**Mathematics C12** 

Past Paper

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Pearson Edexcel nternational Advanced Level	Centre Number	Candidate Number
<b>Core Math</b>	namatic	c <b>C</b> 12
Advanced Subsidiar		3 C 1 Z
	<b>ry</b> - Morning	Paper Reference WMA01/01

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 quide 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 ▶



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1. Simplify the following	llowing expressions fully.	
$\frac{1}{2}$		
(a) $(x^6)^{\frac{1}{3}}$		
		(1)
(b) $\sqrt{2}(x^3) \div \sqrt{2}(x^3)$	32	
$(0)$ $\sqrt{2(x)}$ $\cdot$	$\sqrt{x^2}$	
·		(2)
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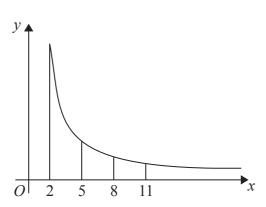


Figure 1

Figure 1 shows a sketch of part of the graph of  $y = \frac{12}{\sqrt{(x^2 - 2)}}, x \ge 2$ 

The table below gives values of y rounded to 3 decimal places.

x	2	5	8	11
y	8.485	2.502	1.524	1.100

(a) Use the trapezium rule with all the values of *y* from the table to find an approximate value, to 2 decimal places, for

$$\int_{2}^{11} \frac{12}{\sqrt{(x^2 - 2)}} \, \mathrm{d}x$$

**(4)** 

(b) Use your answer to part (a) to estimate a value for

$$\int_2^{11} \left(1 + \frac{6}{\sqrt{(x^2 - 2)}}\right) \mathrm{d}x$$

(3)

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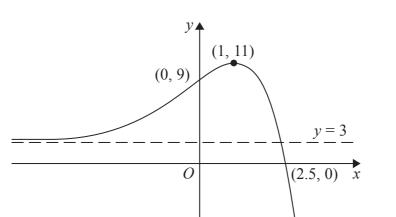


Figure 2

Figure 2 shows a sketch of part of the curve with equation y = f(x). The curve crosses the coordinate axes at the points (2.5, 0) and (0, 9), has a stationary point at (1, 11), and has an asymptote y = 3

On **separate** diagrams, sketch the curve with equation

(a) 
$$y = 3f(x)$$

(b) 
$$y = f(-x)$$
 (3)

On each diagram show clearly the coordinates of the points of intersection of the curve with the two coordinate axes, the coordinates of the stationary point, and the equation of the asymptote.

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$\left(2+\frac{x}{4}\right)^{10}$	
giving each term in its simplest form.	(4)
b) Use your expansion to find an estimated value for 2.025 <sup>10</sup> , stating the value you have used and showing your working.	e of $x$ which (3)

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$$S_n = \frac{n}{2}[2a + (n-1)d]$$

where a is the first term of the series and d is the common difference between the terms.

**(4)** 

(b) Find the sum of the integers which are divisible by 7 and lie between 1 and 500
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**(3)** 

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**6.** Given that

$$2\log_4(2x+3) = 1 + \log_4 x + \log_4(2x-1), \quad x > \frac{1}{2}$$

(a) show that

$$4x^2 - 16x - 9 = 0$$

**(5)** 

(b) Hence solve the equation

$$2\log_4(2x+3) = 1 + \log_4 x + \log_4(2x-1), \quad x > \frac{1}{2}$$

**(2)** 

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7. The c	ircle C has	equation
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 $x^2 + y^2 + 10x - 6y + 18 = 0$ 

Find

(a) the coordinates of the centre of C,

**(2)** 

(b) the radius of *C*.

**(2)** 

The circle C meets the line with equation x = -3 at two points.

(c) Find the exact values for the *y* coordinates of these two points, giving your answers as fully simplified surds.

**(4)** 

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**8.** A sequence is defined by

$$u_1 = k$$
  
 $u_{n+1} = 3u_n - 12, \quad n \geqslant 1$ 

where k is a constant.

(a) Write down fully simplified expressions for  $u_2$ ,  $u_3$  and  $u_4$  in terms of k.

**(4)** 

Given that  $u_4 = 15$ 

(b) find the value of k,

**(2)** 

(c) find  $\sum_{i=1}^{4} u_i$ , giving an exact numerical answer.

(3)

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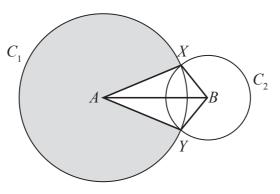


Figure 3

In Figure 3, the points A and B are the centres of the circles  $C_1$  and  $C_2$  respectively. The circle  $C_1$  has radius 10 cm and the circle  $C_2$  has radius 5 cm. The circles intersect at the points X and Y, as shown in the figure.

Given that the distance between the centres of the circles is 12 cm,

(a) calculate the size of the acute angle *XAB*, giving your answer in radians to 3 significant figures,

(2)

(b) find the area of the major sector of circle  $C_1$ , shown shaded in Figure 3,

**(3)** 

(c) find the area of the kite *AYBX*.

(3)

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When $f(x)$ is divided by $(x + 1)$ there is no remainder. When $f(x)$ is divided by $(2x - 1)$ the remainder is $-15$ (a) Find the value of $a$ and the value of $b$ .			
When $f(x)$ is divided by $(x + 1)$ there is no remainder.  When $f(x)$ is divided by $(2x - 1)$ the remainder is $-15$ (a) Find the value of $a$ and the value of $b$ .  (b) Factorise $f(x)$ completely.	f(x) =	$= 6x^3 + ax^2 + bx - 5$	
When $f(x)$ is divided by $(2x - 1)$ the remainder is $-15$ (a) Find the value of $a$ and the value of $b$ .  (b) Factorise $f(x)$ completely.	where $a$ and $b$ are constants.		
<ul><li>(a) Find the value of a and the value of b.</li><li>(b) Factorise f(x) completely.</li></ul>	When $f(x)$ is divided by $(x + 1)$ then	re is no remainder.	
(b) Factorise f(x) completely.	When $f(x)$ is divided by $(2x - 1)$ the	e remainder is –15	
(b) Factorise f(x) completely.	(a) Find the value of <i>a</i> and the valu	ue of b.	
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	(b) Factorise $f(x)$ completely.		(4)
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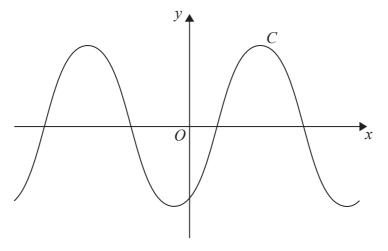


Figure 4

Figure 4 shows a sketch of the curve C with equation  $y = \sin(x - 60^\circ)$ ,  $-360^\circ \le x \le 360^\circ$ 

(a) Write down the exact coordinates of the points at which C meets the two coordinate axes.

**(3)** 

(b) Solve, for  $-360^{\circ} \leqslant x \leqslant 360^{\circ}$ ,

$$4\sin(x-60^\circ) = \sqrt{6} - \sqrt{2}$$

showing each stage of your working.

**(5)** 

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12. A business is expected to have a yearly profit of £275 000 for the year 2016. The profit is expected to increase by 10% per year, so that the expected yearly profits form a geometric sequence with common ratio 1.1	
(a) Show that the difference between the expected profit for the year 2020 and the expected profit for the year 2021 is £40 300 to the nearest hundred pounds.	
(3)	
(b) Find the first year for which the expected yearly profit is more than one million pounds. (4)	
(c) Find the total expected profits for the years 2016 to 2026 inclusive, giving your answer to the nearest hundred pounds.	
(3)	

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**13.** The curve *C* has equation

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

The line  $l_1$  is the normal to the curve C at the point P(1, 1)

(a) Show that  $l_1$  has equation

$$x + 2y - 3 = 0$$

**(5)** 

The line  $l_1$  meets curve C again at the point Q.

(b) By solving simultaneous equations, determine the coordinates of the point Q.

**(4)** 

Another line  $l_2$  has equation kx + 2y - 3 = 0, where k is a constant.

(c) Show that the line  $l_2$  meets the curve C once only when

$$k^2 - 16k + 40 = 0$$

**(4)** 

(d) Find the two exact values of k for which  $l_2$  is a tangent to C.

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<b>14.</b> In this question, solutions based entirely on graphical or numerical methods ar acceptable.	re not
(i) Solve, for $0 \le x < 360^\circ$ ,	
$3\sin x + 7\cos x = 0$	
Give each solution, in degrees, to one decimal place.	
	(4)
(ii) Solve, for $0 \le \theta < 2\pi$ ,	
$10\cos^2\theta + \cos\theta = 11\sin^2\theta - 9$	
Give each solution, in radians, to 3 significant figures.	
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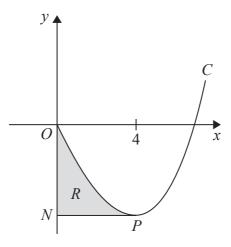


Figure 5

Figure 5 shows a sketch of part of the curve C with equation

$$y = x^3 + 10x^{\frac{3}{2}} + kx, \quad x \geqslant 0$$

where k is a constant.

(a) Find 
$$\frac{dy}{dx}$$
 (2)

The point P on the curve C is a minimum turning point. Given that the *x* coordinate of *P* is 4

(c) Use integration to find the area of R.

(b) show that 
$$k = -78$$
 (2)

The line through P parallel to the x-axis cuts the y-axis at the point N.

The finite region R, shown shaded in Figure 5, is bounded by C, the y-axis and PN.

**(7)** 



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