Write your name here

Surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number	Candidate Number

Core Mathematics C12

Advanced Subsidiary

Wednesday 11 October 2017 – Morning
Time: 2 hours 30 minutes

Paper Reference
WMA01/01

You must have:
Mathematical Formulae and Statistical Tables (Blue)

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 125.
- 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.

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Pearson

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1. The line l_1 has equation

$$8x + 2y - 15 = 0$$

(a) Find the gradient of l_1

(1)

The line l_2 is parallel to the line l_1 and passes through the point $\left(-\frac{3}{4}, 16\right)$.

(b) Find the equation of l_2 in the form $y = mx + c$, where m and c are constants.

(3)

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Question 1 continued

(Total 4 marks)

Q1

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2. The point $P(2, 3)$ lies on the curve with equation $y = \mathrm{f}(x)$.

State the coordinates of the image of P under the transformation represented by the curve with equation

(a) $y = \mathrm{f}(x + 2)$

(1)

(b) $y = -\mathrm{f}(x)$

(1)

(c) $2y = \mathrm{f}(x)$

(1)

(d) $y = \mathrm{f}(x) - 4$

(1)

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Question 2 continued

Q2

(Total 4 marks)

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3. (a) Express $\dfrac{x^3 + 4}{2x^2}$ in the form $Ax^p + Bx^q$, where A, B, p and q are constants.

(3)

(b) Hence find

$$\int \frac{x^3 + 4}{2x^2}\, \mathrm{d}x$$

simplifying your answer.

(3)

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Question 3 continued

Q3

(Total 6 marks)

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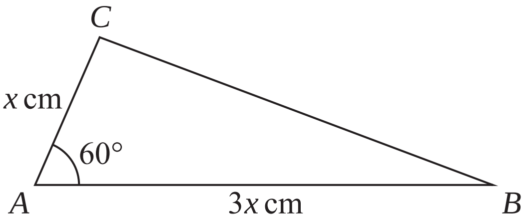

Figure 1

Figure 1 shows a sketch of a triangle ABC with $AB = 3x$ cm, $AC = x$ cm and angle $CAB = 60°$

Given that the area of triangle $ABC = 24\sqrt{3}$

(a) show that $x = 4\sqrt{2}$

(3)

(b) Hence find the exact length of BC, giving your answer as a simplified surd.

(3)

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Question 4 continued

Q4

(Total 6 marks)

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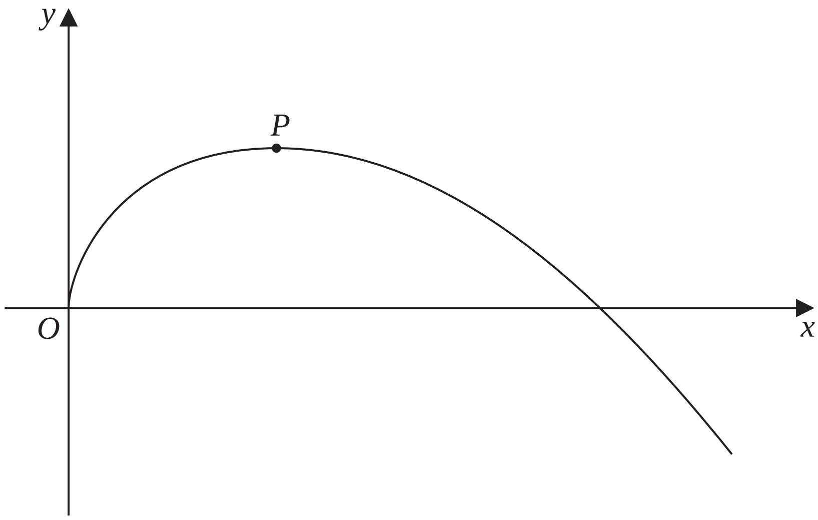

Figure 2

Figure 2 shows a sketch of part of the curve with equation

$$y = 27\sqrt{x} - 2x^2, \qquad x \in \mathbb{R}, x > 0$$

(a) Find $\dfrac{dy}{dx}$

(3)

The curve has a maximum turning point P, as shown in Figure 2.

(b) Use the answer to part (a) to find the exact coordinates of P.

(5)

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Question 5 continued

Q5

(Total 8 marks)

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6. Each year Lin pays into a savings scheme. In year 1 she pays in £600.
Her payments then increase by £80 a year, so that she pays £680 into the savings scheme in year 2, £760 in year 3 and so on. In year N, Lin pays £1000 into the savings scheme.

(a) Find the value of N.

(2)

(b) Find the total amount that Lin pays into the savings scheme from year 1 to year 15 inclusive.

(2)

Saima starts paying into a different savings scheme at the same time as Lin starts paying into her savings scheme.

In year 1 she pays in £A. Her payments increase by £A each year so that she pays £$2A$ in year 2, £$3A$ in year 3 and so on.

Given that Saima and Lin have each paid, in total, the same amount of money into their savings schemes after 15 years,

(c) find the value of A.

(3)

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Question 6 continued

Q6

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7. $$g(x) = 2x^3 + ax^2 - 18x - 8$$

Given that $(x + 2)$ is a factor of $g(x)$,

(a) show that $a = -3$

(2)

(b) Hence, using algebra, fully factorise $g(x)$.

(4)

Using your answer to part (b),

(c) solve, for $0 \leqslant \theta < 2\pi$, the equation

$$2\sin^3\theta - 3\sin^2\theta - 18\sin\theta = 8$$

giving each answer, in radians, as a multiple of π.

(3)

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Question 7 continued

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Question 7 continued

Q7

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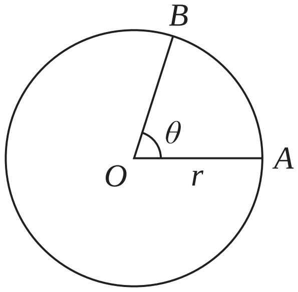

Figure 3

Figure 3 shows a circle with centre O and radius r cm.

The points A and B lie on the circumference of this circle.

The minor arc AB subtends an angle θ radians at O, as shown in Figure 3.

Given the length of minor arc AB is 6 cm and the area of minor sector OAB is 20 cm^2,

(a) write down two different equations in r and θ.

(2)

(b) Hence find the value of r and the value of θ.

(4)

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Question 8 continued

Q8

(Total 6 marks)

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9. (a) Given that a is a constant, $a > 1$, sketch the graph of

$$y = a^x, \qquad x \in \mathbb{R}$$

On your diagram show the coordinates of the point where the graph crosses the y-axis.
(2)

The table below shows corresponding values of x and y for $y = 2^x$

x	-4	-2	0	2	4
y	0.0625	0.25	1	4	16

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

$$\int_{-4}^{4} 2^x \, dx$$

(4)

(c) Use the answer to part (b) to find an approximate value for

(i) $\displaystyle\int_{-4}^{4} 2^{x+2} \, dx$

(ii) $\displaystyle\int_{-4}^{4} (3 + 2^x) \, dx$

(4)

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Question 9 continued

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Question 9 continued

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Question 9 continued

Q9

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10.

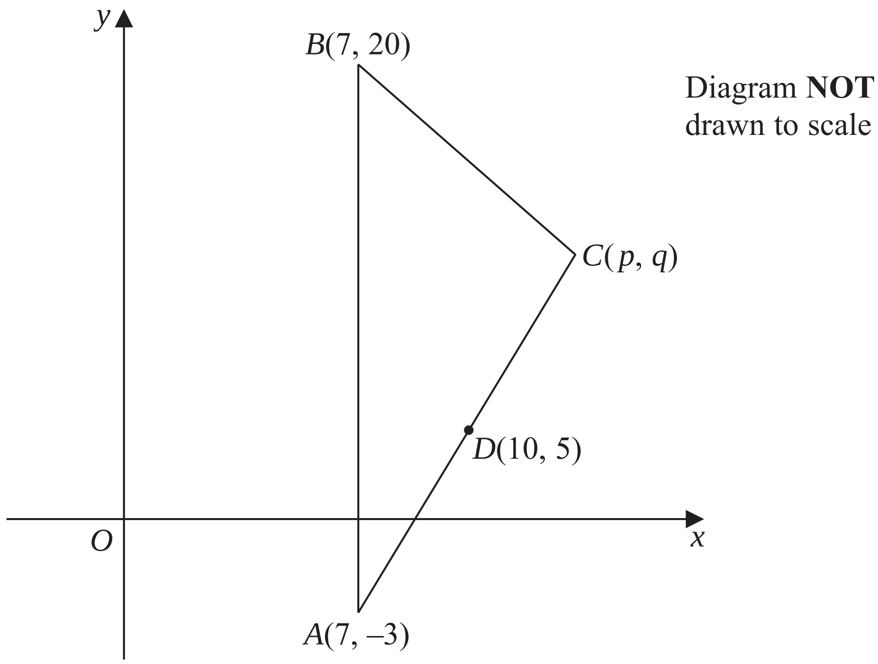

Figure 4

The points $A(7, -3)$, $B(7, 20)$ and $C(p, q)$ form the vertices of a triangle ABC, as shown in Figure 4. The point $D(10, 5)$ is the midpoint of AC.

(a) Find the value of p and the value of q.

(2)

The line l passes through D and is perpendicular to AC.

(b) Find an equation for l, in the form $ax + by = c$, where a, b and c are integers.

(5)

Given that the line l intersects AB at E,

(c) find the exact coordinates of E.

(2)

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Question 10 continued

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Question 10 continued

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Question 10 continued

(Total 9 marks)

Q10

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11. $\mathrm{f}(x) = (a - x)(3 + ax)^5$, where a is a positive constant

(a) Find the first 3 terms, in ascending powers of x, in the binomial expansion of

$$(3 + ax)^5$$

Give each term in its simplest form.

(4)

Given that in the expansion of $\mathrm{f}(x)$ the coefficient of x is zero,

(b) find the exact value of a.

(3)

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Question 11 continued

(Total 7 marks)

Q11

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12. (i) Solve, for $0 < \theta \leqslant 360°$,

$$3\sin(\theta + 30°) = 2\cos(\theta + 30°)$$

giving your answers, in degrees, to 2 decimal places.

(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

(4)

(ii) (a) Given that

$$\frac{\cos^2 x + 2\sin^2 x}{1 - \sin^2 x} = 5$$

show that

$$\tan^2 x = k, \qquad \text{where } k \text{ is a constant.}$$

(b) Hence solve, for $0 < x \leqslant 2\pi$,

$$\frac{\cos^2 x + 2\sin^2 x}{1 - \sin^2 x} = 5$$

giving your answers, in radians, to 3 decimal places.

(7)

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Question 12 continued

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Question 12 continued

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Question 12 continued

(Total 11 marks)

Q12

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13. The circle C has equation

$$(x - 3)^2 + (y + 4)^2 = 30$$

Write down

(a) (i) the coordinates of the centre of C,

(ii) the exact value of the radius of C.

(2)

Given that the point P with coordinates $(6, k)$, where k is a constant, lies inside circle C,

(b) show that

$$k^2 + 8k - 5 < 0$$

(3)

(c) Hence find the exact set of values of k for which P lies inside C.

(4)

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Question 13 continued

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Question 13 continued

(Total 9 marks)

Q13

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14. A new mineral has been discovered and is going to be mined over a number of years.

A model predicts that the mass of the mineral mined each year will decrease by 15% per year, so that the mass of the mineral mined each year forms a geometric sequence.

Given that the mass of the mineral mined during year 1 is 8000 tonnes,

(a) show that, according to the model, the mass of the mineral mined during year 6 will be approximately 3550 tonnes.
(2)

According to the model, there is a limit to the total mass of the mineral that can be mined.

(b) With reference to the geometric series, state why this limit exists.
(1)

(c) Calculate the value of this limit.
(2)

It is decided that a total mass of 40 000 tonnes of the mineral is required. This is going to be mined from year 1 to year N inclusive.

(d) Assuming the model, find the value of N.
(5)

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Question 14 continued

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Question 14 continued

Q14

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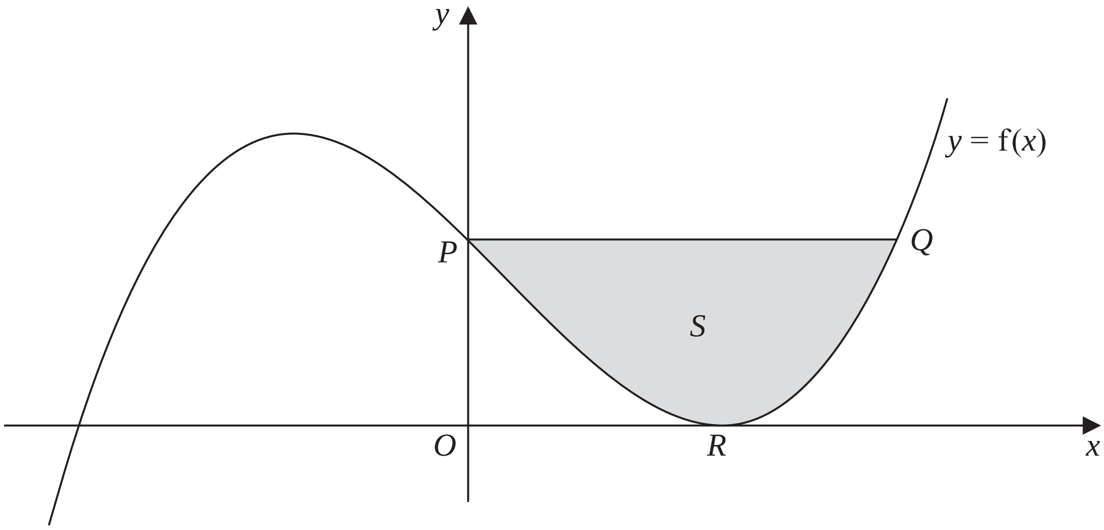

Figure 5

Figure 5 shows a sketch of part of the graph $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = \frac{(x-3)^2(x+4)}{2}, \qquad x \in \mathbb{R}$$

The graph cuts the y-axis at the point P and meets the positive x-axis at the point R, as shown in Figure 5.

(a) (i) State the y coordinate of P.

(ii) State the x coordinate of R.

(2)

The line segment PQ is parallel to the x-axis. Point Q lies on $y = \mathrm{f}(x)$, $x > 0$

(b) Use algebra to show that the x coordinate of Q satisfies the equation

$$x^2 - 2x - 15 = 0$$

(3)

(c) Use part (b) to find the coordinates of Q.

(3)

The region S, shown shaded in Figure 5, is bounded by the curve $y = \mathrm{f}(x)$ and the line segment PQ.

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

(6)

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Question 15 continued

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Question 15 continued

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Question 15 continued

Q15

(Total 14 marks)

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16. $f(x) = ax^3 + bx^2 + 2x - 5$, where a and b are constants

The point $P(1, 4)$ lies on the curve with equation $y = f(x)$.

The tangent to $y = f(x)$ at the point P has equation $y = 12x - 8$

Calculate the value of a and the value of b.

(5)

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Question 16 continued

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Question 16 continued

Q16

(Total 5 marks)

TOTAL FOR PAPER: 125 MARKS

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