


Please check the examination details below before entering your candidate information

Candidate surname	Other names
Pearson Edexcel	Centre Number
International GCSE	Candidate Number
Monday 15 June 2020	
Afternoon (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

MensurationSurface area of sphere = $4\pi r^2$ Curved surface area of cone = $\pi r \times$ slant heightVolume 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, $S_\infty = \frac{a}{1-r}$ $|r| < 1$ **Binomial series** $(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \dots + \frac{n(n-1)\dots(n-r+1)}{r!}x^r + \dots$ 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**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 Differentiate with respect to x

$$6e^{3x^2} \cos 2x$$

(3)

(Total for Question 1 is 3 marks)



2 (a) Using the axes below sketch the line with equation

$$(i) \ y = 6 \quad (ii) \ y + x = 10 \quad (iii) \ y = 2x - 5$$

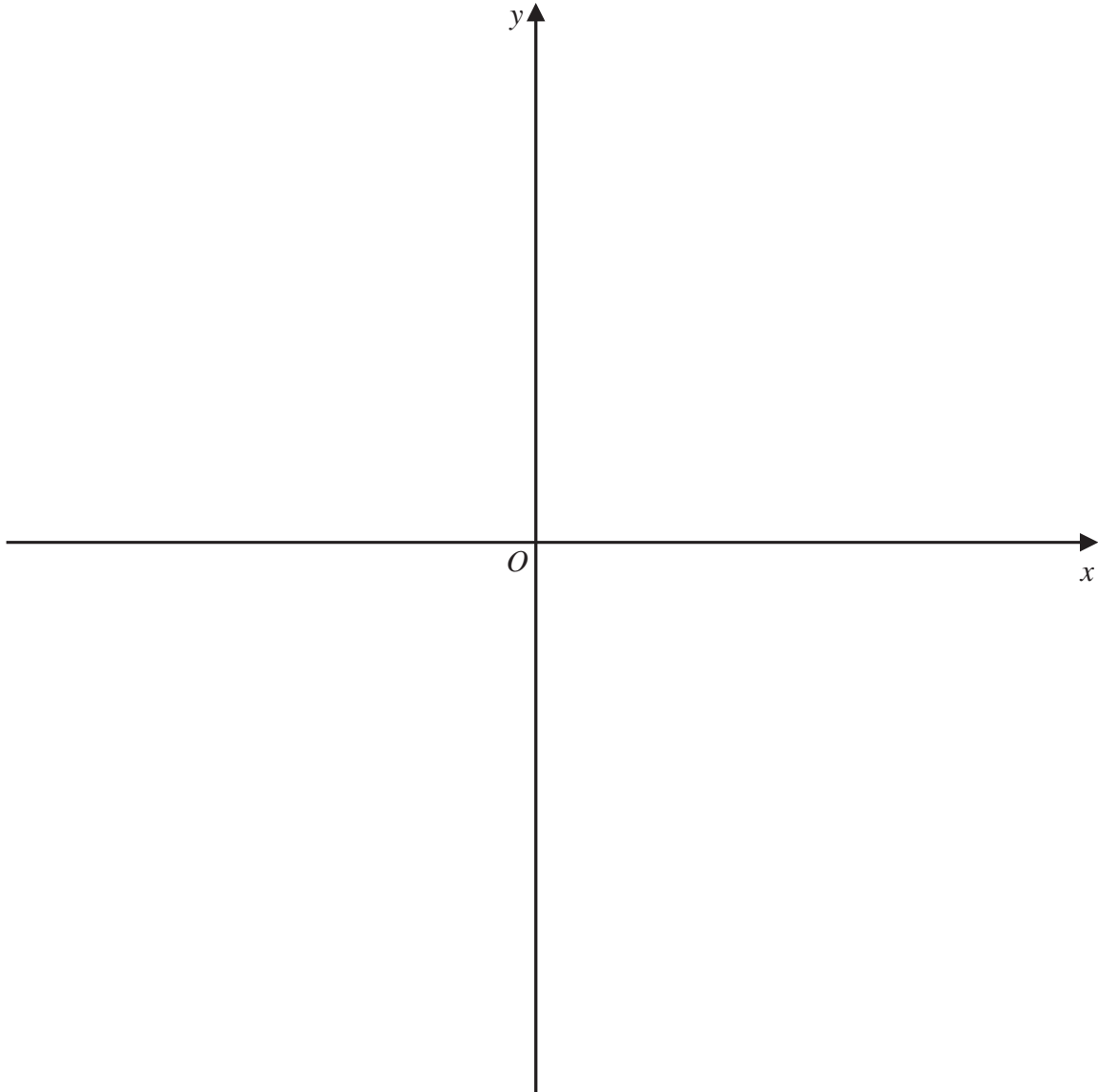
Show the coordinates of any point where each line crosses the coordinate axes.

(3)

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

$$y \leq 6 \quad y + x \leq 10 \quad y \geq 2x - 5 \quad x \geq 0$$

(1)



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Question 2 continued

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(Total for Question 2 is 4 marks)



Question 3 continued

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(Total for Question 3 is 9 marks)



4

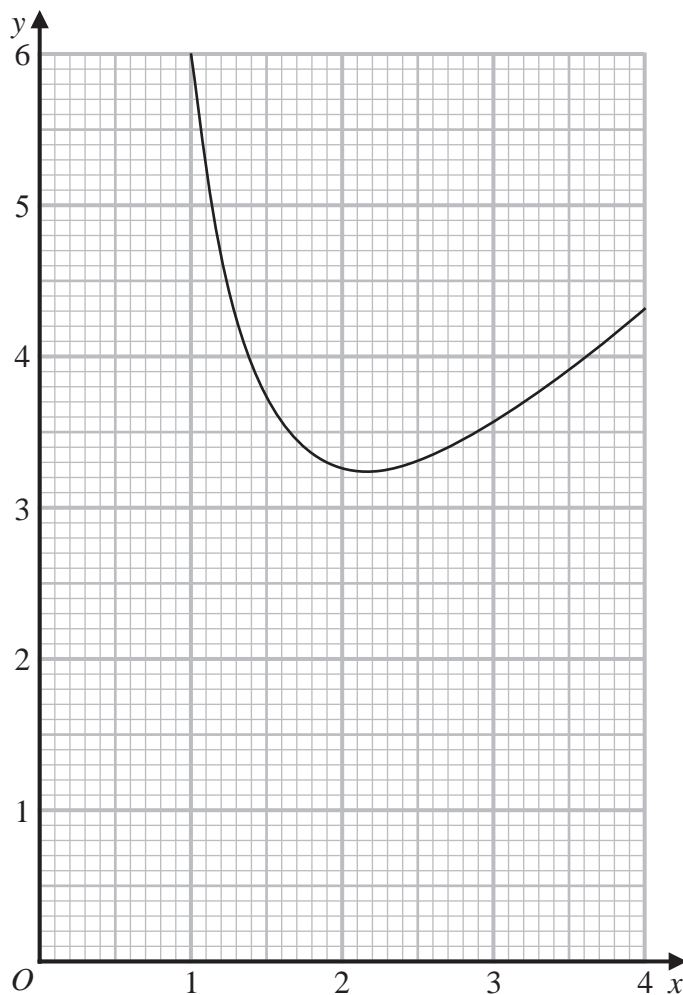


Figure 2

Figure 2 shows the graph of $y = x + \frac{5}{x^2}$ for $1 \leq x \leq 4$ drawn on a grid.

- (a) By drawing a suitable straight line on the grid, obtain estimates, to one decimal place, for the roots of the equation

$$x^3 - 4x^2 + 5 = 0$$

in the interval $1 \leq x \leq 4$

(3)

- (b) By drawing a suitable straight line on the grid, obtain an estimate, to one decimal place, for the root of the equation

$$x^3 - x^2 - 5 = 0$$

in the interval $1 \leq x \leq 4$

(4)

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Question 4 continued

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(Total for Question 4 is 7 marks)



5 The points P , Q , R and S have coordinates $(4, 7)$, $(3, 0)$, $(10, 1)$ and $(11, 8)$ respectively.

(a) Show, by calculation, that the lines PR and QS are perpendicular.

(3)

(b) Find the exact lengths of (i) PR (ii) QS

(2)

(c) Find the area of the quadrilateral $PQRS$

(2)

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Question 5 continued

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(Total for Question 5 is 7 marks)



6 An arithmetic series A has first term a and common difference d .

The sum S_n of the first n terms of A is given by $S_n = n(15 + 2n)$

(a) Find the value of a and the value of d .

(4)

(b) Find the 20th term of A .

(2)

Given that $S_{2p} - 2S_p = 1 + S_{(p-1)}$

(c) find the value of p .

(4)

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Question 6 continued

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(Total for Question 6 is 10 marks)



7

$$f(x) = x^2 - 9x + 14$$

Given that $f(x)$ can be written in the form $(x + a)^2 + b$, where a and b are constants,

(a) find the value of a and the value of b . (2)

(b) Hence, or otherwise, find

(i) the minimum value of $f(x)$

(ii) the value of x for which this minimum occurs. (2)

The curve C has equation $y = f(x)$

The line l has equation $y = x + 5$

(c) Use algebra to find the coordinates of the points of intersection of C and l . (4)

(d) Use algebraic integration to find the exact area of the finite region bounded by C and l . (5)

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Question 7 continued

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Question 7 continued

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(Total for Question 7 is 13 marks)



8 Given that $2xy + 5y = e^x$

(a) show that $\frac{dy}{dx} = \frac{y(2x + 3)}{2x + 5}$

(5)

(b) find the value of $\frac{dy}{dx}$ when $x = 0$

(2)

(c) find an equation of the normal to the curve with equation $2xy + 5y = e^x$ at the point where $x = 0$

Give your answer in the form $px + qy + r = 0$ where p , q and r 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 10 marks)



Question 9 continued

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Question 9 continued

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(Total for Question 9 is 12 marks)



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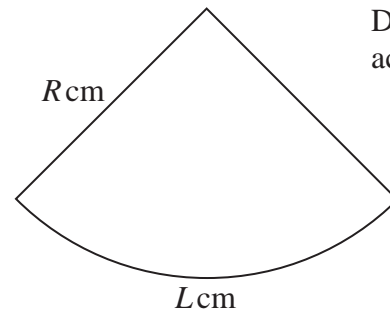
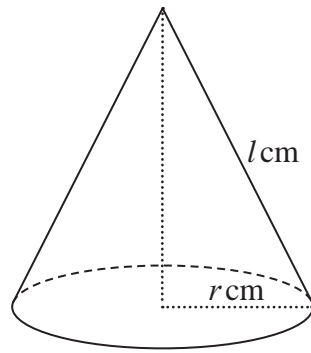
Diagram NOT
accurately drawn

Figure 4

Figure 4 shows a right circular cone with base radius $r \text{ cm}$ and slant height $l \text{ cm}$.
Figure 4 also shows a sector of a circle with radius $R \text{ cm}$ and arc length $L \text{ cm}$.

The area of the curved surface of the cone is $A \text{ cm}^2$

By considering how the sector of the circle can be folded to exactly form the curved surface of the cone with R and L suitably chosen,

- (a) prove that $A = \pi r l$ (4)

Sand is poured onto a horizontal surface at a constant rate of $1.5 \text{ cm}^3/\text{s}$.

The sand forms a pile in the shape of a right circular cone with its base on the surface.

The curved surface area of the cone, $A \text{ cm}^2$, increases in such a way that the height of the cone is always three times the radius of the base of the cone.

Given that $\frac{dA}{dr} = k\pi r$, where k is a constant,

- (b) find the exact value of k . (3)
- (c) Calculate the rate, in cm^2/s , to 3 significant figures, at which the curved surface area of the pile is increasing when the height of the pile is 24 cm . (5)

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 12 marks)



Question 11 continued

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