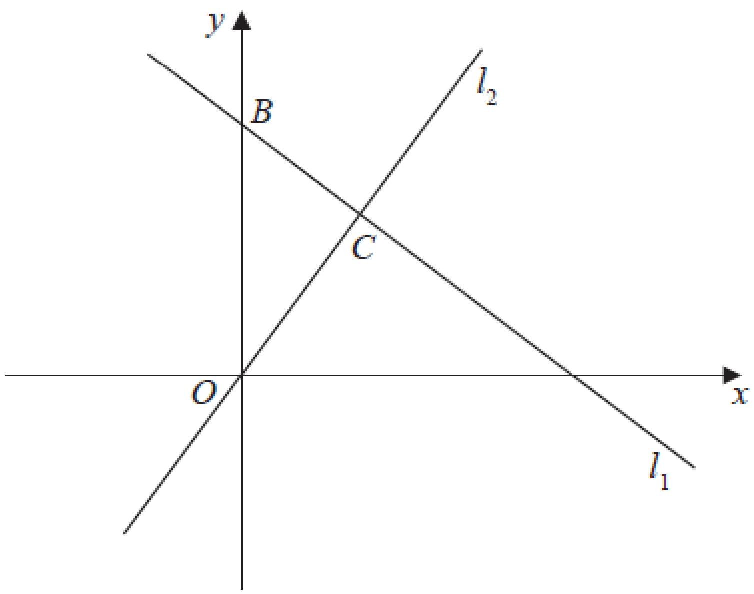

Figure 2

The line l_1, shown in Figure 2 has equation $2x + 3y = 26$.

The line l_2 passes through the origin O and is perpendicular to l_1.

(a) Find an equation for the line l_2.

(4)

The line l_2 intersects the line l_1 at the point C. Line l_1 crosses the y-axis at the point B as shown in Figure 2.

(b) Find the area of triangle OBC. Give your answer in the form $\frac{a}{b}$, where a and b are integers to be determined.

(6)

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7. $$f(x) = 2x^3 - 7x^2 + 4x + 4.$$

(a) Use the factor theorem to show that $(x - 2)$ is a factor of $f(x)$.

(2)

(b) Factorise $f(x)$ completely.

(4)

8. Use integration to find

$$\int_1^{\sqrt{3}} \left(\frac{x^3}{6} + \frac{1}{3x^2} \right) \mathrm{d}x ,$$

giving your answer in the form $a + b\sqrt{3}$, where a and b are constants to be determined.

(5)

9.

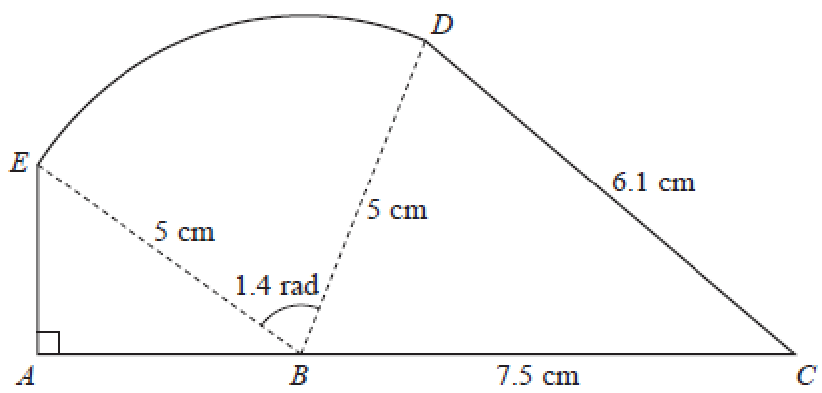

Figure 2

The shape *ABCDEA*, as shown in Figure 2, consists of a right-angled triangle *EAB* and a triangle *DBC* joined to a sector *BDE* of a circle with radius 5 cm and centre *B*.

The points *A*, *B* and *C* lie on a straight line with *BC* = 7.5 cm.

Angle *EAB* = $\frac{\pi}{2}$ radians, angle *EBD* = 1.4 radians and *CD* = 6.1 cm.

(*a*) Find, in cm^2, the area of the sector *BDE*.

(2)

(*b*) Find the size of the angle *DBC*, giving your answer in radians to 3 decimal places.

(2)

(*c*) Find, in cm^2, the area of the shape *ABCDEA*, giving your answer to 3 significant figures.

(5)

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10. The first term of a geometric series is 20 and the common ratio is $\frac{7}{8}$. The sum to infinity of the series is S_∞.

(*a*) Find the value of S_∞.

(2)

The sum to N terms of the series is S_N.

(*b*) Find, to 1 decimal place, the value of S_{12}.

(2)

(*c*) Find the smallest value of N, for which $S_\infty - S_N < 0.5$.

(4)

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11. (i) Solve, for $0 \leq \theta < 360°$, the equation $9 \sin (\theta + 60°) = 4$, giving your answers to 1 decimal place. You must show each step of your working.

(4)

(ii) Solve, for $-\pi \leq x < \pi$, the equation $2 \tan x - 3 \sin x = 0$, giving your answers to 2 decimal places where appropriate.

[*Solutions based entirely on graphical or numerical methods are not acceptable.*]

(5)

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12. (*a*) Sketch the graph of

$$y = 3^x, x \in \mathbb{R},$$

showing the coordinates of any points at which the graph crosses the axes.

(2)

(*b*) Use algebra to solve the equation $3^{2x} - 9(3^x) + 18 = 0$, giving your answers to 2 decimal places where appropriate.

(5)

13.

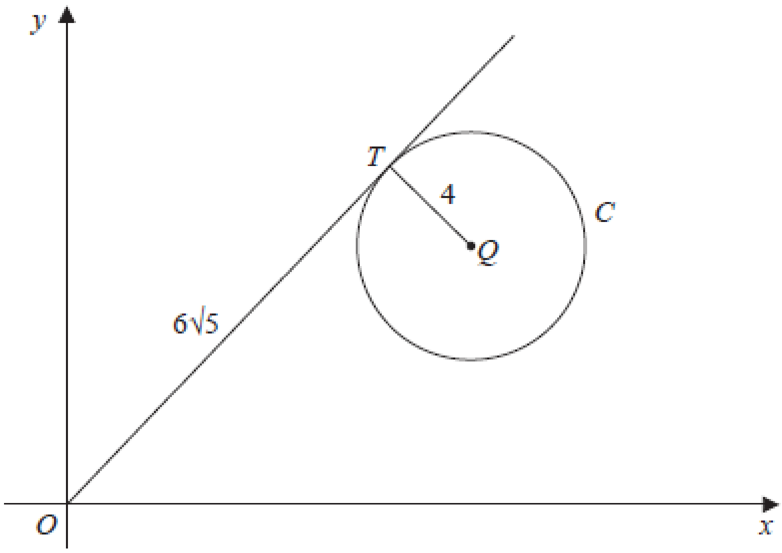

Figure 3

Figure 3 shows a circle C with centre Q and radius 4 and the point T which lies on C. The tangent to C at the point T passes through the origin O and $OT = 6\sqrt{5}$.

Given that the coordinates of Q are $(11, k)$, where k is a positive constant,

(*a*) find the exact value of k,

(3)

(*b*) find an equation for C.

(2)

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14. $$\mathrm{g}(x) = \frac{x}{x+3} + \frac{3(2x+1)}{x^2+x-6}, \qquad x > 3$$

(a) Show that $\mathrm{g}(x) = \dfrac{x+1}{x-2}$, $x > 3$

(4)

(b) Find the range of g.

(2)

(c) Find the exact value of a for which $\mathrm{g}(a) = \mathrm{g}^{-1}(a)$.

(4)