

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*

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

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

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

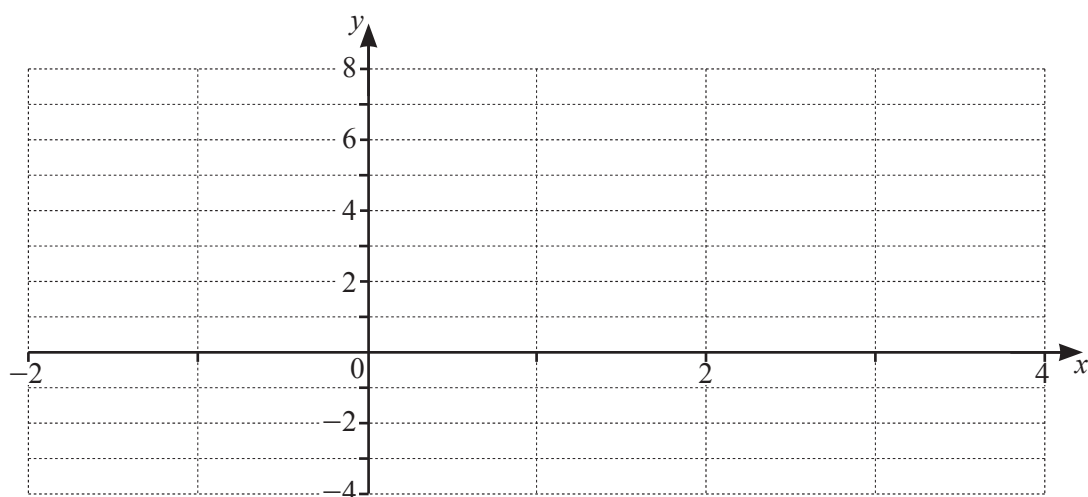
Formulae for ΔABC

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

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

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

- 1 (i) On the axes below, draw the graph of $y = |2x - 3|$.

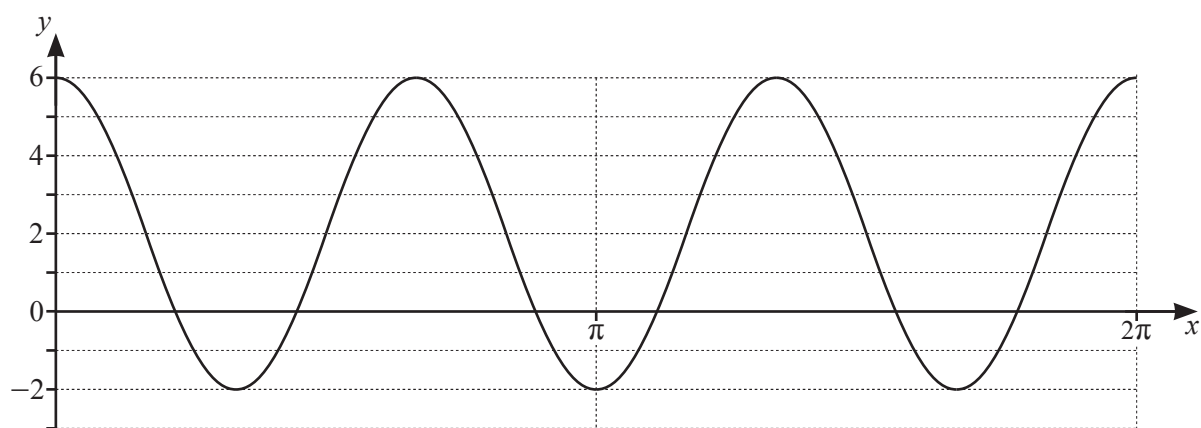


[2]

- (ii) Solve the equation $7 - |2x - 3| = 0$.

[3]

2



The figure shows part of the graph of $y = p + q \cos rx$. Find the value of each of the integers p , q and r .

 $p =$ $q =$ $r =$

[3]

3 (a) Solve $e^{2x+1} = 3e^{4-3x}$. [3]

(b) Solve $\lg(y-6) + \lg(y+15) = 2$. [5]

4 Do not use a calculator in this question.

Solve the following simultaneous equations, giving your answers for both x and y in the form $a + b\sqrt{2}$, where a and b are integers.

$$2x + y = 5$$

$$3x - \sqrt{2}y = 7 \quad [5]$$

- 5 A particle is moving in a straight line such that t seconds after passing a fixed point O its displacement, s m, is given by $s = 3 \sin 2t + 4 \cos 2t - 4$.

(i) Find expressions for the velocity and acceleration of the particle at time t . [3]

(ii) Find the first time when the particle is instantaneously at rest. [3]

(iii) Find the acceleration of the particle at the time found in **part (ii)**. [2]

6 Do not use a calculator in this question.

The curve $xy = 11x + 5$ cuts the line $y = x + 10$ at the points A and B . The mid-point of AB is the point C . Show that the point C lies on the line $x + y = 11$. [7]

- 7 **(a) (i)** Use the factor theorem to show that $2x - 1$ is a factor of $p(x)$, where $p(x) = 4x^3 + 9x - 5$. [1]

- (ii)** Write $p(x)$ as a product of linear and quadratic factors. [2]

(b) (i) Show that $13 \tan x \sec x - 4 \sin x - 5 \sec^2 x = 0$ can be written as $4 \sin^3 x + 9 \sin x - 5 = 0$. [3]

(ii) Using your answers to **part (a)(ii)** and **part (b)(i)** solve the equation

$$13 \tan x \sec x - 4 \sin x - 5 \sec^2 x = 0 \quad \text{for } 0 < x < 2\pi \text{ radians.} \quad [4]$$

8 The equation of a curve is given by $y = xe^{-2x}$.

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

(ii) Find the exact coordinates of the stationary point on the curve $y = xe^{-2x}$. [2]

- (iii) Find, in terms of e , the equation of the tangent to the curve $y = xe^{-2x}$ at the point $\left(1, \frac{1}{e^2}\right)$. [2]

- (iv) Using your answer to **part (i)**, find $\int xe^{-2x} dx$. [3]

9 Given that $\mathbf{A} = \begin{pmatrix} 5 & 2 \\ -9 & -3 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 2 & 1 \\ 6 & 5 \end{pmatrix}$, find

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

(ii) $\mathbf{B}^2$, [2]

(iii) the matrix $\mathbf{C}$, where $\mathbf{B}^{-1}\mathbf{C} + \mathbf{A} = \mathbf{B}$, [3]

(iv) the matrix $\mathbf{D}$, where $\mathbf{B}^{-2}\mathbf{D}\mathbf{A} = \mathbf{I}$.

[3]

- 10 (i)** Expand $(3+x)^4$ evaluating each coefficient. [3]

In the expansion of $\left(x - \frac{p}{x}\right)(3+x)^4$ the coefficient of x is zero.

- (ii)** Find the value of the constant p . [2]

- (iii)** Hence find the term independent of x . [1]

- (iv)** Show that the coefficient of x^2 is 90. [2]

- 11** A plane, which can travel at a speed of 300 km h^{-1} in still air, heads due north. The plane is blown off course by a wind so that it travels on a bearing of 010° at a speed of 280 km h^{-1} .

(i) Find the speed of the wind.

[3]

(ii) Find the direction of the wind as a bearing correct to the nearest degree.

[3]

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 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.