

Please check the examination details below before entering your candidate information


Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International GCSE

Tuesday 31 October 2023

Morning (Time: 2 hours) **Paper reference** **4PM1/01**

Further Pure Mathematics
PAPER 1



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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International GCSE in Further Pure Mathematics Formulae sheet

Mensuration

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

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

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

Series**Arithmetic series**

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

Geometric series

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

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

Binomial series

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

Calculus**Quotient rule (differentiation)**

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

Trigonometry**Cosine rule**

$$\text{In triangle } ABC: a^2 = b^2 + c^2 - 2bc \cos A$$

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

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

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

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

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

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

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

Logarithms

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

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Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1

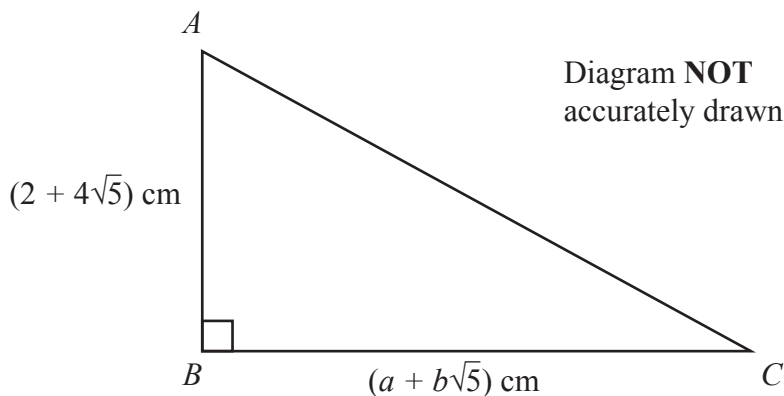


Figure 1

Figure 1 shows the triangle ABC

$\angle ABC = 90^\circ$ $AB = (2 + 4\sqrt{5})$ cm $BC = (a + b\sqrt{5})$ cm where a and b are integers.

The area of triangle $ABC = (34 + 11\sqrt{5})$ cm²

Without using a calculator, find the value of a and the value of b

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Question 1 continued

Dotted lines for writing.

(Total for Question 1 is 4 marks)



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Question 2 continued

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(Total for Question 2 is 7 marks)



3

$$g'(x) = mx^2 - 10x - 37 \quad \text{where } m \text{ is an integer}$$

The curve $y = g(x)$ passes through the point with coordinates $(1, 20)$

Given that $(x - 5)$ is a factor of $g(x)$

(a) show that $g(x) = 2x^3 - 5x^2 - 37x + 60$ (5)

(b) Hence, or otherwise, use algebra to solve the equation $g(x) = 0$ (3)

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Question 3 continued

Area with horizontal dotted lines for writing answers.

(Total for Question 3 is 8 marks)



4 The point A with coordinates $(12, 14)$ and the point B with coordinates $(q, 2)$ where q is a constant, lie on the straight line with equation $3y - 2x - p = 0$ where p is a constant.

(a) Find the value of p and the value of q

(3)

The line L is perpendicular to AB and passes through the point X , which lies on AB such that $AX : XB = 1 : 2$

(b) Find an equation for L in the form $ax + by + c = 0$ where a , b and c are integers to be found.

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Question 4 continued

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Handwriting practice area consisting of 25 horizontal dotted lines.



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Question 4 continued

Area with horizontal dotted lines for writing answers.

(Total for Question 4 is 9 marks)



Question 5 continued

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(Total for Question 5 is 8 marks)



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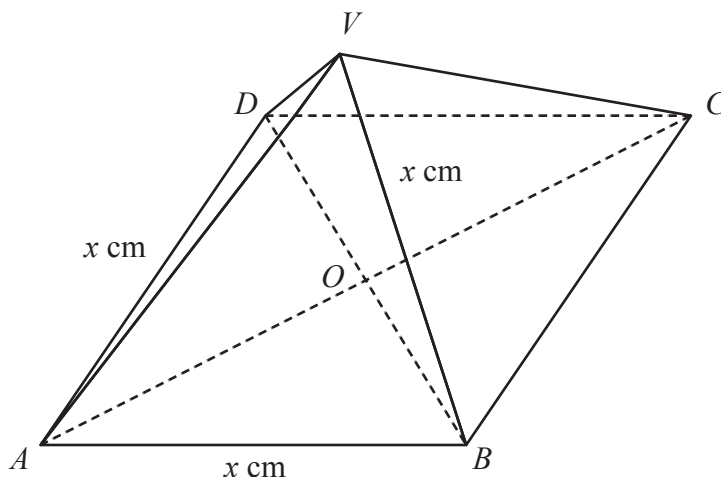


Diagram NOT accurately drawn

Figure 3

Figure 3 shows a right pyramid with a horizontal square base.

$$AB = BC = CD = DA = x \text{ cm}$$

$$AV = BV = CV = DV = x \text{ cm}$$

O is the point of intersection of the diagonals of the base.

The vertex V of the pyramid is vertically above O

(a) Show that $VO = \frac{\sqrt{2}}{2}x \text{ cm}$ (3)

(b) Find, in degrees, the size of the angle AVC (2)

(c) Find, in degrees to one decimal place, the size of the angle between the plane VAB and the plane VDC (3)

The volume of the pyramid is 200 cm^3

Given that the volume of a pyramid $= \frac{1}{3} \times \text{base area} \times \text{height}$

(d) Find to 3 significant figures, the value of x (3)

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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 11 marks)



Question 7 continued

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(Total for Question 7 is 9 marks)



8

$$y = \frac{2e^{3x+1}}{5x^2}$$

(a) Find $\frac{dy}{dx}$

Give your answer in the form $\frac{Ae^{3x+1}(Bx-A)}{Cx^3}$ where A , B and C are prime numbers to be found.

(5)

The value of x increases by 2%

(b) Use your answer to part (a) to find an estimate, in terms of x , for the percentage change in y

Give your answer in the form $(Px - Q)$ where P and Q are integers.

(3)

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Question 8 continued

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Question 8 continued

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(Total for Question 8 is 8 marks)



- 9 (a) Expand $(1-8x^2)^{\frac{1}{2}}$ in ascending powers of x , up to and including the term in x^6 giving each coefficient as an integer. (3)

$$g(x) = \frac{a+bx}{\sqrt{1-8x^2}} \quad \text{where } a \text{ and } b \text{ are prime numbers}$$

Given that the fourth and fifth terms, in ascending powers of x , in the series expansion of $g(x)$ are $20x^3$ and $48x^4$ respectively,

- (b) find the value of a and the value of b (4)

Using the first five terms, in ascending powers of x , in the series expansion of $g(x)$

- (c) obtain an estimate, to 4 significant figures, of $\int_0^{0.2} g(x) dx$ (4)

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 11 marks)



10 (a) Using formulae on page 2, show that

(i) $\sin 2A = 2 \sin A \cos A$

(ii) $\cos 2A = 2 \cos^2 A - 1$

(3)

$$f(\theta) = \frac{2 \tan \theta}{1 + \tan^2 \theta}$$

(b) Show that $f(\theta) = \sin 2\theta$

(4)

(c) Solve, in radians to 3 significant figures, for $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$, the equation

$$5 \tan \left(x + \frac{\pi}{6} \right) = \left[1 + \tan^2 \left(x + \frac{\pi}{6} \right) \right] \left[1 - 2 \cos^2 \left(x + \frac{\pi}{6} \right) \right]$$

(6)

(d) Using calculus, find the exact value of

$$\int_0^{\frac{\pi}{2}} \left(\frac{4 \tan \theta}{1 + \tan^2 \theta} - \cos 5\theta + 2 \right) d\theta$$

(4)

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 17 marks)



11 Solve the simultaneous equations

$$2\log_4 x = \log_3 3y^2$$

$$\log_2 x^3 + 8\log_9 y = 13$$

Show your working clearly.

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Question 11 continued

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