WMA02

Past Paper

This resource was created and owned by Pearson Edexcel

Surname		Other names	
Pearson Edexcel nternational Advanced Level	Centre Number		andidate Number
	_		
Core Matr Advanced	iemat	ics (C34
Core Matr Advanced Monday 26 January 2015 – Time: 2 hours 30 minutes	Afternoon	Pa	per Reference VMA02/01

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B). Coloured pencils and highlighter pens must not be used.
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided - there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information

- The total mark for this paper is 125.
- The marks for **each** question are shown in brackets - use this as a guide as to how much time to spend on each guestion.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶



Mathematics C34

■ Past Paper

This resource was created and owned by Pearson Edexcel

WMA02

Leave blank

1.	The curve	C has	equation
----	-----------	-------	----------

$$y = \frac{3x - 2}{(x - 2)^2}, \ x \neq 2$$

The point P on C has x coordinate 3

Find an equation of the normal to C at the point P in the form ax + by + c = 0, where a, b and c are integers.

(6)

14/2	0045
Winter	ソロフち

Paper Paper	This resource was created and owned by Pearson Edexcel	Watnematics
		L t
Question 1 continued	I	
		Q

Mathematics C34

■ Past Paper

www.mystudybro.comThis resource was created and owned by Pearson Edexcel

WMA02

Leave blank	

	$2\cos 2\theta = 5 - 13\sin \theta$	
<i>C</i> .		
GI	ve your answers in radians to 3 decimal places.	
(Sc	olutions based entirely on graphical or numerical methods are not acceptable.)	(5)

14/2	0045
Winter	ソロフち

www.mystudybro.com was created and owned by Pearson Edexcel

apei	This resource was created and owned by Fearson Edexcer	VVIVIA
		Lea
		blan
Question 2 continue	d .	
		—
		Q2
	(Total 5 mar	

Past Paper

This resource was created and owned by Pearson Edexcel

WMA02 Leave

blank

3. The function g is defined by

$$g: x \mapsto |8-2x|, \qquad x \in \mathbb{R}, \quad x \geqslant 0$$

(a) Sketch the graph with equation y = g(x), showing the coordinates of the points where the graph cuts or meets the axes.

(3)

(b) Solve the equation

$$|8 - 2x| = x + 5$$

(3)

The function f is defined by

$$f: x \mapsto x^2 - 3x + 1, \qquad x \in \mathbb{R}, \qquad 0 \leqslant x \leqslant 4$$

(c) Find fg(5).

(2)

(d) Find the range of f. You must make your method clear.

(4)

Winter	2015
Past Pape	er

/inter 2015 ast Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics C34
act rupor	This recourse that distribution by Fedition Europe	Leave blank
Question 3 conti	inued	blank

VIIICI ZUIJ	www.mystadybro.com	Matriciliatics 05
Past Paper	This resource was created and owned by Pearson Edexcel	WMA0

Question 3 continued	blar
	_
	-
	-
	-
	-
	-
	-
	-
	_
	-
	_

\A/:	ntar	204	
vvi	ME	/ []	-

www.mystudybro.com was created and owned by Pearson Edexcel

apei	This resource was created and owned by Fearson Edexcer	VVIVIA
		Leav
		blan
Question 3 continued		
		-
		-
		_
		_
		-
		_
		_
		_
		-
		-
		_
		_
		_
		-
		-
		_
		_
		_
		-
		-
		_
		_
		-
		_
		_
		_
		-
		_
		_
		_
		_
		Q
		- m
	(Total 12 marks	

Mathematics C34

■ Past Paper

www.mystudybro.comThis resource was created and owned by Pearson Edexcel

WMA02

Leave	
hlank	

Use the substitution $x = 2\sin\theta$ to find the exact value of $\int_0^{\sqrt{3}} \frac{1}{(4-x^2)^{\frac{3}{2}}} dx$	
	(7)

	_	
\A/		2015
ww		

www.mystudybro.com was created and owned by Pearson Edexcel

	This resource was created and owned by Fearson Edexcer	
		Lea
		bla
Question 4 continued	l	
		Q4
		— <u> </u>
		rks)

Past Paper

This resource was created and owned by Pearson Edexcel

WMA02

Leave blank

5. (a) Use the binomial expansion, in ascending powers of x, of $\frac{1}{\sqrt{1-2x}}$ to show that

$$\frac{2+3x}{\sqrt{(1-2x)}} \approx 2+5x+6x^2, \qquad |x| < 0.5$$

(4)

(b) Substitute $x = \frac{1}{20}$ into

$$\frac{2+3x}{\sqrt{(1-2x)}} = 2 + 5x + 6x^2$$

to obtain an approximation to $\sqrt{10}$

Give your answer as a fraction in its simplest form.

(3)

\A/:	ntar	204	
vvi	ME	/ []	-

iter 2015	www.mystudybro.com	Mathematics C3
Paper	This resource was created and owned by Pearson Edexcel	WMAC
		Leave
		blank
Question 5 continued	d	

inter 2015	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics C34
st Paper	This resource was created and owned by Pearson Edexcel	WMA02
		Leave blank
Question 5 cont	inued	Oldlik

Win	tΔr	201	5

Paper	This resource was created and owned by Pearson Edexcel	WM
		Lea
Question 5 continue	d	bla
Question 5 continue	u	
		Q5
	(Total 7 ma	arks)

■ Past Paper

This resource was created and owned by Pearson Edexcel

WMA02

Leave blank

6. (i) Given $x = \tan^2 4y$, $0 < y < \frac{\pi}{8}$, find $\frac{dy}{dx}$ as a function of x.

Write your answer in the form $\frac{1}{A(x^p + x^q)}$, where A, p and q are constants to be found.

(5)

(ii) The volume V of a cube is increasing at a constant rate of 2 cm³ s⁻¹. Find the rate at which the length of the edge of the cube is increasing when the volume of the cube is 64 cm³.

(5)

\A/:	ntar	204	
vvi	ME	/ []	-

Winter 2015	www.mystudybro.com	Mathematics C34
Past Paper	This resource was created and owned by Pearson Edexcel	WMA02
		Leave

uestion 6 continued	

VIIILEI ZUIJ	www.iiiystaaybio.com	Matriciliatics C3
Past Paper	This resource was created and owned by Pearson Edexcel	WMAC

14/2	0045
Winter	ソロフち

st Paper	This resource was created and owned by Pearson Edexcel	WMA02
		Leave
Question 6 continued	1	blank
Question o continue	•	
		Q6
	(Total 10 ma	rks)

■ Past Paper

This resource was created and owned by Pearson Edexcel

WMA02

Leave	
blank	

7. (a) Given that

$$2\cos(x+30)^\circ = \sin(x-30)^\circ$$

without using a calculator, show that

$$\tan x^{\circ} = 3\sqrt{3} - 4$$

(b) Hence or otherwise solve, for $0 \leqslant \theta < 180$,

$$2\cos(2\theta + 40)^{\circ} = \sin(2\theta - 20)^{\circ}$$

Give your answers to one decimal place.

(4)

(5)

\A/:	ntar	204	
vvi	ME	/ []	-

Vinter 2015 ast Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics C3 WMA0
		Leave blank
Question 7 cont	inued	

VIIILEI ZUIJ	www.iiiystudybio.com	Mathematics Co
ast Paper	This resource was created and owned by Pearson Edexcel	WMA0

	blank
Question 7 continued	

	_	
\A/		2015
ww		

st Paper	This resource was created and owned by Pearson Edexcei	VVIVIAU
		Leave
		blank
Question 7 continue	ed	
		Q 7
	(Total 9 m	arks)
	(10(a) 7 11)	iai Noj

Past Paper

WMA02 Leave

blank

8.

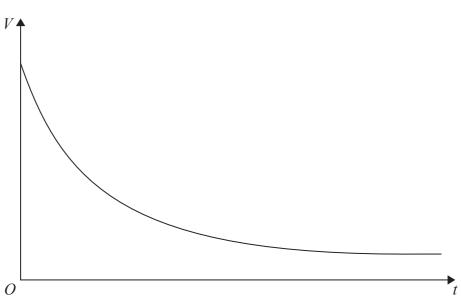


Figure 1

The value of Lin's car is modelled by the formula

$$V = 18000e^{-0.2t} + 4000e^{-0.1t} + 1000, \quad t \geqslant 0$$

where the value of the car is V pounds when the age of the car is t years.

A sketch of t against V is shown in Figure 1.

(a) State the range of V.

(2)

According to this model,

(b) find the rate at which the value of the car is decreasing when t = 10Give your answer in pounds per year.

(3)

(c) Calculate the exact value of t when V = 15000

(4)

Winter	2015
Past Pape	er

linter 2015 ast Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics C34 WMA02
		Leave blank
Question 8 continue	d	

VIIILEI ZUIJ	www.iiiystudybio.com	Mathematics Co
ast Paper	This resource was created and owned by Pearson Edexcel	WMA0

estion 8 continued	

14/2	0045
Winter	ソロフち

www.mystudybro.comThis resource was created and owned by Pearson Edexcel

Past Paper	This resource was created and owned by Pearson Edexcel	WMA0
		Leave
Overtion 9 continue	ad.	blank
Question 8 continue	cu	
		Q8
	(Total 9 m:	arks)

Past Paper

This resource was created and owned by Pearson Edexcel

WMA02

Leave blank

9.

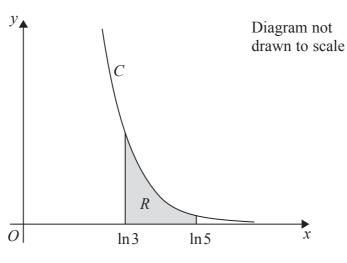


Figure 2

The curve C has parametric equations

$$x = \ln(t+2), \quad y = \frac{4}{t^2} \qquad t > 0$$

The finite region R, shown shaded in Figure 2, is bounded by the curve C, the x-axis and the lines with equations $x = \ln 3$ and $x = \ln 5$

(a) Show that the area of R is given by the integral

$$\int_1^3 \frac{4}{t^2(t+2)} \, \mathrm{d}t$$

(3)

(b) Hence find an exact value for the area of R.

Write your answer in the form $(a + \ln b)$, where a and b are rational numbers.

(7)

(c) Find a cartesian equation of the curve C in the form y = f(x).

(2)

Wi	nter	2015	

Winter 2015	www.mystudybro.com	Mathematics C34
Past Paper	This resource was created and owned by Pearson Edexcel	WMA02
		Leave

Question 9 continued	blan

www.mvstudvbro.com

William EU 13	www.iiiystaaybio.com	Matricinatics 05-
Past Paper	This resource was created and owned by Pearson Edexcel	WMA02
		Leave

Question 9 continued	bla

14/2	0045
Winter	ソロフち

www.mystudybro.com was created and owned by Pearson Edexcel

apei	This resource was created and owned by Fearson Edexcer	VVIV
		Le
		bla
Question 9 continued		
C		
	(Total 12 marks)	1

Past Paper

This resource was created and owned by Pearson Edexcel

WMA02

Leave blank

10.

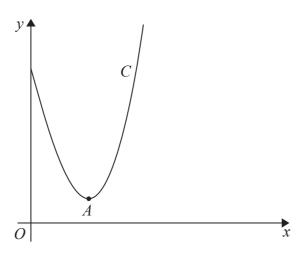


Figure 3

Figure 3 shows a sketch of part of the curve C with equation

$$y = \frac{x^2 \ln x}{3} - 2x + 4, \quad x > 0$$

Point A is the minimum turning point on the curve.

(a) Show, by using calculus, that the x coordinate of point A is a solution of

$$x = \frac{6}{1 + \ln(x^2)}$$

(5)

(b) Starting with $x_0 = 2.27$, use the iteration

$$x_{n+1} = \frac{6}{1 + \ln(x_n^2)}$$

to calculate the values of x_1 , x_2 and x_3 , giving your answers to 3 decimal places.

(3)

(c) Use your answer to part (b) to deduce the coordinates of point A to one decimal place.

(2)

Wi	nter	2015	

ter 2015 Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	VMA
Question 10 con	tinued	Lea blar

Mathematics C34

Leave

VIIIICI ZUIJ	www.mystadybro.com	Matricinatics 054
Past Paper	This resource was created and owned by Pearson Edexcel	WMA02

Question 10 continued	blank

1000	
Winter	ンロコち

Paper	This resource was created and owned by Pearson Edexcel	W
		I
Question 10 conti	nued	
		(
	(Total 10 m	

■ Past Paper

This resource was created and owned by Pearson Edexcel

WMA02

Leave blank

11. With respect to a fixed origin O the lines l_1 and l_2 are given by the equations

$$l_1: \mathbf{r} = \begin{pmatrix} 14 \\ -6 \\ -13 \end{pmatrix} + \lambda \begin{pmatrix} -2 \\ 1 \\ 4 \end{pmatrix} \qquad l_2: \mathbf{r} = \begin{pmatrix} p \\ -7 \\ 4 \end{pmatrix} + \mu \begin{pmatrix} q \\ 2 \\ 1 \end{pmatrix}$$

where λ and μ are scalar parameters and p and q are constants.

Given that l_1 and l_2 are perpendicular,

(a) show that q = 3

(2)

Given further that l_1 and l_2 intersect at point X,

find

(b) the value of p,

(5)

(c) the coordinates of X.

(2)

The point A lies on l_1 and has position vector $\begin{pmatrix} 6 \\ -2 \\ 3 \end{pmatrix}$

Given that point B also lies on l_1 and that AB = 2AX

(d) find the two possible position vectors of B.

(3)

Winter 2015
Past Paper

Vinter 2015 ast Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics C34 WMA02
аст про	The recorded has created and owned by I carson Edexoer	Leave
Question 11 con	tinued	blank

VIIILEI ZUIJ	www.iiiystuaybio.com	Matriciliatics Co.		
Past Paper	This resource was created and owned by Pearson Edexcel	WMA02		
		Leave		

Question 11 continued	blan

1000	
Winter	ンロコち

Paper	This resource was created and owned by Pearson Edexcel	WMA
		Leav blan
Question 11 continu	ued	Ulaii
		Q1
	(Total 12 ma	

WMA02

Leave blank

12.

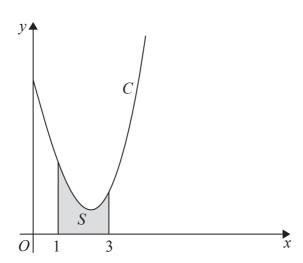


Figure 4

Figure 4 shows a sketch of part of the curve C with equation

$$y = \frac{x^2 \ln x}{3} - 2x + 4, \quad x > 0$$

The finite region S, shown shaded in Figure 4, is bounded by the curve C, the x-axis and the lines with equations x = 1 and x = 3

(a) Complete the table below with the value of y corresponding to x = 2. Give your answer to 4 decimal places.

х	1	1.5	2	2.5	3
y	2	1.3041		0.9089	1.2958

(1)

(b) Use the trapezium rule, with all the values of y in the completed table, to obtain an estimate for the area of S, giving your answer to 3 decimal places.

(3)

(c) Use calculus to find the exact area of S.

Give your answer in the form $\frac{a}{b} + \ln c$, where a, b and c are integers.

(6)

(d) Hence calculate the percentage error in using your answer to part (b) to estimate the area of *S*. Give your answer to one decimal place.

(2)

(e) Explain how the trapezium rule could be used to obtain a more accurate estimate for the area of *S*.

(1)

W/i	nter	201	F
VVI	nter	Z (1)	

www.mystudybro.comThis resource was created and owned by Pearson Edexcel **Mathematics C34** Past Paper WMA02 Leave blank **Question 12 continued**

		Ш												Ш
Ш		Ш	Ш											
Ш		Ш	Ш											
	Р	_	1	5	Ω	5	Α	Δ	Λ	4	1	4	8	

Mathematics C3

Leave

VIIILEI ZUIJ	www.iiiystuuybio.coiii	Maniemancs Co
ast Paper	This resource was created and owned by Pearson Edexcel	WMA0

Question 12 continued	blanl
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_

		0045
VVI	nter	2015

st Paper	This resource was created and owned by Pearson Edexcel	WMA
		Leav
Question 12 cont	inued	blan
Question 12 cont	mucu	
		Q
		_ []
	(Total 13 m	arks)



Leave blank

13. (a) Express $10\cos\theta - 3\sin\theta$ in the form $R\cos(\theta + \alpha)$, where R > 0 and $0 < \alpha < 90^{\circ}$

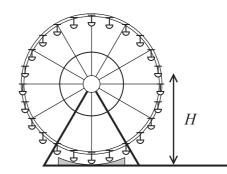
Give the exact value of R and give the value of α to 2 decimal places.

(3)

Alana models the height above the ground of a passenger on a Ferris wheel by the equation

$$H = 12 - 10\cos(30t)^{\circ} + 3\sin(30t)^{\circ}$$

where the height of the passenger above the ground is H metres at time t minutes after the wheel starts turning.



- (b) Calculate
 - (i) the maximum value of H predicted by this model,
 - (ii) the value of t when this maximum first occurs.

Give each answer to 2 decimal places.

(4)

(c) Calculate the value of t when the passenger is 18 m above the ground for the first time. Give your answer to 2 decimal places.

(4)

(d) Determine the time taken for the Ferris wheel to complete two revolutions.

(2)



Wi	nter	2015	

VIIILEI ZUIS	www.mystudybro.com	Mathematics C34
ast Paper	This resource was created and owned by Pearson Edexcel	WMA02
$\overline{}$		

	Leave
	blank
Question 13 continued	
	1

Mathematics C34

Leave

William ZUIS	www.iiiystaaybio.com	Mathematics Co
Past Paper	This resource was created and owned by Pearson Edexcel	WMA0

	blank
Question 13 continued	

	_	
\A/		2015
vv		

inter 2015 st Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics C34 WMA0
		Leave blank
Question 13 con	ntinued	Ulalik

Wi	nter	201	15

Mathematics	C34
--------------------	-----

Paper	This resource was created and owned by Pearson Edexcel	WMA02
		Leave blank
Question 13 co	ontinued	biank
Question 10 of	V	
		-
		-
		_
		-
		-
		-
		_
		-
		-
		_
		_
		-
		-
		-
		_
		-
		-
		-
		-
		_
		-
		-
		-
		-
		-
		-
		-
		_
		Q13
	(Total 13 marks	
	TOTAL FOR PAPER: 125 MARKS	s
	END	
	END	