Please check the examination details bel	low before enter	ring your candidate information
Candidate surname		Other names
Centre Number Candidate N Pearson Edexcel Inter		al GCSE
Tuesday 21 May 202	24	
Morning (Time: 2 hours)	Paper reference	4PM1/01R
Further Pure Mat PAPER 1R	hema	tics
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: $a^2 = b^2 + c^2 - 2bc \cos A$

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

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

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

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

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

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

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

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	Without using a calculator, solve the inequality $\sqrt{50} x - \sqrt{18} > 6x + 5$
	Give your answer in an exact form with a rationalised denominator. Show your working clearly.

(Total for Question 1 is 4 marks)
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2 Given that

$$1 - \frac{1}{3}x + \frac{5}{36}x^2 + \dots$$

is the binomial expansion, in ascending powers of x, of $(1 + Ax)^n$

where A and n are rational numbers,

(a) find the value of A and the value of n

(6)

(b) Hence find the value of the coefficient of x^3

Give your answer in the form $-\frac{p}{}$	where p is a prime number and q is an	integer.
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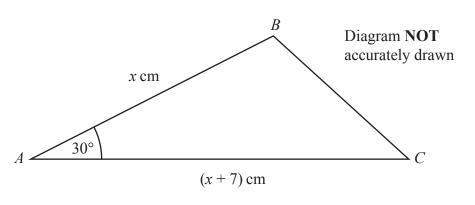


Figure 1

Figure 1 shows triangle ABC where

$$AB = x \text{ cm}$$
 $AC = (x + 7) \text{ cm}$ $\angle BAC = 30^{\circ}$

The area of triangle $ABC = 36 \text{ cm}^2$

(a) Show that x = 9

(3)

(b) Find, in cm to 3 significant figures, the length of BC

(2)

- (c) Find, in degrees to one decimal place, the size of
 - (i) ∠ABC
 - (ii) ∠ACB

(3)



Figure 2

Figure 2 shows the sector OPQ of a circle with centre O and radius r cm.

$$OP = OQ = r \text{ cm}$$
 arc $PQ = (21 - r) \text{ cm}$ $\angle POQ = \theta \text{ radians}$

The area of the sector is $A \text{ cm}^2$

(a) Show that
$$A = \frac{r}{2}(21 - r)$$

The area of the sector must be greater than or equal to 27 cm²

(b) Find the set of possible values of r

(c) Hence write down the set of possible values of θ

8

(3)

(4)

(2)



5	The sum of the first 10 terms of an arithmetic series A is $36k + 1$ where k is a constant.	
	The 6th term of A is $4k + 1$	
	(a) (i) Find an expression in terms of k for the common difference of A	
	(ii) Show that the first term of A is -8	(5)
	Given that the 4th term of A is 7	(5)
	(b) show that $k = 4$	(2)
	The sum of the first n terms of A is S_n and the n th term of A is U_n	
	(c) Find the value of <i>n</i> such that $S_n = 5U_{n+10} + 105$	(4)
		(4)





Question 5 continued	





A particle P is moving in a straight line. The displacement s of P, in metres, at time t seconds, $t \ge 0$, is given by

$$s = e^{2t} \sin 3t + 2$$

At time t = 0, P is at the point A and at time $t = \frac{\pi}{6}$, P is at the point B

(a) Find the exact distance AB

(2)

(b) Find the exact velocity of *P* when $t = \frac{\pi}{3}$

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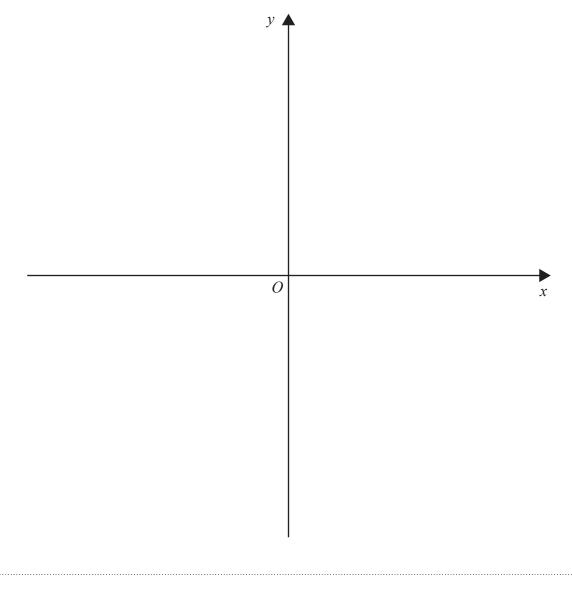


- 7 The curve C has equation $y = -\log_4(x+4)$
 - (a) Using the axes below, sketch the graph of *C*. Label the coordinates of the points of intersection of *C* with the coordinate axes and the equation of any asymptote to *C*.

(4)

(b) Solve the equation $\log_{(x+4)} 256 - \log_4 (x+4) = 0$

(5)





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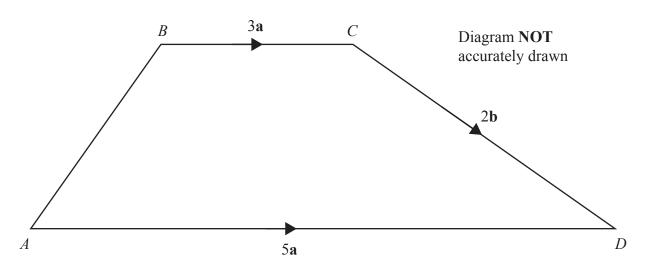


Figure 3

Figure 3 shows a trapezium ABCD

$$\overrightarrow{BC} = 3\mathbf{a}$$
 $\overrightarrow{AD} = 5\mathbf{a}$ $\overrightarrow{CD} = 2\mathbf{b}$

(a) Find \overrightarrow{AB} as a simplified expression in terms of **a** and **b**

The diagonals BD and AC intersect at point X where $\overrightarrow{BX} = k \ BD$

(b) Using a vector method, find the value of k

(c) Find the ratio of the area of triangle CXD: area of the trapezium ABCD



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Question 8 continued	





9	The point A has coordinates $(-4, 3)$ and the point B has coordinates $(6, 8)$ The points A and B lie on the line k	
	(a) Find an equation of k	(2)
	The point C , on k , is such that $AC : CB = 4:1$	
	(b) Find the coordinates of point C	(2)
	The point D with coordinates (p, q) , where $p < 0$, lies on the line l through C that is perpendicular to k	
	The length of CD is $8\sqrt{5}$	
	(c) Find the coordinates of D	(0)
	(1) F' 14 (CD)	(6)
	(d) Find the area of triangle ACD	(2)





Question 9 continued	





10 The quadratic equation $2x^2 + kx + 4 = 0$ has roots α and β such that

$$k < 0$$
 and $\alpha > \beta$

Given that $\alpha^2 - \beta^2 = \frac{7\sqrt{17}}{4}$

(a) show that k = -7

(8)

(b) Hence form a quadratic equation that has roots

$$(\alpha - \beta)$$
 and $(\alpha + \beta)$



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Question 10 continued	





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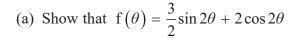


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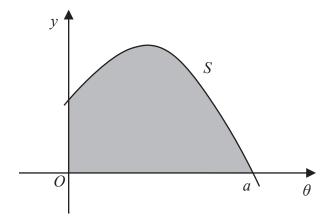


Figure 4

Figure 4 shows part of the curve S with equation $y = f(\theta) + 2$

Given that S intersects with the θ -axis at the point with coordinates (a, 0)

(b) using
$$\sin^2 \theta + \cos^2 \theta = 1$$
, or otherwise, show that $a = \frac{\pi}{2}$

(5)

(c) Using algebraic integration, find the exact area bounded by S, the positive θ -axis and the positive y-axis shown shaded in Figure 4

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Question 11 continued	
	(Total for Question 11 is 11 marks)
	TOTAL FOR PAPER IS 100 MARKS

