6666

## www.mystudybro.com

Past Paper

This resource was created and owned by Pearson Edexcel

Write your name here Surname	Other nam	nes
Pearson Edexcel GCE Core Mat	Centre Number  Chematics	Candidate Number
Advanced		
Friday 23 June 2017 – M Time: 1 hour 30 minute	•	Paper Reference <b>6666/01</b>
You must have:		Total Marks

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 75.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶







6666

6666

Past Paper

Leave blank

1. The curve C has parametric equations

$$x = 3t - 4$$
,  $y = 5 - \frac{6}{t}$ ,  $t > 0$ 

(a) Find 
$$\frac{dy}{dx}$$
 in terms of  $t$ 

**(2)** 

The point *P* lies on *C* where  $t = \frac{1}{2}$ 

(b) Find the equation of the tangent to C at the point P. Give your answer in the form y = px + q, where p and q are integers to be determined.

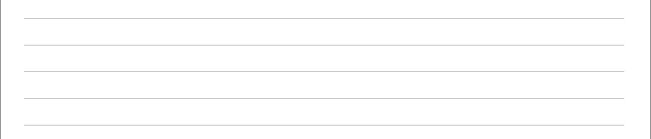
**(3)** 

(c) Show that the cartesian equation for C can be written in the form

$$y = \frac{ax+b}{x+4}, \quad x > -4$$

where a and b are integers to be determined.

**(3)** 



Summer	2017

DO NOT WRITE IN THIS AREA

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

<b>J</b> anning, <b>J</b> on	
Past Paner	This resource was created a

s <b>C4</b>	
Leave	

	blank
Question 1 continued	

Past Paper

2000

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

estion 1 continued		

I <b>mmer 2017</b> st Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics 6
	,	Lea bla
Question 1 conti	nued	

DO NOT WRITE IN THIS AREA

	5 <b>Turn over</b>
(Total 8 marks	
	Q1
	-
	_
	_
	-
	_
	_
	_
	_
	_
	_
	_
	_



## **www.mystudybro.com**This resource was created and owned by Pearson Edexcel

,s C.

6666

Leave blank

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Past Paper

2.  $f(x) = (2 + kx)^{-3}$ , |kx| < 2, where k is a positive constant

The binomial expansion of f(x), in ascending powers of x, up to and including the term in  $x^2$  is

$$A + Bx + \frac{243}{16}x^2$$

where A and B are constants.

(a) Write down the value of A.

(1)

(b) Find the value of k.

(3)

(c) Find the value of B.

**(2)** 

nmer 2017 Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics
		L
0		l b
Question 2 continued		

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total 6 marks)



Q2

blank

3.

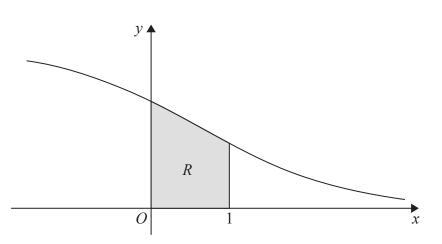


Figure 1

Figure 1 shows a sketch of part of the curve with equation  $y = \frac{6}{(e^x + 2)}$ ,  $x \in \mathbb{R}$ 

The finite region R, shown shaded in Figure 1, is bounded by the curve, the y-axis, the x-axis and the line with equation x = 1

The table below shows corresponding values of x and y for  $y = \frac{6}{(e^x + 2)}$ 

x	0	0.2	0.4	0.6	0.8	1
у	2		1.71830	1.56981	1.41994	1.27165

(a) Complete the table above by giving the missing value of y to 5 decimal places.

**(1)** 

(b) Use the trapezium rule, with all the values of y in the completed table, to find an estimate for the area of R, giving your answer to 4 decimal places.

**(3)** 

(c) Use the substitution  $u = e^x$  to show that the area of R can be given by

$$\int_a^b \frac{6}{u(u+2)} \, \mathrm{d}u$$

where a and b are constants to be determined.

**(2)** 

(d) Hence use calculus to find the exact area of R. [Solutions based entirely on graphical or numerical methods are not acceptable.]

(6)

Summer 2	201	7
----------	-----	---

DO NOT WRITE IN THIS AREA

Summer 2017	www.mystudybro.com	watnematics C4
Past Paper	This resource was created and owned by Pearson Edexcel	6666
		т.

	I I
estion 3 continued	

### www.mystudybro.com

**Mathematics C4** 

DO NOT WRITE IN THIS AREA

ullille ZUII	www.iiiystuaybio.com	Mathematics C+
ast Paper	This resource was created and owned by Pearson Edexcel	6666

Question 3 continued	blank

mmer 2017 t Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics
		L b
Question 3 contin	ued	

NOT WRITE IN THIS AR

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(Total 12 marks)

DO NOT WRITE IN THIS AREA

6666 Leave

blank

The curve C has equation

$$4x^2 - y^3 - 4xy + 2^y = 0$$

The point P with coordinates (-2, 4) lies on C.

(a) Find the exact value of  $\frac{dy}{dx}$  at the point P.

**(6)** 

The normal to C at P meets the y-axis at the point A.

(b) Find the y coordinate of A, giving your answer in the form  $p + q \ln 2$ , where p and q are constants to be determined.

**(3)** 



Summer	2017

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

## www.mystudybro.com

Mathematics C

Julillie Zuli	www.iiiystudybio.com	Mathematics C
Past Paper	This resource was created and owned by Pearson Edexcel	666

	Leave
Question 4 continued	blank
Question 4 continued	

■ Past Paper

# **www.mystudybro.com**This resource was created and owned by Pearson Edexcel

watnematics	<b>C</b> 4

6666	

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

estion 4 continued		

I <b>mmer 2017</b> st Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics C
		Leav
Question 4 conti	nued	blanl

(Total 9 marks)



Q4

DO NOT WRITE IN THIS AREA

Leave blank

DO NOT WRITE IN THIS AREA

DO NOT WRITE INTHIS AREA

5.

Past Paper

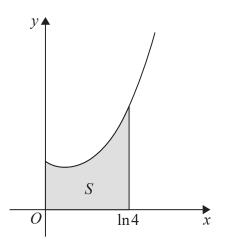


Diagram not drawn to scale

Figure 2

The finite region S, shown shaded in Figure 2, is bounded by the y-axis, the x-axis, the line with equation  $x = \ln 4$  and the curve with equation

$$y = e^x + 2e^{-x}, \quad x \geqslant 0$$

The region *S* is rotated through  $2\pi$  radians about the *x*-axis.

Use integration to find the exact value of the volume of the solid generated. Give your answer in its simplest form.

[Solutions based entirely on graphical or numerical methods are not acceptable.]

1	1	
,	,	
	-	

Summer 2	2017
----------	------

Mathe

		_		_	-			-	-	7	-
		Ρ	a	s	t	F	6	aļ	Э	е	r

DO NOT WRITE IN THIS AREA

**www.mystudybro.com**This resource was created and owned by Pearson Edexcel

matics C4					
	Leave				
	blank				
	o i willi				
_					
_					
_					
_					
_					
_					
_					
_					
_					
_					
_					
_					
_					
_					
_					
_					
_					
_					

Question 5 continued	

■ Past Paper

www.mystudybro.com	Mainemancs C
This resource was created and owned by Pearson Edexcel	666

stion 5 continued		
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_
		_

mmer 2017 t Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics (
<u>.</u>		Lea
Question 5 contin	nuad	blar
Question 5 contin	iueu	

DO NOT WRITE IN THIS AREA

(Total 7 marks)



Q5

DO NOT WRITE IN THIS AREA

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

$$l_1: \mathbf{r} = \begin{pmatrix} 4 \\ 28 \\ 4 \end{pmatrix} + \lambda \begin{pmatrix} -1 \\ -5 \\ 1 \end{pmatrix}, \qquad l_2: \mathbf{r} = \begin{pmatrix} 5 \\ 3 \\ 1 \end{pmatrix} + \mu \begin{pmatrix} 3 \\ 0 \\ -4 \end{pmatrix}$$

where  $\lambda$  and  $\mu$  are scalar parameters.

The lines  $l_1$  and  $l_2$  intersect at the point X.

- (a) Find the coordinates of the point *X*.
- (b) Find the size of the acute angle between  $l_1$  and  $l_2$ , giving your answer in degrees to 2 decimal places. **(3)**

The point A lies on  $l_1$  and has position vector  $\begin{bmatrix} 2\\18 \end{bmatrix}$ 

(c) Find the distance AX, giving your answer as a surd in its simplest form.

**(2)** 

**(3)** 

The point Y lies on  $l_2$ . Given that the vector  $\overrightarrow{YA}$  is perpendicular to the line  $l_1$ 

(d) find the distance YA, giving your answer to one decimal place.

**(2)** 

The point B lies on  $l_1$  where  $|\overrightarrow{AX}| = 2|\overrightarrow{AB}|$ .

(e) Find the two possible position vectors of *B*.

**(3)** 

Sur	nmer	2017
_	_	

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

Mathematics C4

п Рареі	This resource was created and owned by Fearson Edexcer	
<b>Question 6 continue</b>	d	
		_

Paper	This resource was created and owned by Pearson Edexcel	6666
		Leave
Question 6 continued		blank
Question o continued		

mmer 2017 Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics
		L
<b>Question 6 contin</b>	ned	0
Question o contin	ucu	





DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Leave blank

Past Paper

7.

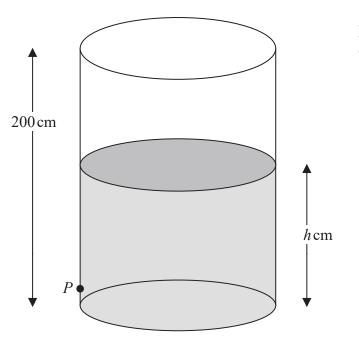


Diagram not drawn to scale

Figure 3

Figure 3 shows a vertical cylindrical tank of height 200 cm containing water. Water is leaking from a hole *P* on the side of the tank.

At time t minutes after the leaking starts, the height of water in the tank is h cm.

The height h cm of the water in the tank satisfies the differential equation

$$\frac{dh}{dt} = k(h-9)^{\frac{1}{2}}, \quad 9 < h \le 200$$

where k is a constant.

Given that, when h = 130, the height of the water is falling at a rate of 1.1 cm per minute,

(a) find the value of k.

**(2)** 

Given that the tank was full of water when the leaking started,

(b) solve the differential equation with your value of k, to find the value of t when h = 50

**(6)** 

ummer 2017 ast Paper	www.mystudybro.com This resource was created and owned by Pearson Edexcel	Mathematics C
Question 7 conti	inued	Leav blank



■ Past Paper

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Mathematics C	www.mystudybro.com This resource was created and owned by Pearson Edexcel	ummer 2017 ast Paper
Leav	This resource was dicated and owned by I carson Edoxoci	ast i apoi
blan	ed	Question 7 contin
		Question / contin

(Total 8 marks)	



Leave blank

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

8.

Past Paper

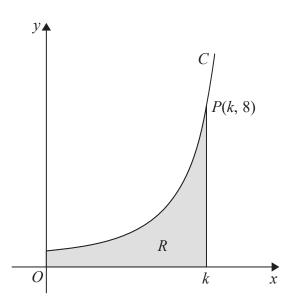


Diagram not drawn to scale

Figure 4

Figure 4 shows a sketch of part of the curve C with parametric equations

$$x = 3\theta \sin \theta$$
,  $y = \sec^3 \theta$ ,  $0 \leqslant \theta < \frac{\pi}{2}$ 

The point P(k, 8) lies on C, where k is a constant.

(a) Find the exact value of k.

**(2)** 

The finite region R, shown shaded in Figure 4, is bounded by the curve C, the y-axis, the *x*-axis and the line with equation x = k.

(b) Show that the area of R can be expressed in the form

$$\lambda \int_{\alpha}^{\beta} \left(\theta \sec^2 \theta + \tan \theta \sec^2 \theta\right) d\theta$$

where  $\lambda$ ,  $\alpha$  and  $\beta$  are constants to be determined.

**(4)** 

(c) Hence use integration to find the exact value of the area of R.

**(6)** 

Sum	mer	2017

## www.mystudybro.com

**Mathematics C4** 

Past Paper	This resource was created and owned by Pearson Edexce
Question 8 co	ontinued
DO NOT WRITE IN THIS AREA	
S	
<b>=</b>	
E.	
N	
N	
ă	
THIS ARE	
<b>X</b>	
<b>S</b>	
<b>5</b>	

	6666
	Leave
	blank
_	
_	
_	
_	
_	
_	
_	
_	
_	
_	
_	
_	
_	
_	
_	
_	
_	
_	
_	
_	
-	
_	
_	
_	

ı					Ė		į	þ	į
ı					9	d		5	١
ı					g	Ġ		J	Į.
ı						í		٩	
ı					Ì			į	
ı					9	5		á	2
ı					2	9		ġ	
ı					i	j	Ę	j	
ı						Ť		9	
ı								۹	
ı					I	Ī	ľ	j	ŀ
ı					i				
ı					i	ė	3	ä	3.
ı					d	Ģ		ė	
ı					ì	i		d	
ı					B	ė	ė	å	ì
ı					Ė		ļ	4	į
ı					i		à	n	ŀ
ı					1	Ų	,	ļ	•
ı					ij	i		į	ŀ
ı					5	9			
ı					ı	d	Ę	J	
ı					Ī	Ė	ľ	۹	ŀ
ı					ē	١		į	ì
ı					į	ē		ľ	
ı					٠				۰
ı					ì				
ı									
ı									
ı									
ı									
ı									
ı					٠				
ı					ì				
ı									
ı									
ı					٠				
ı									
ı									
ı					•	,		,	,
ı	ì	/			į				,
ı		į	/			Ź			
ı	Ċ	١		2	1	ć	_		
ı	4	(		· · · · · · · · · · · · · · · · · · ·	j	á	í	á	í
ı					ļ	ķ	é	d	9
ı		Ì	×		8	ì	j	ý	ì
ı		١		1	ij	É	Ę	ė	ę
ı	4	ĺ,		ì	ı	ř		3	ŀ
ı	Ì	į	×	`	j	Ž		í	
ı		ì	>	Ć	1	Š	×	4	
ı	4	(		į	ij	É	Š	ŝ	į,
ı	è	ł		`	Ì	Ę	ξ	S	,
ı		Ì	×	ζ	1	Ì	ľ	j	ŀ
ı		`	,	d	í		ŕ	á	j
ı	0	ĺ,		ì	×	é		j	ŀ
ı	Ì	į	>		J	7	Ĭ	Í	
ı		Ì	×	(	į		×	ĺ	í
ı				į	í	Ĭ	9	í	
ı	0	ć			Á	É	2	9	,
ı		Ì	×	(	ě		×	ĺ	į
ı		`	×		í	Š	ú	2	ľ
ı	9	Ś		ì	¥	4	į	×	ì
ı	0	1		>	á	7	j	5	Š
ı		>	>		ı	è	ľ	3	
ı	9	>			š	ì	6	٤	>
ı	0	×		?	é	d	Ź	f	
П	4	Š	×	S	2	j	ľ		١

׌				
×				
À				
×				
O				
×				
n				
1				
c				
ø				
XII				
Χá				
(I				
×				
×				
4				
×I				
C				
Q				
×				
Ş				
		É		
×a				
3				
×į				
ĸ,	S			
K				
ĸ.				
×				
J				
КI				
×				
ો				
×				
S)			À	
×í				
4				
X.				
٦,				

st Paper	This resource was created and owned by Pearson Edexcel	666
		Leave
Question 8 continued	1	blank
Question o continuet	1	
		1

Summer	2017

DO NOT WRITE IN THIS AREA

Summer 2017	www.mystuaypro.com	Mathematics C4
Past Paper	This resource was created and owned by Pearson Edexcel	6666
		Leave

Question 8 continued	
destion o continued	

ulliller 2017	www.mystudybro.com	Mathematics C
ist Paper	This resource was created and owned by Pearson Edexcel	666

Question 8 continued		blaı
		Q
	(Total 12 marks)	

END