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

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

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

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

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

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

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

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

## 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
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Give your answer in an exact form with a rationalised denominator. Show your working clearly.

	(4)
(Total for Question 1 is 4	marks)



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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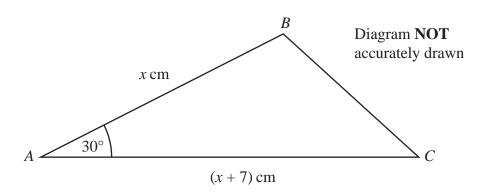


Figure 1

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)

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Question 3 continued	



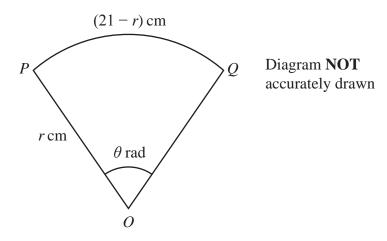


Figure 2

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

(3)

The area of the sector must be greater than or equal to 27 cm<sup>2</sup>

(b) Find the set of possible values of r

(4)

(c) Hence write down the set of possible values of  $\theta$ 

(2)

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Question 4 continued	
(Total for	Question 4 is 9 marks)



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	
	(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 $S_n = 5U_{n+10} + 105$	
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Question 5 continued	



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Question 5 continued	

Question 5 continued
(Total for Question 5 is 11 marks)



6 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  $t = \frac{\pi}{3}$ 

(4)

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

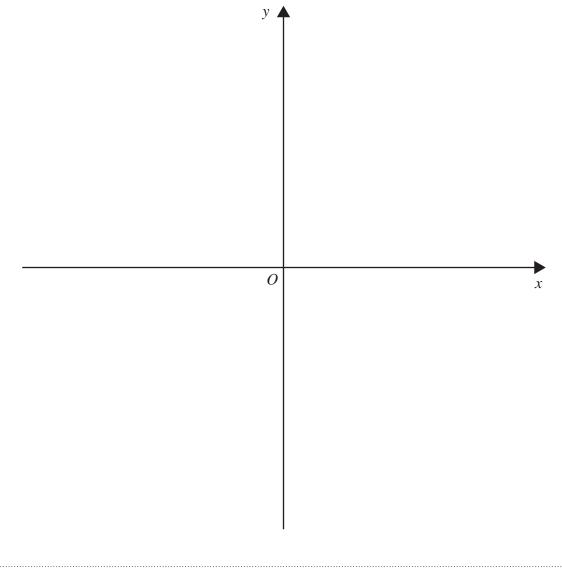


- 7 The curve C has equation  $y = -\log_4(x+4)$ 
  - (a) Using the axes below, sketch the graph of *C*. Label the coordinates of the points of intersection of *C* with the coordinate axes and the equation of any asymptote to *C*.

(4)

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

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Question 7 continued	
(Total	for Question 7 is 9 marks)



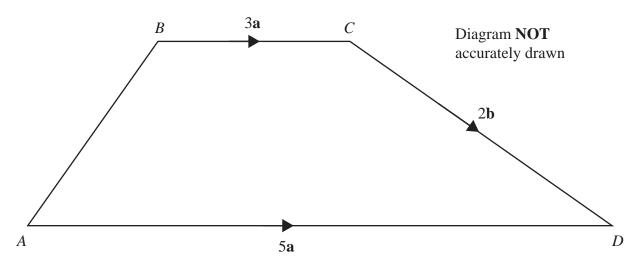


Figure 3

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** 

(1)

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

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

(5)

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





Question 8 continued



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Question 8 continued

Question 8 continued	
	(Total for Question 8 is 10 marks)



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 <i>C</i>	(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 <i>D</i>	(6)
	(d) Find the area of triangle <i>ACD</i>	(2)

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Question 9 continued	



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Question 9 continued
(Total for Question 9 is 12 marks)



10 The quadratic equation  $2x^2 + kx + 4 = 0$  has roots  $\alpha$  and  $\beta$  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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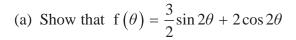
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Question 10 continued

Question 10 continued
(Total for Operation 10 is 12 marks)
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11  $f(\theta) = (2\cos\theta - \sin\theta)(2\sin\theta + \cos\theta)$ 



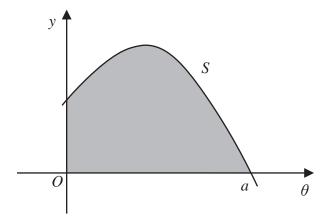


Diagram **NOT** accurately drawn

(3)

Figure 4

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

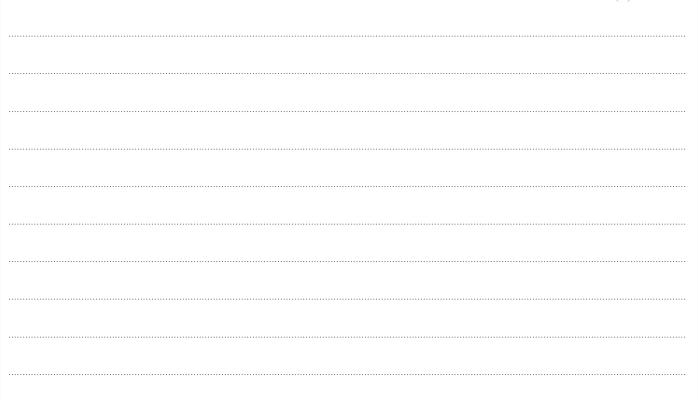
Given that S intersects with the  $\theta$ -axis at the point with coordinates (a, 0)

(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  $\theta$ -axis and the positive y-axis shown shaded in Figure 4

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Question 11 continued	



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Question 11 continued	
	(Total for Ougstion 11 is 11 morely)
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