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Pearson Edexcel nternational GCSE	Centre Number	Candidate Number
Further Pure Mathematics Paper 1		
	ornina	Paper Reference
Monday 8 June 2015 – Mo Time: 2 hours	511111g	4PM0/01

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 ▶

PEARSON

Answer all TEN questions

Write your answers in the spaces provided

You must write down all the stages in your working

1	The region enclosed by the curve with equation $y = 4x^2 - 9$, the positive x-axis and the negative y-axis is rotated through 360° about the x-axis.	
	Use algebraic integration to find, to 3 significant figures, the volume of the solid generated.	
		(5)



Question 1 continued		
	(Total for Question 1 is 5 marks)	



2	Given that $y = 4x^2e^{2x}$ (a) find $\frac{dy}{dx}$	
		(3)
	(b) hence show that $x \frac{dy}{dx} = 2y(1+x)$	(2)

Question 2 continued	
	(Total for Question 2 is 5 marks)



3	$f(x) = 4x^2 - 8x + 7$	
	Given that $f(x) = l(x - m)^2 + n$, for all values of x ,	
	(a) find the value of l , the value of m and the value of n .	(3)
	(b) Hence, or otherwise, find	
	(i) the minimum value of $f(x)$,	
	(ii) the value of x for which this minimum occurs.	(2)

Question 3 continued	
	(Total for Question 3 is 5 marks)



4	The sum S_n of the first n terms of an arithmetic series is given by $S_n = 2n(10 - n)$	
	(a) Write down the first term of the series.	(1)
	(b) Find the common difference of the series.	(2)
	Given that $S_n > -50$	
	(c) (i) write down an inequality satisfied by n ,	
	(ii) hence find the largest value of n for which $S_n > -50$	(4)

Question 4 continued	
	(Total for Question 4 is 7 marks)



5	(a) Show that $(\alpha + \beta)(\alpha^2 - \alpha\beta + \beta^2) = \alpha^3 + \beta^3$ The roots of the equation $2x^2 + 6x - 7 = 0$ are α and β where $\alpha > \beta$ Without solving the equation,	(1)
	(b) find the value of $\alpha^3 + \beta^3$ (c) show that $\alpha - \beta = \sqrt{23}$ (d) Hence find the exact value of $\alpha^3 - \beta^3$	(4)(2)(2)

Question 5 continued	



Question 5 continued	



Question 5 continued	
	Total for Question 5 is 9 marks)



6

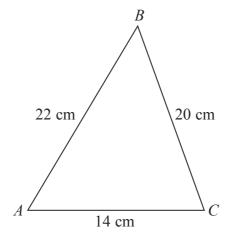


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows $\triangle ABC$ with AB = 22 cm, AC = 14 cm and BC = 20 cm.

(a) Find, to 3 decimal places, the size of each of the three angles of $\triangle ABC$.

(5)

The bisector of angle BAC meets BC at P.

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

(3)

(c) Find, to the nearest cm², the area of $\triangle ABC$.

(2)

Question 6 continued	



Question 6 continued	



Question 6 continued	
	(Total for Question 6 is 10 marks)



7 (a) Expand $\left(1 + \frac{x}{3}\right)^{\frac{1}{4}}$ in ascending powers of x up to and including the term in x^3 , giving each coefficient as an exact fraction.

(3)

(b) Expand $\left(1 - \frac{x}{3}\right)^{-\frac{1}{4}}$ in ascending powers of x up to and including the term in x^3 , giving each coefficient as an exact fraction.

(3)

(c) Write down the range of values of x for which both of your expansions are valid.

(1)

(d) Expand $\left(\frac{3+x}{3-x}\right)^{\frac{1}{4}}$ in ascending powers of x up to and including the term in x^2 , giving each coefficient as an exact fraction.

(3)

(e) Hence obtain an estimate, to 3 significant figures, of $\int_0^{0.6} \left(\frac{3+x}{3-x}\right)^{\frac{1}{4}} dx$

(4)

Question 7 continued	



Question 7 continued



Question 7 continued	
	(Total for Question 7 is 14 marks)



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

(a) (i) show that
$$\cos 2A = 1 - 2 \sin^2 A$$

(ii) express
$$\sin 2A$$
 in terms of $\sin A$ and $\cos A$, simplifying your answer.

(1)

(b) Hence show that
$$\sin 3A = 3 \sin A - 4 \sin^3 A$$

(4)

(c) Solve, for
$$-90^{\circ} \leqslant A \leqslant 90^{\circ}$$
, the equation

$$8\sin^3 A - 6\sin A = 1$$

(4)

(d) (i) Find
$$\int \sin^3 \theta \, d\theta$$

(ii) Evaluate $\int_0^{\frac{\pi}{4}} \sin^3 \theta \, d\theta$, giving your answer in the form $\frac{a - b\sqrt{2}}{c}$, where a, b, and c are integers.

(5)

https://xtremepape.rs/

Question 8 continued		



Question 8 continued	



Question 8 continued	
(To	tal for Question 8 is 17 marks)



9 A curve C has equation $y = \frac{3x+1}{2x+3}$ $x \neq -$	$y = \frac{3x+1}{2x+3} \qquad x \neq -1$	We C has equation $y = \frac{3x+1}{2x+3}$	A cı	9
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- (a) Write down an equation of the asymptote of C which is parallel to
 - (i) the x-axis,
 - (ii) the y-axis.

(2)

- (b) Find the coordinates of the points where C crosses
 - (i) the x-axis,
 - (ii) the y-axis.

(2)

(c) Using the axes opposite, sketch the curve *C*, showing clearly the asymptotes and the coordinates of the points where *C* crosses the axes.

(3)

The curve C intersects the x-axis at the point A.

The line *l* is the normal to *C* at *A*.

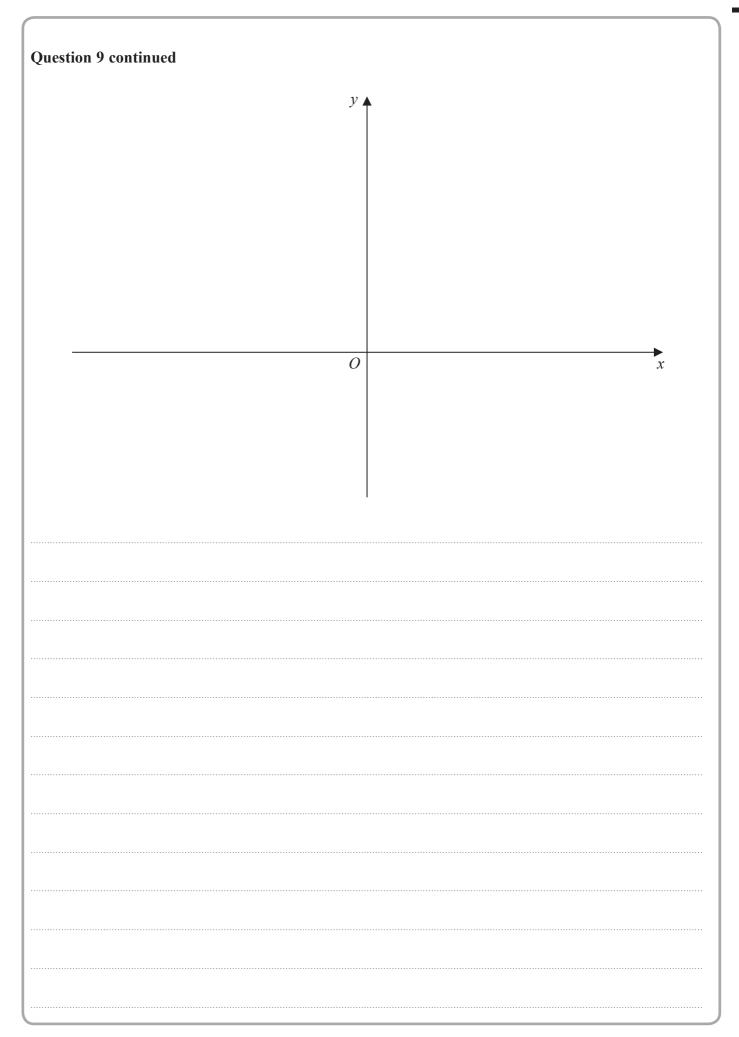
(d) Find an equation for l.

(5)

The line l meets C again at the point B.

(e) Find the *x*-coordinate of *B*.

(5)





Question 9 continued	



Question 9 continued
(Total for Question 9 is 17 marks)



10	A solid right circular cylinder has base radius r cm and height h cm. The volume of th	e
	cylinder is 50 cm 3 and the total surface area is A cm 2 .	
	(a) Show that $A = 2\pi r^2 + \frac{100}{r}$	
	(a) Show that $A = 2\pi r^2 + \frac{1}{r}$	(3)
		(3)
	(b) Use calculus to find, to 4 significant figures, the value of r for which A is a	
	minimum.	
		(3)
	(c) Use calculus to verify that the value of r found in part (b) does give a minimum	
	value of A .	
		(3)
	(d) Find, to the nearest whole number, the minimum value of A .	(2)
		(2)

Question 10 continued	



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