Please check the examination details be	ow before entering your candidate information
Candidate surname	Other names
Centre Number Candidate N Pearson Edexcel Inter	
Time 2 hours	Paper reference 4PM1/01R
Further Pure Mat	hematics
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 ▶







International GCSE in Further Pure Mathematics Formulae sheet

Mensuration

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

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

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,
$$S_{\infty} = \frac{a}{1-r} |r| < 1$$

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)

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

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

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



Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1	An arithmetic series has 5th term 16 and 100th term 301	
	Find the sum of the first 50 terms of the series.	(5)
_	(Total for Question 1 is 5 ma	arks)



2	A particle <i>P</i> is moving along a straight line, which passes through the fixed point <i>O</i> .								
	At time t seconds ($t \ge 0$), the velocity, $v \text{ m/s}$, of P is given by								
	$v = t^2 - 3t + 4$								
	At time t seconds the acceleration of P is $a \mathrm{m/s^2}$								
	(a) Find an expression for a in terms of t	(2)							
	The displacement of <i>P</i> from <i>O</i> is 7 m when $t = 2$								
	(b) Find the exact displacement of P from O when $t = 4$								
		(5)							



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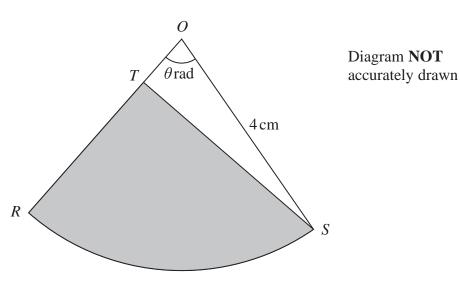


Figure 1

Figure 1 shows sector *ORS* of a circle with centre *O* and radius 4 cm. The size of angle *ROS* is θ radians.

The area of sector *ORS* is 2π cm²

(a) Find the exact value of θ

(2)

(b) Find the perimeter, in cm to 3 significant figures, of the sector *ORS*.

(2)

The point *T* lies on OR such that OT : TR = 1 : 3

The region shown shaded in Figure 1 is bounded by the line *TR*, the line *TS* and the arc *RS* of the sector.

The area of this region is $A \text{ cm}^2$

(c) Find the exact value of A

(2)

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Question 3 continued	
	(Total for Question 3 is 6 marks)



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		Figure 2		
Figure 2 shows a rectang			metres	
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(a) Find, in terms of x, a				
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The perimeter of the rectangle				
(b) Find the set of possib				
Give your answer in	the form $a < x < b$	•		(5)



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	(Total for Question 4 is 7 marks)



- 5 Differentiate with respect to x
 - (a) $e^{4x}(6x+2)^{\frac{3}{2}}$

Give your answer in the form $e^{4x}(\sqrt{6x+2})(Ax+B)$ where A and B are integers.

(5)

$$(b) \frac{\sin 3x}{\left(2x-4\right)^3}$$

(3)

	Question 5 continued
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	(Total for Question 5 is 8 marks)



- 6 Given that $\frac{a + \sqrt{5}}{\sqrt{5} 2} = 11 + 5\sqrt{5}$
 - (a) without using a calculator, find the value of *a* Show your working clearly.

(2)

Triangle PQR is such that

$$PR = (x + 3) \text{ cm}$$
 $QR = x \text{ cm}$ angle $QPR = 30^{\circ}$ angle $PQR = 45^{\circ}$

(b) Show that $x = 3 + 3\sqrt{2}$

(3)

Given that $\sin 105^\circ = \frac{\sqrt{6} + \sqrt{2}}{4}$ and that the area of triangle *PQR* is $A \text{ cm}^2$

(c) find the exact value of A in the form $\frac{9}{8} (p\sqrt{6} + q\sqrt{2} + r\sqrt{3} + s)$ where p, q, r and s are integers.

(3)



Question 6 continued		



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- 7 A curve C has equation $y = \log_{10}(x+2)$
 - (a) Using the axes below, sketch the graph of *C*. Label the coordinates of the points of intersection of *C* with the coordinate axes.

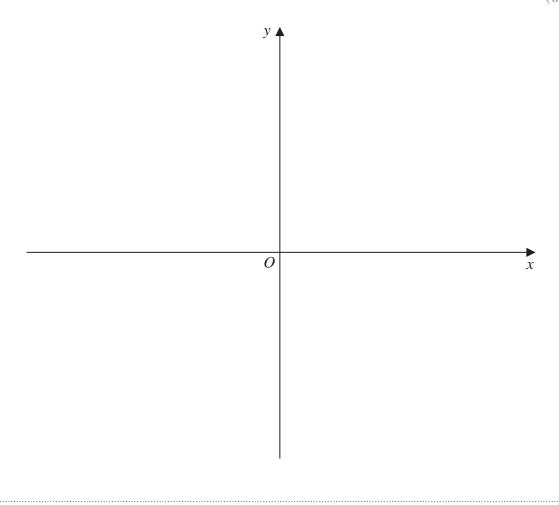
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(b) Solve the equation $2(\log_a 4 + \log_a 16) = 1$

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(c) Solve the equation $5\log_q 16 + 4\log_2 q = 24$

(6)



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8 (a) Using the binomial expansion, or otherwise, find the complete expansion of

$$(x+y)^3$$

(1)

The quadratic equation

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

has roots α and β

(b) Without solving the equation, find the value of

$$\alpha^3 + \beta^3$$

(4)

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

$$\frac{\alpha}{\beta^2}$$
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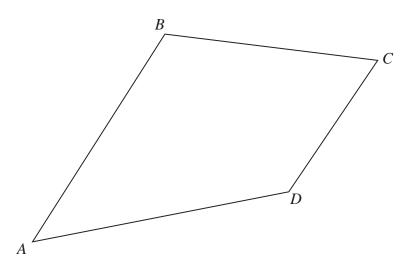


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Figure 3

Figure 3 shows quadrilateral ABCD such that

$$\overrightarrow{AD} = 2\mathbf{a} + \mathbf{b}$$
 $\overrightarrow{BC} = \frac{1}{3}\mathbf{b}$ $\overrightarrow{BD} = -4\mathbf{a} - \mathbf{b}$

(a) Prove that \overrightarrow{AB} is parallel to \overrightarrow{DC}

(4)

The diagonals, AC and BD, of the quadrilateral intersect at the point Y.

(b) Using a vector method, find \overrightarrow{AY} as a simplified expression in terms of **a** and **b** (6)

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Question 9 continued	

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- 10 Using suitable results for $\sin(A + B)$ and $\sin(A B)$ from the formulae page,
 - (a) show that $2\sin 4x\cos x = \sin 5x + \sin 3x$

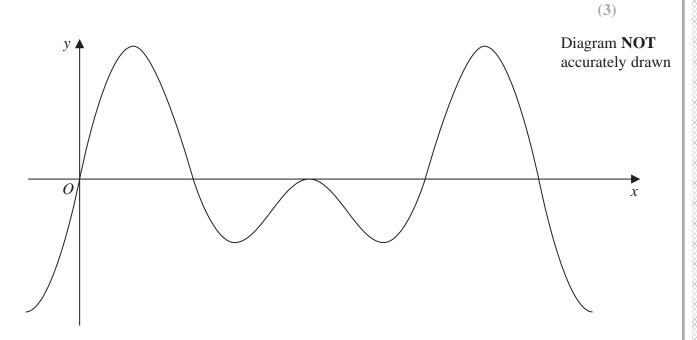


Figure 4

Figure 4 shows part of a sketch of the curve $y = 6 \sin 4x \cos x$

(b) Using calculus, find the total area bounded by the curve and the *x*-axis between x=0 and $x=\frac{\pi}{2}$

Give	vour	answer	to	3	significant	figures
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Question 10 continued
(Total for Question 10 is 11 marks)



11 An equation of the straight line *l* is y - 3x = 3

The point A on l lies on the y-axis.

The point B on l has coordinates (10, b), where b is an integer.

The point C divides AB in the ratio 2:3

The straight line k passes through C and is perpendicular to l

(a) Show that an equation of k is

$$3y + x - 49 = 0$$

(6)

The point *D* with coordinates (p, q), where *q* is positive, is such that *AD* is parallel to *k* and the length of *AD* is $12\sqrt{10}$

(b) Find the coordinates of D

(6)

The point E lies on k such that DE is parallel to the y-axis. The point F lies on l such that DF is parallel to the y-axis.

(c) Find the exact area of triangle *ECF*.

(5)



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