Candidate Number
ematics
Paper Reference 4PM0/02

## **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.

Turn over ▶

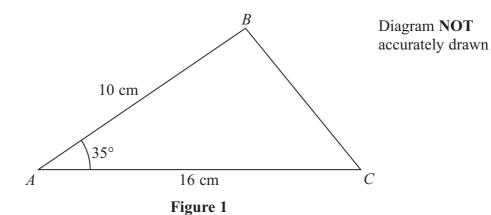


Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1



In triangle ABC, AB = 10 cm, AC = 16 cm and  $\angle BAC = 35^{\circ}$ , as shown in Figure 1.

(a) Find, to 3 significant figures, the area of the triangle ABC.

**(2)** 

(b)	Find,	in	degrees	to the	nearest	0.1°,	the	size	of tl	he	angle <i>ABC</i> .	
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(5)


Question 1 continued	
	(Total for Question 1 is 7 marks)



2	Given that $2\log_4 x - \log_2 y = 3$	
	(a) show that $x = 8y$	
		(4)
	Given also that $\log_5(3x + y) = 4$	
	(b) find the value of x and the value of y	(3)
		(3)

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



3	(a) (i) Find $\int \left(1 + 3x - \frac{2}{x^2}\right) dx$	
	(ii) Hence show that $\int_{1}^{2} \left(1 + 3x - \frac{2}{x^{2}}\right) dx = 4\frac{1}{2}$	(4)
	(b) (i) Find $\int 3\sin 2x  dx$	
	(ii) Hence show that $\int_0^{\frac{\pi}{6}} 3\sin 2x  dx = \frac{3}{4}$	(4)

nestion 3 continued	
	(Total for Question 3 is 8 marks)



4	The <i>n</i> th term of a geometric series is $t_n$ and the common ratio is $r$ , where $r > 0$	
	Given that $t_1 = 1$	
	(a) write down an expression in terms of $r$ and $n$ for $t_n$	(1)
	Given also that $t_n + t_{n+1} = t_{n+2}$	
	(b) show that $r = \frac{1+\sqrt{5}}{2}$	(4)
	(c) find the exact value of $t_4$ giving your answer in the form $f + g\sqrt{h}$ , where $f$ , $g$ and $h$ are integers.	
		(3)

Question 4 continued	
	(Total for Question 4 is 8 marks)



5

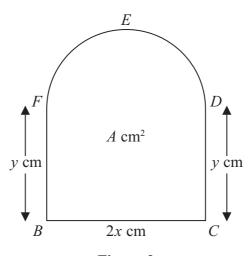


Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows a shape BCDEF of area A cm<sup>2</sup>. In the shape, BCDF is a rectangle and DEF is a semicircle with FD as diameter.

BF = CD = y cm and BC = FD = 2x cm. The perimeter of the shape BCDEF is 30 cm.

(a) Find an expression for y in terms of x.

(2)

(b) Show that  $A = 30x - 2x^2 - \frac{1}{2}\pi x^2$ 

(2)

(c) Find, to 2 significant figures, the maximum value of A, justifying that the value you have found is a maximum.

**(7)** 



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

6					
$p(x) = 2x^3 + 13x^2 - 17x - 70$					
(a) Show that $p(-2) = 0$	(2)				
(b) Solve the equation $n(x) = 0$	(2)				
(b) Solve the equation $p(x) = 0$	(4)				
	(Total for Question 6 is 6 marks)				
	(100mi ioi Amendion o 10 o man iro)				



7 (a) Complete the table of values for  $y = 5 \log_{10}(x+2) - x$ , giving your answers to 2 decimal places.

Х	-1	0	1	2	3	4	5
y	1	1.51	1.39				-0.77

**(2)** 

(b) On the grid opposite, draw the graph of  $y = 5\log_{10}(x+2) - x$  for  $-1 \le x \le 5$ 

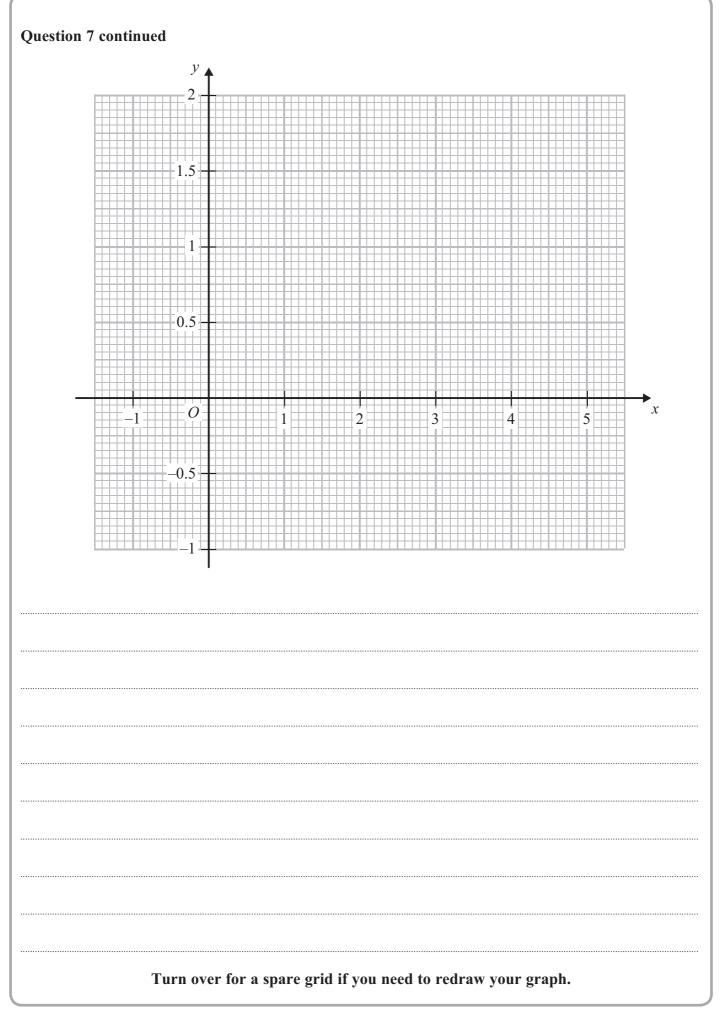
**(2)** 

(c) Use your graph to obtain an estimate, to 1 decimal place, of the root of the equation  $10\log_{10}(x+2) - 2x = 1\frac{1}{2}$  in the interval  $-1 \le x \le 5$ 

**(2)** 

(d) By drawing an appropriate straight line on your graph, obtain an estimate, to 1 decimal place, of the root of the equation  $x = 10^{\frac{1}{2}x} - 2$  in the interval  $-1 \le x \le 5$ 

**(4)** 

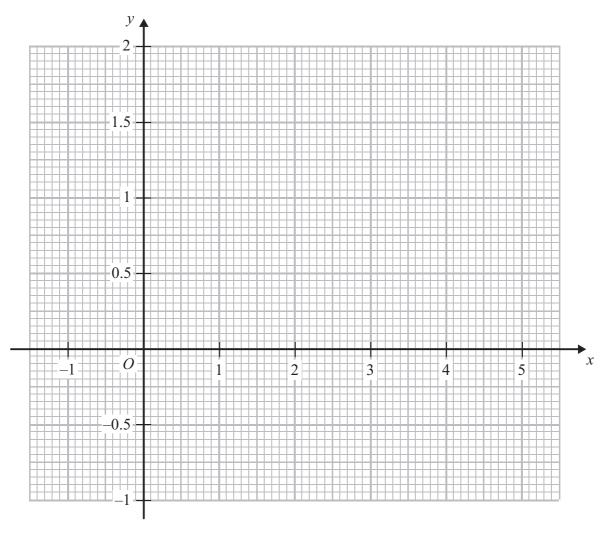





Question 7 continued			

## Question 7 continued

Only use this grid if you need to redraw your graph.






(Total for Question 7 is 10 marks)

8	The equation of line $l_1$ is $2x + 3y + 6 = 0$	
	(a) Find the gradient of $l_1$	
		(1)
	The line $l_2$ is perpendicular to $l_1$ and passes through the point $P$ with coordinates $(7, 2)$ .	
	(b) Find an equation for $l_2$	(3)
	The lines $l_1$ and $l_2$ intersect at the point $Q$ .	
	<ul><li>(c) Find the coordinates of Q.</li></ul>	
	(c) I ma the coordinates of Q.	(3)
	The line $l_3$ is parallel to $l_1$ and passes through the point $P$ .	
	(d) Find an equation for $l_3$	
		(2)
	The line $l_1$ crosses the x-axis at the point $R$ .	
	(e) Show that $PQ = QR$ .	(3)
	The point $S$ lies on $l_3$	
	The line $PR$ is perpendicular to $QS$ .	
	<ul><li>(f) Find the exact area of the quadrilateral <i>PQRS</i>.</li></ul>	
	(1) I find the exact area of the quadrilateral I QNS.	(3)

Question 8 continued		



Question 8 continued	

Question 8 continued	
	(Total for Question 8 is 15 marks)



9	(a) Expand, in ascending powers of $x$ up to and including the term in $x^3$ , simplifying each
	term as far as possible,

(i) 
$$(1 + x)^{-1}$$

(ii) 
$$(1-2x)^{-1}$$

**(4)** 

Given that 
$$\frac{2}{1-2x} + \frac{1}{1+x} = \frac{Ax+B}{(1-2x)(1+x)}$$

(b) find the value of A and the value of B.

**(2)** 

- (c) (i) Obtain a series expansion for  $\frac{1}{(1-2x)(1+x)}$  in ascending powers of x up to and including the term in  $x^2$ 
  - (ii) State the range of values of x for which this expansion is valid.

**(4)** 

(d) Use your series expansion from part (c) to obtain an estimate, to 3 decimal places,

of 
$$\int_{0.1}^{0.2} \frac{1}{(1 - 2x)(1 + x)} \, \mathrm{d}x$$

(4)

Question 9 continued		



Question 9 continued		

Question 9 continued	
	(Total for Question 9 is 14 marks)



**(2)** 

**(4)** 

10

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

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

A particle *P* is moving along a straight line. At time *t* seconds ( $t \ge 0$ ) the displacement, *s* metres, of *P* from a fixed point *O* on the line is given by  $s = \sqrt{3} \sin \frac{1}{2} t + \cos \frac{1}{2} t$ 

- (a) Find the exact value of s when  $t = \frac{\pi}{3}$
- (b) Find the exact value of t when P first passes through O. (4)

The velocity of P at time t seconds is v m/s.

- (c) Find an expression for v in terms of t.
- (d) Show that  $v = \cos\left(\frac{\pi}{6} + \frac{1}{2}t\right)$  (2)
- (e) Find the exact value of t for which  $v = \frac{1}{2}$  when
  - (i)  $0 \le t < 2\pi$
  - (ii)  $2\pi \leqslant t < 4\pi$

Question 10 continued		



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	(Total for O	
	(Total for Question 10 is 14 marks)	