



--	--	--	--	--

--	--	--	--

0606/23

October/November 2013

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 **19** 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 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 Find the coordinates of the stationary points on the curve $y = x^3 - 6x^2 - 36x + 16$.

[5]

*For
Examiner's
Use*

- 2 (i) Find how many different numbers can be formed using 4 of the digits 1, 2, 3, 4, 5, 6 and 7 if no digit is repeated.

[1]

*For
Examiner's
Use*

Find how many of these 4-digit numbers are

- (ii) odd,

[1]

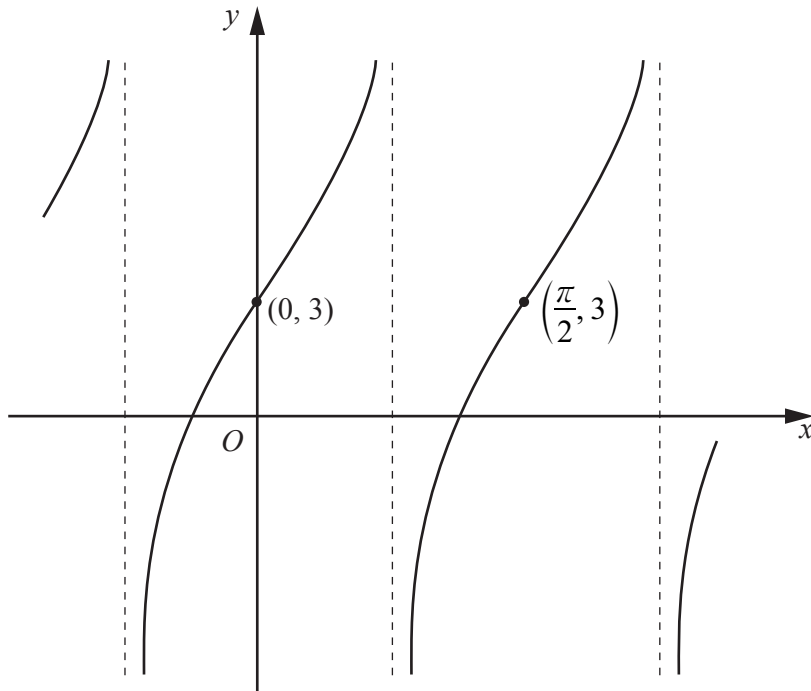
- (iii) odd and less than 3000.

[3]

- 3 Find the set of values of k for which the line $y = 3x - k$ does not meet the curve $y = kx^2 + 11x - 6$.

[6]

*For
Examiner's
Use*



- (a) (i) The diagram shows the graph of $y = A + C \tan(Bx)$ passing through the points $(0, 3)$ and $(\frac{\pi}{2}, 3)$. Find the value of A and of B . [2]

- (ii) Given that the point $(\frac{\pi}{8}, 7)$ also lies on the graph, find the value of C . [1]

(b) Given that $f(x) = 8 - 5 \cos 3x$, state the period and the amplitude of f .

[2]

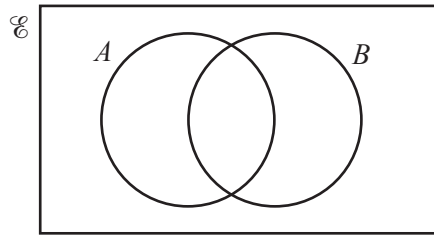
*For
Examiner's
Use*

period amplitude

- 5 (a) (i) In the Venn diagram below shade the region that represents $(A \cup B)'$.

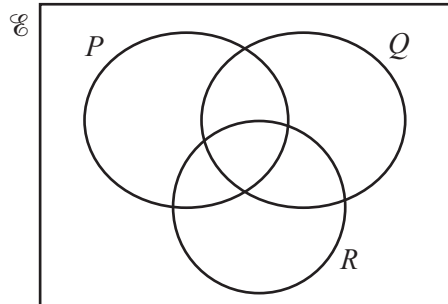
[1]

For
Examiner's
Use



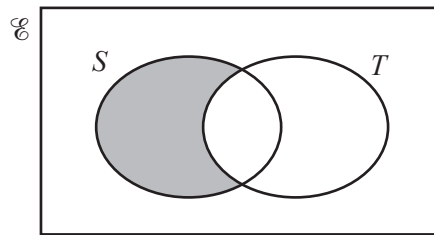
- (ii) In the Venn diagram below shade the region that represents $P \cap Q \cap R'$.

[1]



- (b) Express, in set notation, the set represented by the shaded region.

[1]



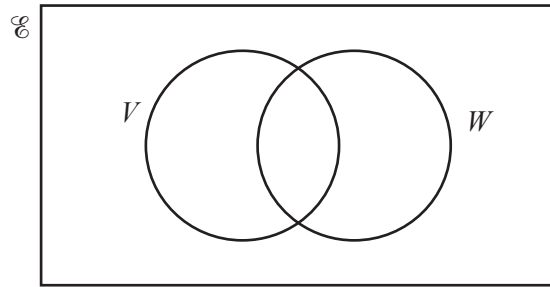
Answer

- (c) The universal set $\mathcal{E}$ and the sets V and W are such that $n(\mathcal{E}) = 40$, $n(V) = 18$ and $n(W) = 14$. Given that $n(V \cap W) = x$ and $n((V \cup W)') = 3x$ find the value of x .

For
Examiner's
Use

You may use the Venn diagram below to help you.

[3]



- 6 The expression $2x^3 + ax^2 + bx + 21$ has a factor $x + 3$ and leaves a remainder of 65 when divided by $x - 2$.

*For
Examiner's
Use*

(i) Find the value of a and of b . [5]

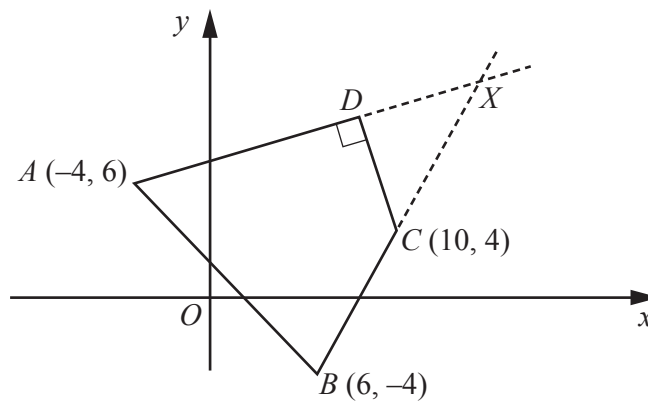
(ii) Hence find the value of the remainder when the expression is divided by $2x + 1$. [2]

- 7 The line $4x + y = 16$ intersects the curve $\frac{4}{x} - \frac{8}{y} = 1$ at the points A and B . The x -coordinate of A is less than the x -coordinate of B . Given that the point C lies on the line AB such that $AC:CB = 1:2$, find the coordinates of C . [8]

*For
Examiner's
Use*

8 Solutions to this question by accurate drawing will not be accepted.

For
Examiner's
Use



The diagram shows a quadrilateral $ABCD$, with vertices $A(-4, 6)$, $B(6, -4)$, $C(10, 4)$ and D . The angle $ADC = 90^\circ$. The lines BC and AD are extended to intersect at the point X .

- (i) Given that C is the midpoint of BX , find the coordinates of D .

[7]

- (ii) Hence calculate the area of the quadrilateral $ABCD$.

[2]

*For
Examiner's
Use*

- 9 A particle travels in a straight line so that, t s after passing through a fixed point O , its velocity, $v \text{ ms}^{-1}$, is given by $v = 3 + 6 \sin 2t$.

For
Examiner's
Use

(i) Find the velocity of the particle when $t = \frac{\pi}{4}$. [1]

(ii) Find the acceleration of the particle when $t = 2$. [3]

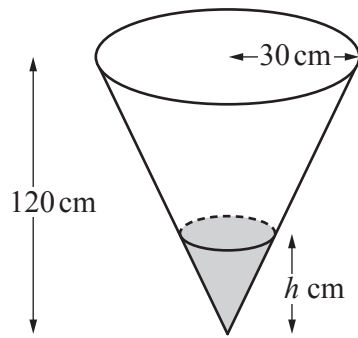
The particle first comes to instantaneous rest at the point P .

- (iii) Find the distance OP .

[5]

*For
Examiner's
Use*

10



The volume of a cone of height H and radius R is

$$\frac{1}{3}\pi R^2 H$$

The diagram shows a container in the shape of a cone of height 120 cm and radius 30 cm. Water is poured into the container at a rate of $20\pi \text{ cm}^3 \text{ s}^{-1}$.

- (i) At the instant when the depth of water in the cone is h cm the volume of water in the cone is $V \text{ cm}^3$. Show that $V = \frac{\pi h^3}{48}$. [3]

- (ii) Find the rate at which h is increasing when $h = 50$.

[3]

*For
Examiner's
Use*

- (iii) Find the rate at which the circular area of the water's surface is increasing when $h = 50$. [4]

- 11** In this question $\mathbf{i}$ is a unit vector due east and $\mathbf{j}$ is a unit vector due north.

At time $t = 0$ boat A leaves the origin O and travels with velocity $(2\mathbf{i} + 4\mathbf{j}) \text{ kmh}^{-1}$. Also at time $t = 0$ boat B leaves the point with position vector $(-21\mathbf{i} + 22\mathbf{j}) \text{ km}$ and travels with velocity $(5\mathbf{i} + 3\mathbf{j}) \text{ kmh}^{-1}$.

*For
Examiner's
Use*

- (i)** Write down the position vectors of boats A and B after t hours. [2]

- (ii)** Show that A and B are 25 km apart when $t = 2$. [3]

- (iii) Find the length of time for which A and B are less than 25 km apart.

[5]

*For
Examiner's
Use*

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.

University of 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.