Write your name here Surname	Other names
Edexcel International GCSE	Centre Number Candidate Number
Further Du	re Mathematics
Paper 2	ile Mathematics
_	

## **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.

## **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.

P 4 2 0 3 9 A 0 1 3 2

Turn over ▶



## Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1

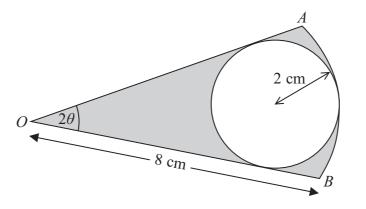


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows the sector, AOB of a circle with centre O and radius 8 cm. A circle of radius 2 cm touches the lines OA and OB and the arc AB. Angle AOB is  $2\theta$  radians,

$$0<\theta<\frac{\pi}{4}.$$

(a) Find, to 4 significant figures, the value of  $\theta$ 

/	$^{-}$	1
г	-6	١.
	a. J	
١.	_	/

(b) Find, to 3 significant figures, the area of the region shaded in Figure 1.

1	1	q	1	
1		2		

Question 1 continued	
	(Total for Question 1 is 6 marks)



2	Using the identities	$\sin(A+B) = \sin A \cos B + \cos A \sin B$
		$\cos (A + B) = \cos A \cos B - \sin A \sin B$
		$\tan A = \frac{\sin A}{\cos A}$

(a) show that 
$$\tan (A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$
 (3)

(b) Hence show that

(i) 
$$\tan 105^\circ = \frac{1+\sqrt{3}}{1-\sqrt{3}}$$
 (ii)  $\tan 15^\circ = \frac{\sqrt{3}-1}{1+\sqrt{3}}$  (4)


Question 2 continued	
	(Total for Question 2 is 7 marks)



3	(a) Expand $(1 + 3x^2)^{-\frac{1}{4}}$ in ascending powers of $x$ up to and including the term in $x^6$ , giving each coefficient as a fraction in its lowest terms.	
		(3)
	(b) Find the range of values of x for which your expansion is valid.	(1)
	$f(x) = \frac{3 + kx^2}{(1 + 3x^2)^{\frac{1}{4}}} \qquad k \in \mathbb{R}^+$	
	(c) Obtain a series expansion for $f(x)$ in ascending powers of $x$ up to and including the term in $x^6$ .	
		(3)
	Given that the coefficient of $x^4$ in the series expansion of $f(x)$ is zero	
	(d) find the exact value of k.	
		(2)

Question 3 continued	



Question 3 continued	
	(Total for Question 3 is 9 marks)

4 Differentiate with r	respect to x			
(a) $3x \sin 5x$				(2)
$e^{2x}$				(3)
(b) $\frac{e^{2x}}{4-3x^2}$				(2)
				(3)
		(Total fo	or Question 4 is 6 ma	rks)



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

(a) Use the above identity to show that  $2 \sin^2 A = 1 - \cos 2A$ 

(3)

(b) Hence find the value of k such that  $\sin^2 2A = k(1 - \cos 4A)$ 

(1)

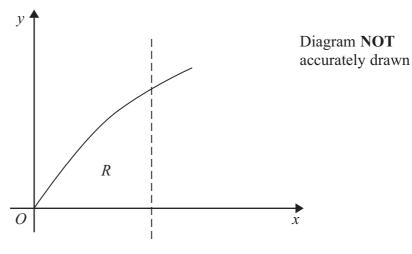


Figure 2

Figure 2 shows part of the curve with equation  $y = 3 \sin 2x$ . The region R, bounded by the curve, the positive x-axis and the line  $x = \frac{\pi}{6}$ , is rotated through  $360^{\circ}$  about the x-axis.

(c) Use calculus to find, to 3 significant figures, the volume of the solid generated.


10

Question 5 continued		



Question 5 continued	

Question 5 continued	
	(Total for Question 5 is 10 marks)



6	A solid paperweight in the shape of a cuboid has volume $15 \text{ cm}^3$ . The paperweight has a rectangular base of length $5x \text{ cm}$ and width $x \text{ cm}$ and a height of $h \text{ cm}$ . The total surface area of the paperweight is $A \text{ cm}^2$ .			
	(a) Show that $A = 10x^2 + \frac{36}{x}$	(3)		
	(b) Find, to 3 significant figures, the value of x for which A is a minimum, justifying that			
	this value of $x$ gives a minimum value of $A$ .	(6)		
	(c) Find, to 3 significant figures, the minimum value of A.			
		(2)		

Question 6 continued	



Question 6 continued	

Question 6 continued	
	(Total for Question 6 is 11 marks)



7	The line $l$ passes through the points with coordinates $(1, 6)$ and $(3, 2)$ .	
	(a) Show that an equation of $l$ is $y + 2x = 8$	(3)
	The curve $C$ has equation $xy = 8$	
	(b) Show that $l$ is a tangent to $C$ .	(3)
	Given that $l$ is the tangent to $C$ at the point $A$ ,	
	(c) find the coordinates of $A$ .	(2)
	(d) Find an equation, with integer coefficients, of the normal to $C$ at $A$ .	(3)

Question 7 continued	



Question 7 continued	

Question 7 continued	
	(Total for Question 7 is 11 marks)



8

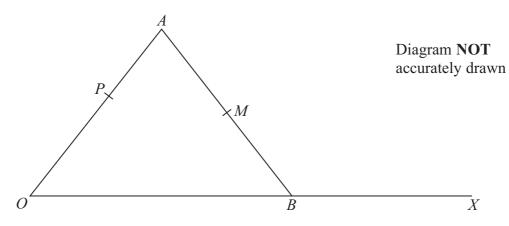


Figure 3

In Figure 3,  $\overrightarrow{OA} = \mathbf{a}$ ,  $\overrightarrow{OB} = \mathbf{b}$  and M is the mid-point of AB.

The point P is on OA such that OP:PA = 3:2

The point X lies on OB produced.

- (a) Find, as simplified expressions in terms of a and b,
  - $(i) \overrightarrow{AB}$
- (ii)  $\overrightarrow{OM}$
- (iii)  $\overrightarrow{PM}$

(6)

Given that P, M and X are collinear

(b) find, in terms of **b**,  $\overrightarrow{OX}$ 

**(4)** 

(c) Find the ratio (area  $\triangle OAM$ ): (area  $\triangle OAX$ ).

(3)

Question 8 continued	



Question 8 continued	

Question 8 continued	
	(Total for Question 8 is 13 marks)



9	The third and fifth terms of a geometric series $S$ are 48 and 768 respectively. Find	
	(a) the two possible values of the common ratio of <i>S</i> ,	(3)
	(b) the first term of <i>S</i> .	(3)
	(b) the first term of 5.	(1)
	Given that the sum of the first 5 terms of S is 615	
	(c) find the sum of the first 9 terms of <i>S</i> .	(4)
	Another geometric series T has the same first term as S. The common ratio of T is $\frac{1}{r}$	(-)
	where $r$ is one of the values obtained in part (a). The $n$ th term of $T$ is $t_n$	
	Given that $t_2 > t_3$	
	(d) find the common ratio of <i>T</i> .	(1)
	The sum of the first $n$ terms of $T$ is $T_n$	
	(e) Writing down all the numbers on your calculator display, find $T_9$	
		(2)
	The sum to infinity of $T$ is $T_{\infty}$	
	Given that $T_{\infty} - T_n > 0.002$	
	(f) find the greatest value of $n$ .	(5)

Question 9 continued		



Question 9 continued	

Question 9 continued	
	(Total for Question 9 is 16 marks)



10 Solve the equations	
(a) $\log_x 1024 = 5$	
	(2)
(b) $\log_5 (6y + 11) = 3$	(3)
(c) $2\log_3 t + \log_t 9 = 5$	(3)
(c) $2\log_3 t + \log_t y - 3$	(6)

Question 10 continued	



Question 10 continued	
	(Total for Question 10 is 11 marks)
	TOTAL FOR PAPER IS 100 MARKS