Write your name here

Surname	Other names

Pearson Edexcel
International GCSE

Centre Number | Candidate Number

Further Pure Mathematics

Level 2
Paper 1

Sample assessment material for first teaching September 2017
Time: 2 hours

Paper Reference
4PM1/01

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.*
- You must **NOT** write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

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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PEARSON

International GCSE in Further Pure Mathematics Formulae sheet

Mensuration

Surface area of sphere = $4\pi r^2$

Curved surface area of cone = $\pi r \times$ slant height

Volume of sphere = $\frac{4}{3}\pi r^3$

Series

Arithmetic series

Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$

Geometric series

Sum to n terms, $S_n = \frac{a(1-r^n)}{(1-r)}$

Sum to infinity, $S_\infty = \frac{a}{1-r} \quad |r| < 1$

Binomial series

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \ldots + \frac{n(n-1)\ldots(n-r+1)}{r!}x^r + \ldots \quad \text{for} \quad |x| < 1, n \in \mathbb{Q}$$

Calculus

Quotient rule (diferentiation)

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{\mathrm{f}(x)}{\mathrm{g}(x)}\right) = \frac{\mathrm{f}'(x)\mathrm{g}(x) - \mathrm{f}(x)\mathrm{g}'(x)}{[\mathrm{g}(x)]^2}$$

Trigonometry

Cosine rule
In triangle ABC: $a^2 = b^2 + c^2 - 2bc\cos A$

$\tan\theta = \frac{\sin\theta}{\cos\theta}$

$\sin(A+B) = \sin A\cos B + \cos A\sin B$ $\quad$ $\sin(A-B) = \sin A\cos B - \cos A\sin B$

$\cos(A+B) = \cos A\cos B - \sin A\sin B$ $\quad$ $\cos(A-B) = \cos A\cos B + \sin A\sin B$

$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A\tan B}$ $\quad$ $\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A\tan B}$

Logarithms

$\log_a x = \frac{\log_b x}{\log_b a}$

Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) On the axes below, sketch the lines with equations $2x + 3y = 8$ and $2y = 4x + 1$

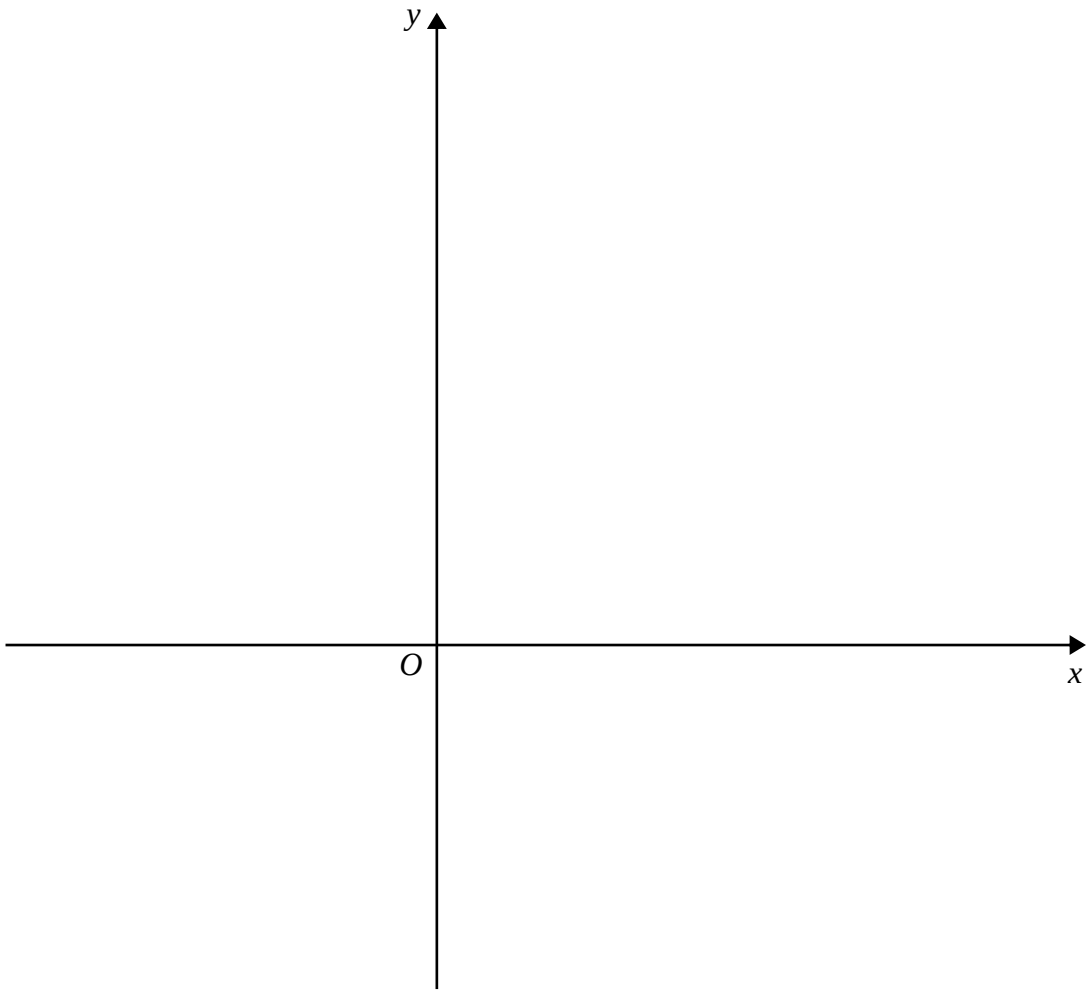
On your sketch, show the coordinates of the points where the lines cross the coordinate axes.

(2)

(b) Show, by shading on your sketch, the region R defined by the inequalities

$$2x + 3y \leqslant 8 \qquad 2y \leqslant 4x + 1 \qquad y \geqslant 0 \qquad x \leqslant 2$$

(2)



(Total for Question 1 is 4 marks)

2

Diagram **NOT** accurately drawn

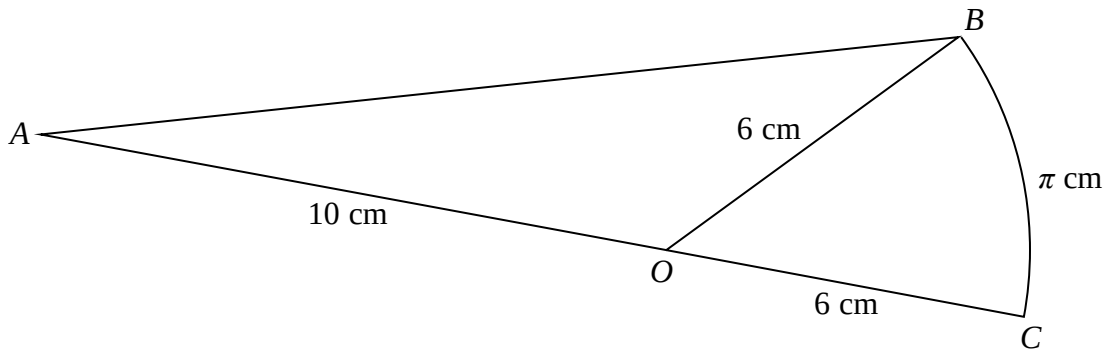


Figure 1

Figure 1 shows a shape ABC in which AOB is a triangle, AOC is a straight line and OBC is a sector of a circle with centre O.

$AO = 10$ cm, $OC = OB = 6$ cm and the length of arc $BC = \pi$ cm.

Find, to 3 significant figures,

(a) the length of AB,

(3)

(b) the area of the shape ABC.

(3)

Question 2 continued

(Total for Question 2 is 6 marks)

3 Solve, in degrees to 1 decimal place, for $0 \leqslant \theta < 180$

$$2\cos(2\theta + 30)° + \tan(2\theta + 30)° = 0$$

(6)

Question 3 continued

(Total for Question 3 is 6 marks)

4 A particle P is moving along the x-axis.

At time t seconds ($t \geqslant 0$) the velocity, v m/s, of P is given by $v = 4t^2 - 19t + 12$

(a) Find the values of t for which P is instantaneously at rest.

(2)

When $t = 0$, the displacement of P from the origin is -4 m.

(b) Find the displacement of P from the origin when $t = 6$

(4)

At time t seconds the acceleration of P is a m/s^2.

(c) Find the value of t when $a = 0$

(3)

Question 4 continued

(Total for Question 4 is 9 marks)

5 Two numbers x and y are such that $2x + y = 13$

The sum of the squares of $2x$ and y is S.

(a) Show that $S = 8x^2 - 52x + 169$

(3)

Using calculus,

(b) find the value of x for which S is a minimum, justifying that this value of x gives a minimum value for S.

(4)

(c) find the minimum value of S.

(2)

Question 5 continued

(Total for Question 5 is 9 marks)

6 $y = e^x\left(x^2 - 3x\right)$

Show that $y - 2\dfrac{dy}{dx} + \dfrac{d^2y}{dx^2} = 2e^x$

(8)

Question 6 continued

(Total for Question 6 is 8 marks)

7 (a) Complete the table of values for

$$y = 2^{\left(\frac{x}{2}+1\right)} + 1$$

giving your answers to 2 decimal places where appropriate.

(2)

x	0	1	2	3	4	5
y	3				9	12.31

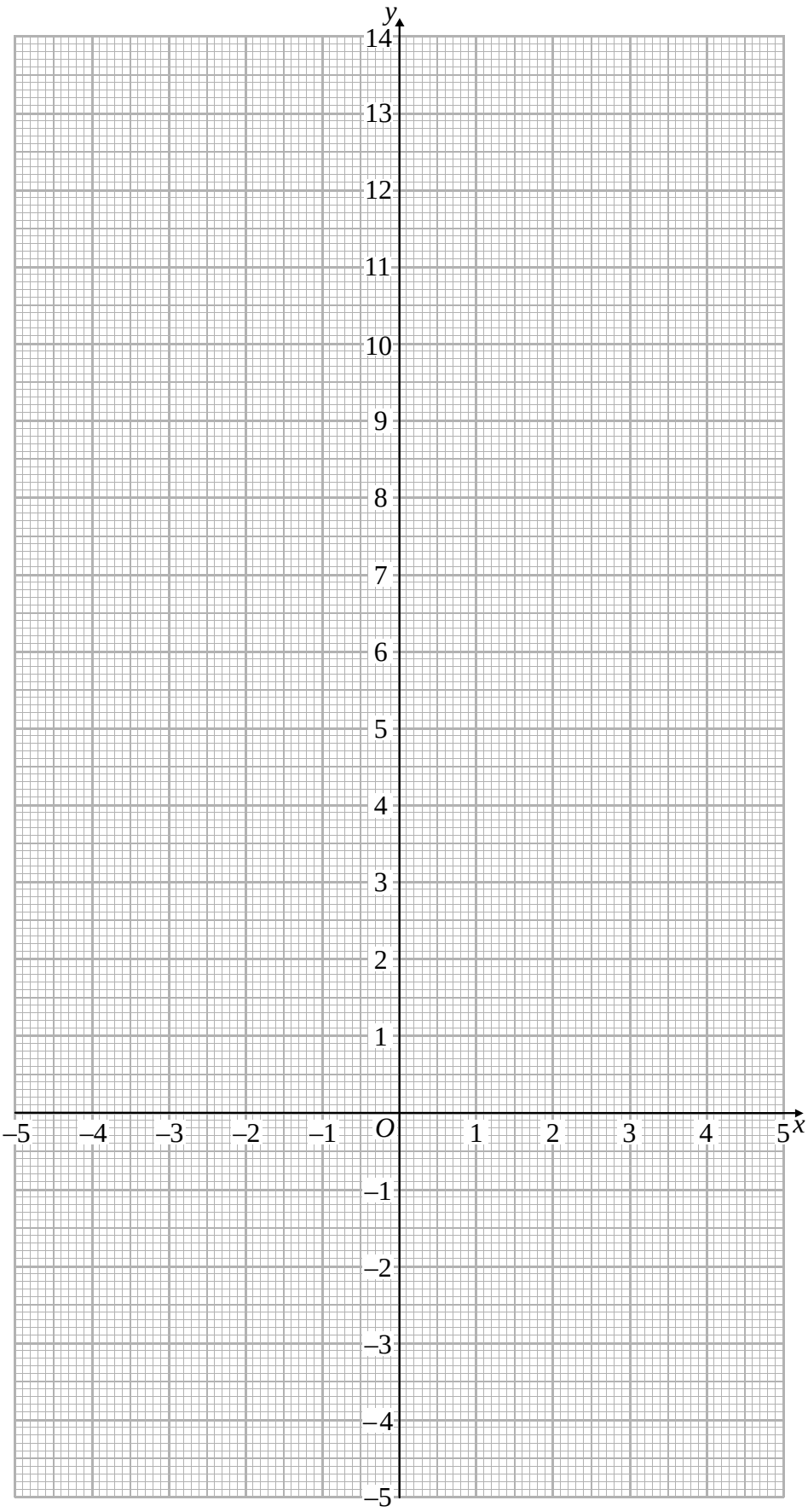
(b) On the grid opposite, draw the graph of $y = 2^{\left(\frac{x}{2}+1\right)} + 1$ for $0 \leqslant x \leqslant 5$

(2)

(c) By drawing a suitable straight line on the grid, obtain an estimate, to 1 decimal place, of the root of the equation $\log_2(4x - 6)^2 - x = 2$ in the interval $0 \leqslant x \leqslant 5$

(4)

Question 7 continued



(Total for Question 7 is 8 marks)

8 The sum S_n of the first n terms of an arithmetic series is given by $S_n = 2n(n + 3)$

(a) Find the first term of the series.

(1)

(b) Find the common difference of the series.

(2)

The nth term of the series is T_n

Given that $6S_{(n-4)} = 7T_{(n+3)}$

(c) find the value of n.

(6)

Question 8 continued

(Total for Question 8 is 9 marks)

9 The roots of a quadratic equation are α and β where $\alpha + \beta = -\frac{7}{3}$ and $\alpha\beta = -2$

(a) Find a quadratic equation, with integer coefficients, which has roots α and β

(4)

Given that $\alpha > \beta$ and without solving the equation,

(b) show that $\alpha - \beta = \frac{11}{3}$

(2)

(c) form a quadratic equation, with integer coefficients, which has roots

$$\frac{\alpha + \beta}{\alpha} \text{ and } \frac{\alpha - \beta}{\beta}$$

(7)

Question 9 continued

(Total for Question 9 is 13 marks)

10

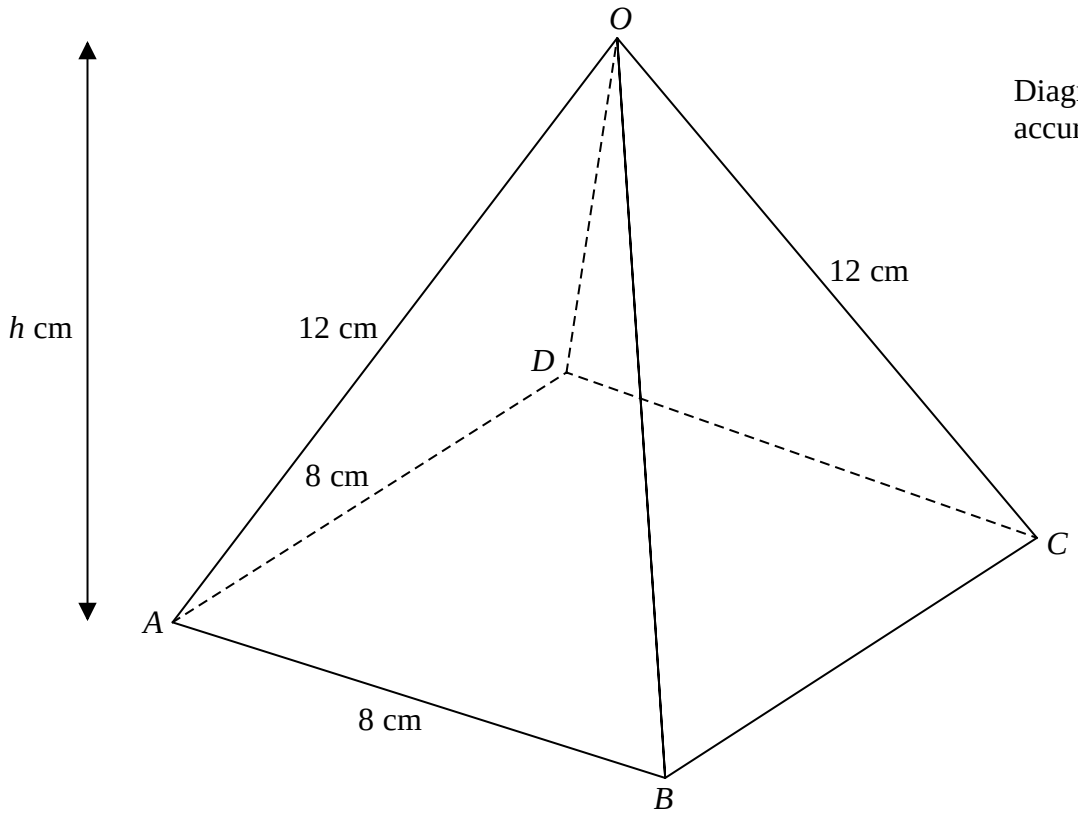


Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows a right pyramid *ABCDO* with a horizontal square base of side 8 cm. The vertical height of the pyramid is *h* cm and $OA = OB = OC = OD = 12$ cm.

(a) Find the exact value of *h*.

(3)

(b) Find, to 1 decimal place, the size of the angle between *OA* and the plane *ABCD*.

(2)

(c) Find, to 1 decimal place, the size of the angle between the plane *AOB* and the plane *ABCD*.

(2)

The midpoint of *OA* is *P* and *Q* is the point on *BC* such that $BQ : QC = 3 : 1$

(d) Show that $PQ = 4\sqrt{5}$ cm.

(4)

(e) Find, to 1 decimal place, the size of angle *PQA*.

(4)

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Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 = 15 marks)

11

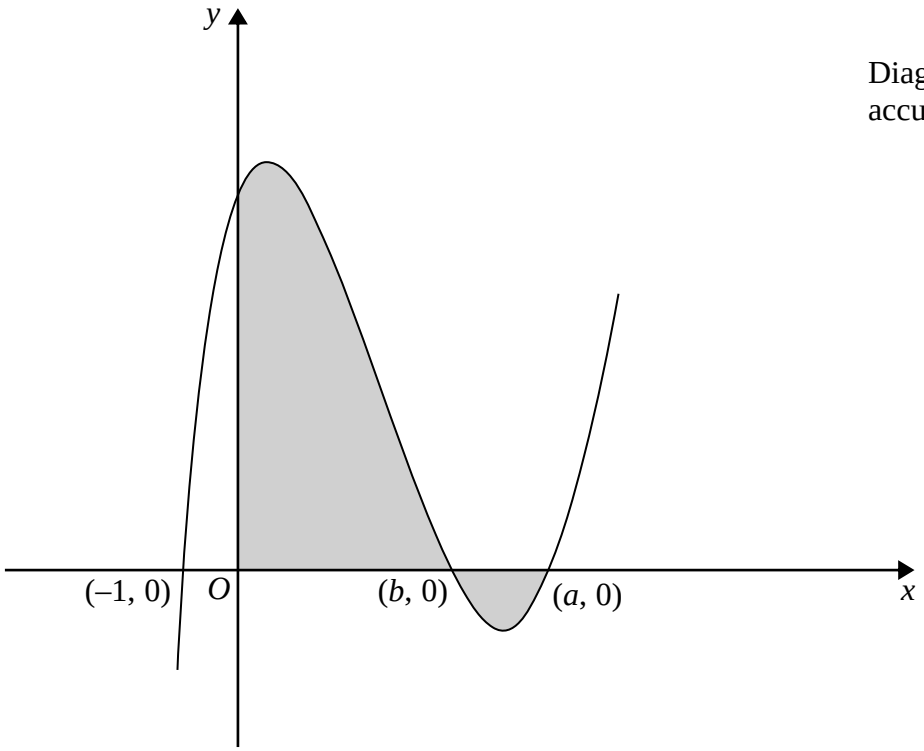

Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows a sketch of the curve with equation $y = f(x)$, which passes through the points with coordinates $(-1, 0)$, $(b, 0)$ and $(a, 0)$ where $0 < b < a$.

Given that $f'(x) = 6x^2 - 26x + 12$

(a) find,

(i) the value of a,

(ii) the value of b.

(8)

(b) Use algebraic integration to determine the exact value of the total area of the shaded regions shown in Figure 3.

(5)

Question 11 continued

Question 11 continued

Question 11 continued

(Total for Question 11 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS

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