EXEMPLAR OF NEW FORMAT

Surname	Centre Number	Candidate Number
First name(s)		2

GCE AS/A LEVEL

2300U10-1

S19-2300U10-1

SUMMER 2019

MATHEMATICS – AS unit 1
PURE MATHEMATICS A

2 hours 30 minutes

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a Formula Booklet;
- a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The maximum mark for this paper is 120.

The number of marks is given in brackets at the end of each question or part-question.

Sufficient working must be shown to demonstrate the **mathematical** method employed.

Answers without working may not gain full credit.

Unless the degree of accuracy is stated in the question, answers should be rounded appropriately.

You are reminded of the necessity for good English and orderly presentation in your answers.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	6	
2	7	
3	6	
4	15	
5	3	
6	5	
7	6	
8	8	
9	12	
10	13	
11	4	
12	6	
13	11	
14	6	
15	4	
16	8	
Total	120	

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Reminder: Sufficient working must be shown to demonstrate the **mathematical** method employed.

1. Solve the following equation for values of θ between 0° and 360°.

$$3\tan\theta + 2\cos\theta = 0$$ [6]

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2. Find all the values of k for which the equation $x^2 + 2kx + 9k = -4x$ has two distinct real roots. [7]

Turn over.

Examiner only

3. Use an **algebraic method** to solve the equation $12x^3 - 29x^2 + 7x + 6 = 0$.
Show all your working. [6]

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4. The line L_1 passes through the points $A(-1, 3)$ and $B(2, 9)$. The line L_2 has equation $2y + x = 25$ and intersects L_1 at the point C. L_2 also intersects the x-axis at the point D.

(a) Show that the equation of the line L_1 is $y = 2x + 5$. [3]

(b) (i) Find the coordinates of the point D.

(ii) Show that L_1 and L_2 are perpendicular.

(iii) Determine the coordinates of C. [5]

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(c) Find the length of *CD*. [2]

(d) Calculate the angle *ADB*. Give your answer in degrees, correct to one decimal place. [5]

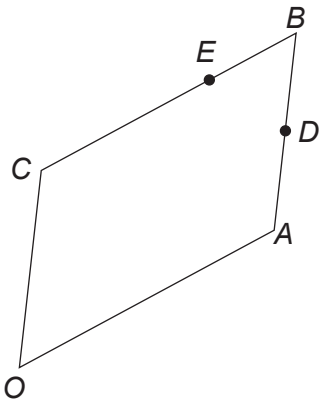
Turn over.

Examiner only

5. Given that n is an integer such that $1 \leqslant n \leqslant 4$, prove that $2n^2 + 5$ is a prime number. [3]

Examiner only

6. *OABC* is a parallelogram with *O* as origin.



The position vector of *A* is $\mathbf{a}$ and the position vector of *C* is $\mathbf{c}$. The midpoint of *AB* is *D*. The point *E* divides the line *CB* such that $CE : EB = 2 : 1$.

(a) Find, in terms of $\mathbf{a}$ and $\mathbf{c}$,

(i) the vector **AC**,

(ii) the position vector of *D*,

(iii) the position vector of *E*. [3]

(b) Determine whether or not *DE* is parallel to *AC*, clearly stating your reason. [2]

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7. Given that a, b are integers, simplify the following. Show all your working.

(a) $\dfrac{2\sqrt{3}+a}{\sqrt{3}-1}$ [3]

(b) $\dfrac{2\sqrt{6b^2}}{\sqrt{2}} - \sqrt{27} + \sqrt{192}$ [3]

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8. (a) Given that $y = 2x^2 - 5x$, find $\frac{dy}{dx}$ from first principles. [5]

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(b) Given that $y = \frac{16}{5}x^{\frac{1}{4}} + \frac{48}{x}$, find the value of $\frac{dy}{dx}$ when $x = 16$. [3]

Turn over.

Examiner only

9. The points $A(-2, 4)$ and $B(6, 10)$ are such that AB is the diameter of a circle.

(a) Show that the centre of the circle has coordinates (2, 7). [1]

(b) The equation of the circle is $x^2 + y^2 + ax + by + c = 0$.
Determine the values of a, b, c. [3]

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A straight line, with equation $y = x + 6$, passes through the point A and cuts the circle again at the point C.

(c) Find the coordinates of C. [5]

(d) Calculate the exact area of the triangle ABC. [3]

Examiner only

10. (a) Solve the following simultaneous equations.

$$3^{3x} \times 9^{y} = 27$$

$$2^{-3x} \times 8^{-y} = \frac{1}{64}$$

[6]

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(b) Find the value of x satisfying the equation

$$\log_a 3 + 2\log_a x - \log_a(x - 1) = \log_a(5x + 2).$$ [7]

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11. Two quantities are related by the equation $Q = 1{\cdot}25P^3$. Explain why the graph of $\log_{10}Q$ against $\log_{10}P$ is a straight line. State the gradient of the straight line and the intercept on the $\log_{10}Q$ axis of the graph. [4]

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12. In the binomial expansion of $(2 - 5x)^8$, find

(a) the number of terms, [1]

(b) the 4th term, when the expansion is in ascending powers of x, [2]

(c) the greatest positive coefficient. [3]

Examiner only

13. A curve *C* has equation $y = \frac{1}{9}x^3 - kx + 5$. A point *Q* lies on *C* and is such that the tangent to *C* at *Q* has gradient –9. The x-coordinate of *Q* is 3.

(a) Show that $k = 12$. [3]

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(b) Find the coordinates of each of the stationary points of C and determine their nature. [6]

Examiner only

(c) Sketch the curve *C*, clearly labelling the stationary points and the point where the curve crosses the y-axis. [2]

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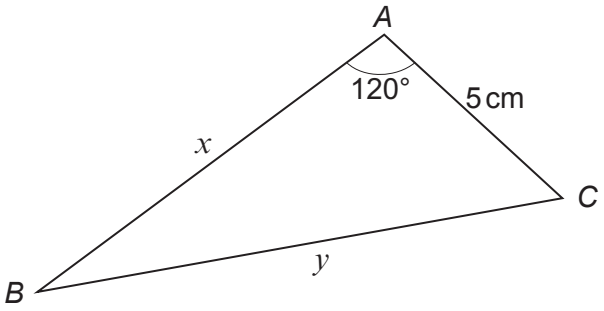
14. The diagram below shows a triangle ABC with $AC = 5\,\text{cm}$, $AB = x\,\text{cm}$, $BC = y\,\text{cm}$ and angle $BAC = 120°$. The area of the triangle ABC is $14\,\text{cm}^2$.



Find the value of x and the value of y. Give your answers correct to 2 decimal places. [6]

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15. Prove that $f(x) = x^3 - 6x^2 + 13x - 7$ is an increasing function. [4]

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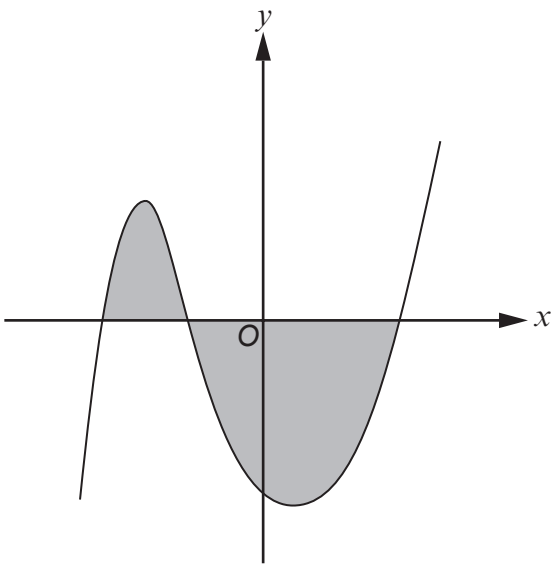
16. The diagram below shows a curve with equation $y = (x + 2)(x - 2)(x + 1)$.



Calculate the total area of the two shaded regions. [8]

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