



--

--	--	--	--	--

--	--	--	--

0606/22

October/November 2019

2 hours

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

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

The total number of marks for this paper is 80.

This document consists of **16** printed pages.

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*

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

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

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

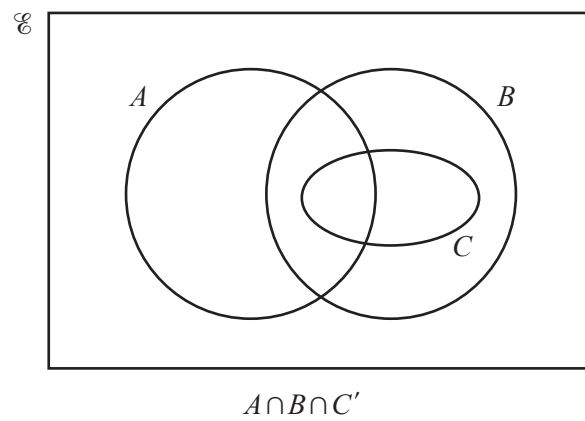
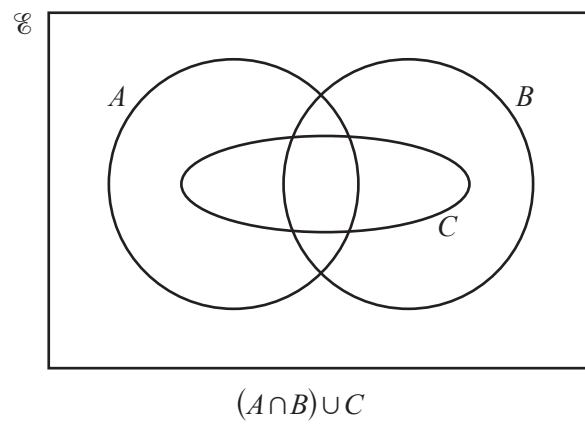
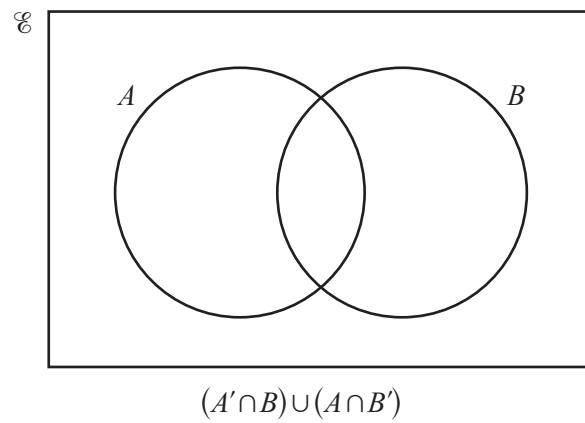
Formulae for $\triangle ABC$

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

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

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

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



[3]

- 2 Given that $y = 2 \sin 3x + \cos 3x$, show that $\frac{d^2y}{dx^2} + \frac{dy}{dx} + 3y = k \sin 3x$, where k is a constant to be determined. [5]

- 3 A 5-digit code is formed using the following characters.

Letters	a	e	i	o	u	
Numbers	1	2	3	4	5	6
Symbols	@	*	#			

No character can be repeated in a code. Find the number of possible codes if

- (i) there are no restrictions, [2]

- (ii) the code starts with a symbol followed by two letters and then two numbers, [2]

- (iii) the first two characters are numbers, and no other numbers appear in the code. [2]

- 4 Find the values of k for which the line $y = kx + 3$ does not meet the curve $y = x^2 + 5x + 12$. [5]

5 At the point where $x = 1$ on the curve $y = \frac{k}{(x+1)^2}$, the normal has a gradient of $\frac{1}{3}$.

(i) Find the value of the constant k . [4]

(ii) Using your value of k , find the equation of the tangent to the curve at $x = 2$. [3]

6 (i) Show that $\frac{\tan x}{1 + \sec x} + \frac{1 + \sec x}{\tan x} = \frac{2}{\sin x}$.

[5]

- (ii) Hence solve the equation $\frac{\tan x}{1 + \sec x} + \frac{1 + \sec x}{\tan x} = 1 + 3 \sin x$ for $0^\circ \leq x \leq 180^\circ$. [4]

- 7 (a) The cubic equation $x^3 + ax^2 + bx - 40 = 0$ has three positive integer roots. Two of the roots are 2 and 4. Find the other root and the value of each of the integers a and b . [4]

(b) Do not use a calculator in this question.

Solve the equation $x^3 - 5x^2 - 46x - 40 = 0$ given that it has three integer roots, only one of which is positive. [4]

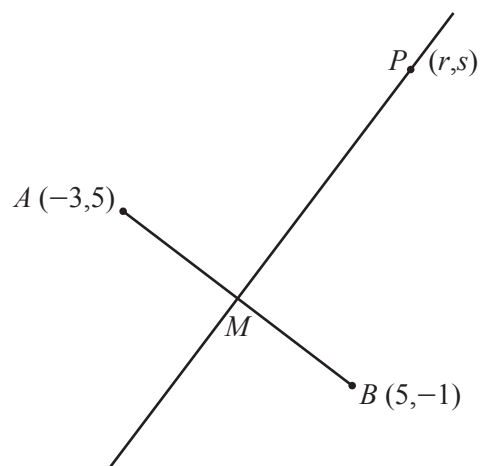
8 (i) A particle A travels with a speed of 6.5 ms^{-1} in the direction $-5\mathbf{i} - 12\mathbf{j}$. Find the velocity, $\mathbf{v}_A$, of A . [2]

(ii) A particle B travels with velocity $\mathbf{v}_B = 12\mathbf{i} - 9\mathbf{j}$. Find the speed, in ms^{-1} , of B . [2]

Particle A starts moving from the point with position vector $20\mathbf{i} - 7\mathbf{j}$. At the same time particle B starts moving from the point with position vector $-67\mathbf{i} + 11\mathbf{j}$.

(iii) Find $\mathbf{r}_A$, the position vector of A after t seconds, and $\mathbf{r}_B$, the position vector of B after t seconds. [2]

(iv) Find the time when the particles collide and the position vector of the point of collision. [3]



The diagram shows the points $A(-3, 5)$ and $B(5, -1)$. The mid-point of AB is M and the line PM is perpendicular to AB . The point P has coordinates (r, s) .

- (i) Find the equation of the line PM in the form $y = mx + c$, where m and c are exact constants. [5]

- (ii) Hence find an expression for s in terms of r . [1]

- (iii) Given that the length of PM is 10 units, find the value of r and of s .

[5]

10 (i) Given that $y = \frac{\ln x}{x^2}$, find $\frac{dy}{dx}$. [3]

(ii) Find the coordinates of the stationary point on the curve $y = \frac{\ln x}{x^2}$. [3]

(iii) Using your answer to **part (i)**, find $\int \frac{\ln x}{x^3} dx$. [3]

(iv) Hence evaluate $\int_1^2 \frac{\ln x}{x^3} dx$. [2]

Question 11 is printed on the next page.

11 Do not use a calculator in this question.

Solve the quadratic equation $(\sqrt{5} - 3)x^2 + 3x + (\sqrt{5} + 3) = 0$, giving your answers in the form $a + b\sqrt{5}$, where a and b are constants. [6]

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 Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

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