Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | Candidate Number

Further Pure Mathematics

Paper 1

Thursday 19 January 2012 – Morning
Time: 2 hours

Paper Reference
4PM0/01

Calculators may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided – *there may be more space than you need.*

Information

- The total mark for this paper is 100.
- 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.
- Check your answers if you have time at the end.

Turn over

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Answer all ELEVEN questions

Write your answers in the spaces provided

You must write down all stages in your working

1 Show that the two lines with equations

$$6x + 4y = -15$$

$$10x - 15y = 9$$

are perpendicular.

(4)

(Total for Question 1 is 4 marks)

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2 Solve the equation

$$\frac{x}{x+1} - \frac{1}{x+2} = 2$$

Give your answers correct to 3 significant figures.

(4)

(Total for Question 2 is 4 marks)

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3 Solve the inequality $6x^2 - 19x - 7 < 0$

(4)

(Total for Question 3 is 4 marks)

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4 Find the coefficient of x^7 in the expansion of $\left(1+\frac{x}{\sqrt{3}}\right)^{10}$, giving your answer in the form $a\sqrt{3}$, where a is a rational number.

(4)

(Total for Question 4 is 4 marks)

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5 Differentiate with respect to x

(a) $y = x^2 e^x$

(2)

(b) $y = (x^3 + 2x^2 + 3)^5$

(3)

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Question 5 continued

(Total for Question 5 is 5 marks)

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6 For x radians,

$$y = 3\cos\frac{x}{2}$$

(a) Complete the table, giving the three missing values correct to 2 decimal places.

(2)

x	0	0.5	1	1.5	2	2.5	3	3.5
y	3		2.63	2.20		0.95	0.21	

On the axes opposite,

(b) draw the graph of $y = 3\cos\frac{x}{2}$ for $0 \leqslant x \leqslant 3.5$

(2)

(c) Using your graph, find an estimate, to 1 decimal place, for the root of the equation

$$2x = 1 + 2\cos\frac{x}{2}$$

(4)

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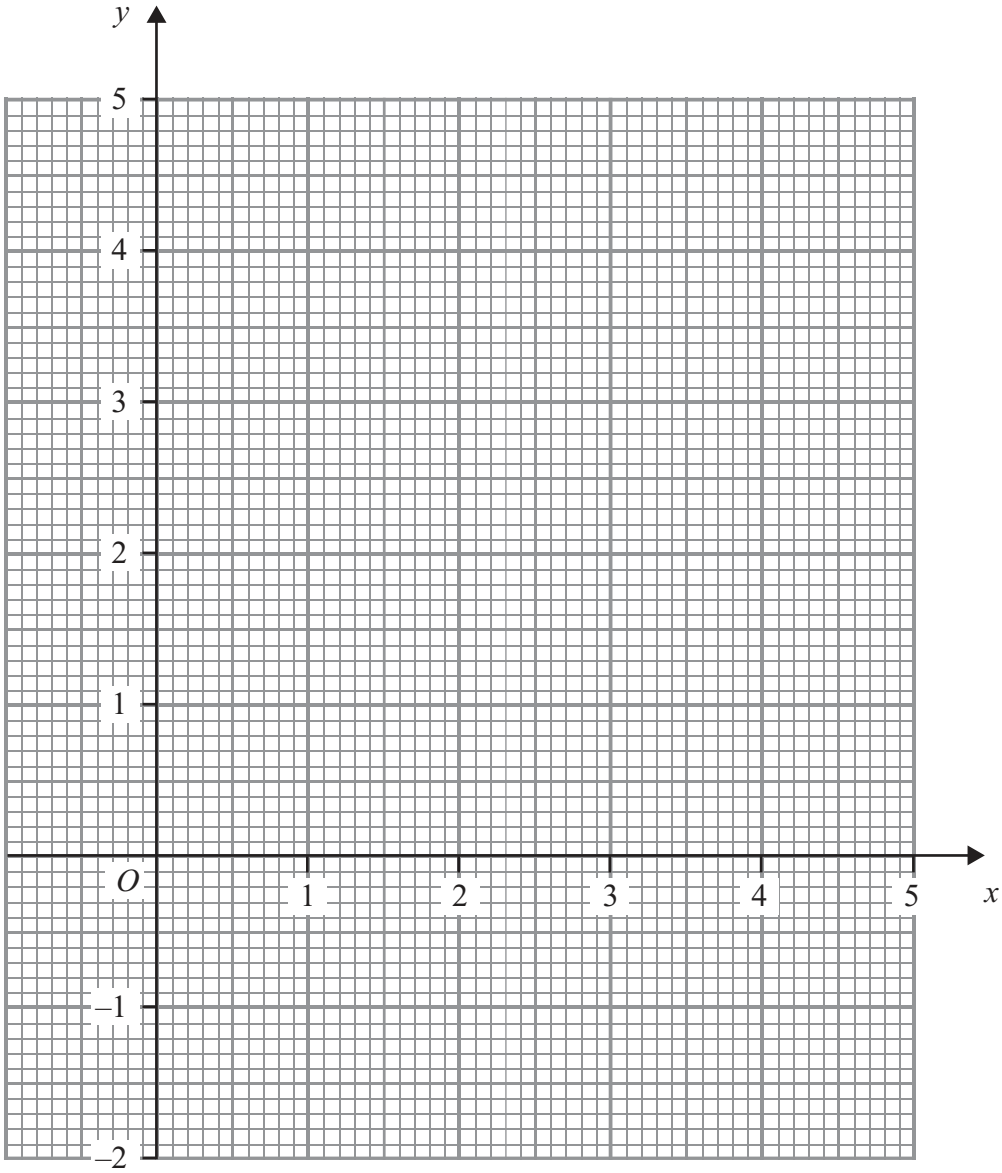
Question 6 continued



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Question 6 continued

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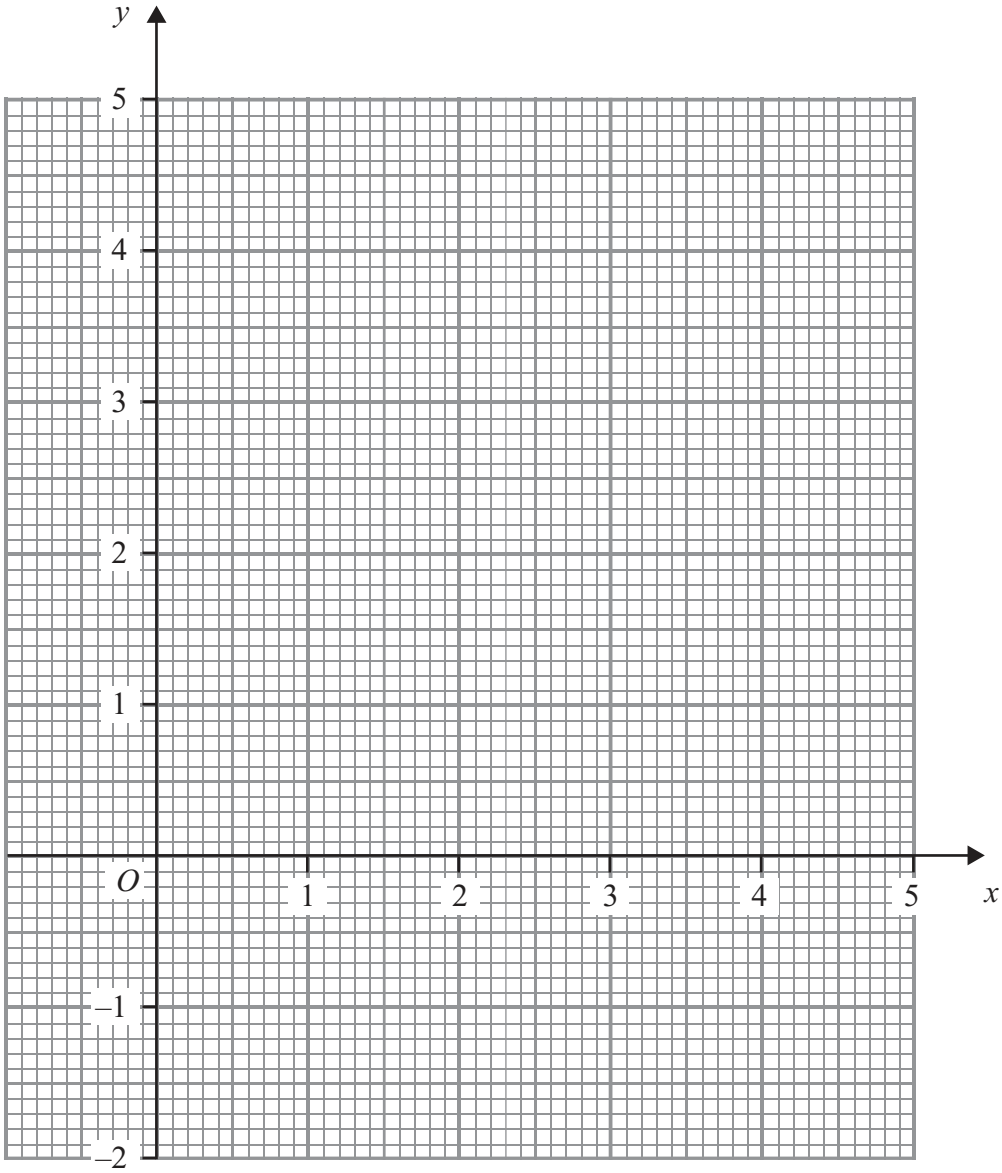
Question 6 continued

Use this page only if you need to redraw your graph.



(Total for Question 6 is 8 marks)

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7 The curve C with equation $y = \dfrac{2x-3}{x-3}$, $x \neq 3$, crosses the x-axis at the point A and the y-axis at the point B.

(a) Find the coordinates of A and the coordinates of B.

(2)

(b) Write down an equation of the asymptote to C which is

(i) parallel to the y-axis,

(ii) parallel to the x-axis.

(2)

(c) Sketch C showing clearly the asymptotes and the coordinates of the points A and B.

(3)

(d) Find an equation of the normal to C at the point B.

(5)

The normal to C at the point B crosses the curve again at the point D.

(e) Find the x-coordinate of D.

(4)

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Question 7 continued

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Question 7 continued

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Question 7 continued

(Total for Question 7 is 16 marks)

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8 The equation $x^2 + mx + 15 = 0$ has roots α and β and the equation $x^2 + hx + k = 0$ has roots $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$

(a) Write down the value of k

(1)

(b) Find an expression for h in terms of m

(6)

Given that $\beta = 2\alpha + 1$

(c) find the two possible values of α

(3)

(d) Hence find the two possible values of m

(3)

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Question 8 continued

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Question 8 continued

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Question 8 continued

(Total for Question 8 is 13 marks)

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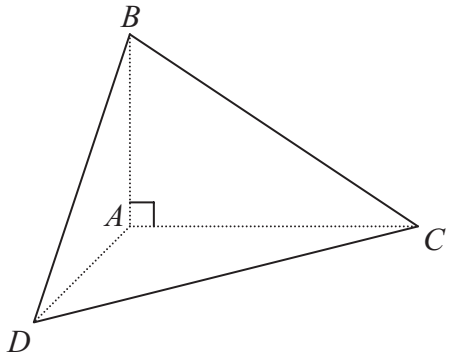

Figure 1

Figure 1 shows a triangular pyramid $ABCD$.

$\angle BAC = \angle DAC = \angle BAD = 90°$

$AD = 5$ cm, $AC = 8$ cm and $AB = 6$ cm.

(a) Find, in degrees to the nearest 0.1°, the size of $\angle BDC$.

(6)

(b) Find, to 3 significant figures, the area of triangle BDC.

(3)

(c) Find the area of triangle DAC.

(1)

The point E lies on CD so that AE is perpendicular to CD.

(d) Find the exact length of AE.

(2)

(e) Hence, or otherwise, find in degrees to the nearest 0.1°, the size of the angle between the planes DAC and BDC.

(4)

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Question 9 continued

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Question 9 continued

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Question 9 continued

(Total for Question 9 is 16 marks)

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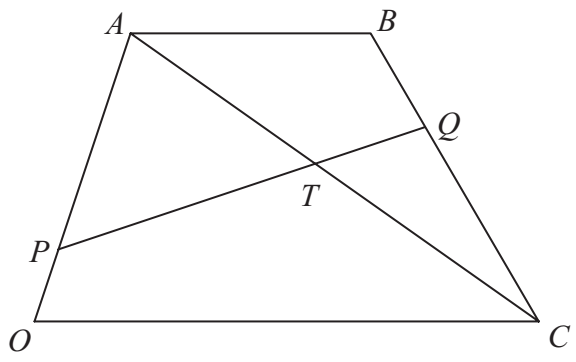

Figure 2

Figure 2 shows a trapezium $OABC$ in which AB is parallel to OC and $AB = \frac{1}{2}OC$. The point P divides OA in the ratio 1:3 and the point Q divides BC in the ratio 1:2

The line AC intersects the line PQ at the point T.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$

(a) Find, as simplified expressions in terms of **a** and **c**

(i) $\overrightarrow{BC}$

(ii) $\overrightarrow{PQ}$

(5)

(b) (i) Given that $\overrightarrow{PT} = \lambda\overrightarrow{PQ}$, find an expression for $\overrightarrow{AT}$ in terms of λ, **a** and **c**

(ii) Given also that $\overrightarrow{AT} = \mu\overrightarrow{AC}$, find an expression for $\overrightarrow{AT}$ in terms of μ, **a** and **c**

(2)

(c) Use your answers from part (b) to find the value of λ and hence write down the ratio $PT : TQ$

(6)

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Question 10 continued

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Question 10 continued

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Question 10 continued

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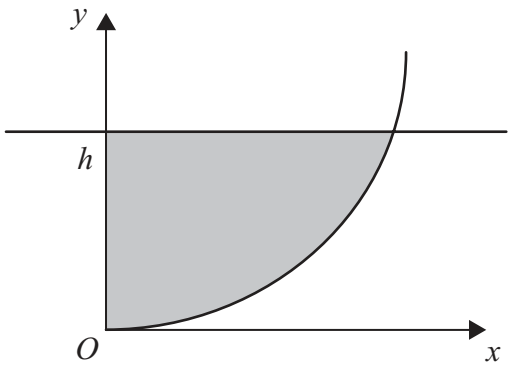

Figure 3

The centre of the circle C, with equation $x^2 + y^2 - 10y = 0$, has coordinates (0, 5). The circle passes through the origin O. The region bounded by the circle, the positive y-axis and the line $y = h$, where $h < 5$, is shown shaded in Figure 3. The shaded region is rotated through 2π radians about the y-axis.

(a) Show that the volume of the solid formed is $\frac{1}{3}\pi h^2(15 - h)$.

(5)

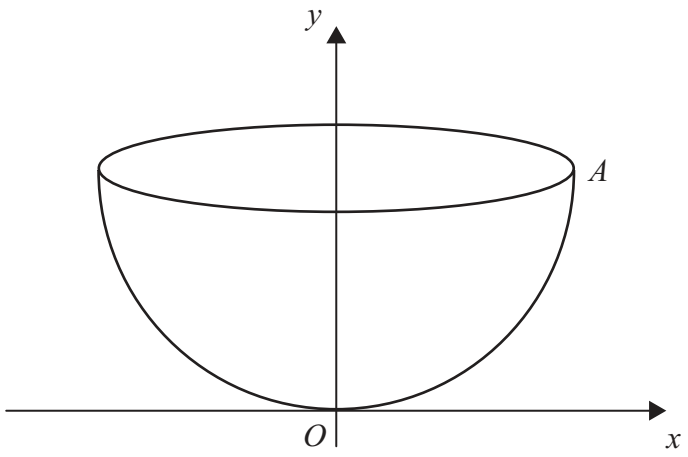

Figure 4

The point A with coordinates (5, 5) lies on C. A bowl is formed by rotating the arc OA through 2π radians about the y-axis, as shown in Figure 4. Water is poured into the bowl at a constant rate of 6 cm^3/s. The volume of water in the bowl is V cm^3 when the depth of water above O is h cm.

(b) Use the formula given in part (a) to find an expression for $\frac{dV}{dh}$ in terms of h.

(1)

(c) Find, to 3 significant figures, the rate at which h is changing when the water above O is 1.5 cm deep.

(4)

The area of the surface of the water is W cm^2 when the depth of water above O is h cm.

(d) Show that, for $0 < h < 5$, the rate of change of the depth of water above O is $\frac{k}{W}$, stating the value of k.

(3)

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Question 11 continued

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Question 11 continued

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Question 11 continued

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Question 11 continued

(Total for Question 11 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS

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