

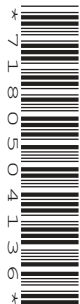
CANDIDATE  
NAME

CENTRE  
NUMBER

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|

CANDIDATE  
NUMBER

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|--|--|--|--|



**ADDITIONAL MATHEMATICS**

**0606/23**

Paper 2

**October/November 2018**

**2 hours**

Candidates answer on the Question Paper.

Additional Materials:      Electronic calculator

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** the questions.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

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

The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

*Mathematical Formulae***1. ALGEBRA***Quadratic Equation*

For the equation  $ax^2 + bx + c = 0$ ,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

*Binomial Theorem*

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \dots + \binom{n}{r} a^{n-r} b^r + \dots + b^n,$$

where  $n$  is a positive integer and  $\binom{n}{r} = \frac{n!}{(n-r)!r!}$ .

**2. TRIGONOMETRY***Identities*

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

*Formulae for  $\Delta ABC$* 

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

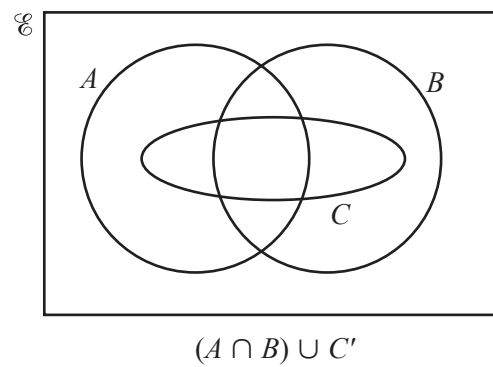
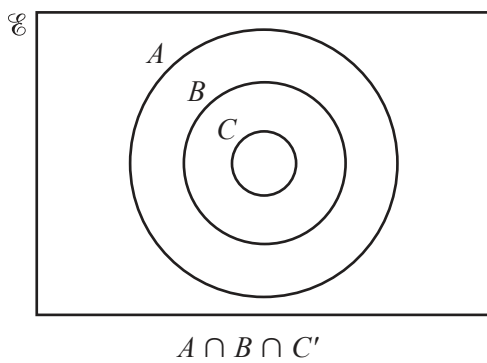
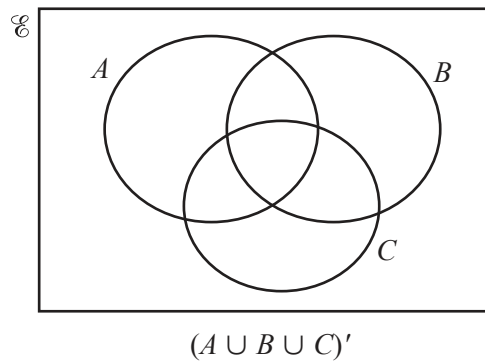
$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

1 Solve the equation  $|5x - 3| = -3x + 13$ .

[3]

2 On each of the Venn diagrams below, shade the region indicated.



[3]

3 (i) Write  $8 + 7x - x^2$  in the form  $a - (x - b)^2$ , where  $a$  and  $b$  are constants. [3]

(ii) Hence state the maximum value of  $8 + 7x - x^2$  and the value of  $x$  at which it occurs. [2]

(iii) Using your answer to **part (i)**, or otherwise, solve the equation  $8 + 7z^2 - z^4 = 0$ . [3]

$$4 \quad \frac{d^2y}{dx^2} = 2x + \frac{3}{(x+1)^4}$$

(i) Find  $\frac{dy}{dx}$ , given that  $\frac{dy}{dx} = 1$  when  $x = 1$ . [3]

(ii) Find  $y$  in terms of  $x$ , given that  $y = 3$  when  $x = 1$ . [3]

5 Given that  $\mathbf{A} = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$  and  $\mathbf{B} = \begin{pmatrix} 1 & 4 \\ -2 & 5 \end{pmatrix}$ , find

(i)  $\mathbf{A}^{-1}$ , [2]

(ii) the matrix  $\mathbf{C}$  such that  $\mathbf{CA} = \mathbf{B}$ , [2]

(iii) the matrix  $\mathbf{D}$  such that  $\mathbf{A}^{-1}\mathbf{D} + \mathbf{B} = \mathbf{I}$ . [3]

6 Solve the simultaneous equations

$$\log_2(x + 2y) = 3,$$

$$\log_2 3x - \log_2 y = 1.$$

[5]

7 A squad of 20 boys, which includes 2 sets of twins, is available for selection for a cricket team of 11 players. Calculate the number of different teams that can be selected if

(i) there are no restrictions, [1]

(ii) both sets of twins are selected, [2]

(iii) one set of twins is selected but neither twin from the other set is selected, [2]

(iv) exactly one twin from each set of twins is selected. [2]



8 Variables  $x$  and  $y$  are such that when  $y^2$  is plotted against  $e^{2x}$  a straight line is obtained which passes through the points (1.5, 5.5) and (3.7, 12.1). Find

(i)  $y$  in terms of  $e^{2x}$ , [3]

(ii) the value of  $y$  when  $x = 3$ , [1]

(iii) the value of  $x$  when  $y = 50$ . [3]

9 (a) Solve  $2 \sin\left(x + \frac{\pi}{4}\right) = \sqrt{3}$  for  $0 < x < \pi$  radians. [3]

(b) Solve  $3 \sec y = 4 \operatorname{cosec} y$  for  $0^\circ < y < 360^\circ$ . [3]

(c) Solve  $7 \cot z - \tan z = 2 \operatorname{cosec} z$  for  $0^\circ < z < 360^\circ$ .

[6]

10 The equation of a curve is  $y = x^2\sqrt{3+x}$  for  $x \geq -3$ .

(i) Find  $\frac{dy}{dx}$ . [3]

(ii) Find the equation of the tangent to the curve  $y = x^2\sqrt{3+x}$  at the point where  $x = 1$ . [3]

- (iii) Find the coordinates of the turning points of the curve  $y = x^2\sqrt{3+x}$ . [4]

11 A line with equation  $y = -5x + k + 5$  is a tangent to a curve with equation  $y = 7 - kx - x^2$ .

(i) Find the two possible values of  $k$ .

[5]

(ii) Find, for **each** of your values of  $k$ ,

- the equation of the tangent
- the equation of the curve
- the coordinates of the point of contact of the tangent and the curve.

[5]

(iii) Find the distance between the two points of contact.

[2]

**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cie.org.uk](http://www.cie.org.uk) after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.