2004-CE
MATH
PAPER 1

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG CERTIFICATE OF EDUCATION EXAMINATION 2004

MATHEMATICS PAPER 1

Question-Answer Book

8.30 am – 10.30 am (2 hours)
This paper must be answered in English

1. Write your Candidate Number, Centre Number and Seat Number in the spaces provided on this cover.
2. This paper consists of THREE sections, A(1), A(2) and B. Each section carries 33 marks.
3. Attempt ALL questions in Sections A(1) and A(2), and any THREE questions in Section B. Write your answers in the spaces provided in this Question-Answer Book. Supplementary answer sheets will be supplied on request. Write your Candidate Number on each sheet and fasten them with string inside this book.
4. Write the question numbers of the questions you have attempted in Section B in the spaces provided on this cover.
5. Unless otherwise specified, all working must be clearly shown.
6. Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.
7. The diagrams in this paper are not necessarily drawn to scale.

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Candidate Number							
Centre Number							
Seat Number							

	Marker's Use Only	**Examiner's Use Only**
	Marker No.	Examiner No.
Section A Question No.	Marks	Marks
1–2		
3–4		
5–6		
7–8		
9		
10		
11		
12		
13		
Section A Total		

Checker's Use Only	Section A Total		

Section B Question No.*	Marks	Marks
Section B Total		

To be filled in by the candidate.

Checker's Use Only	Section B Total		

Checker No.	

FORMULAS FOR REFERENCE

SPHERE	Surface area	=	$4\pi r^2$
	Volume	=	$\frac{4}{3}\pi r^3$
CYLINDER	Area of curved surface	=	$2\pi rh$
	Volume	=	$\pi r^2 h$
CONE	Area of curved surface	=	πrl
	Volume	=	$\frac{1}{3}\pi r^2 h$
PRISM	Volume	=	base area × height
PYRAMID	Volume	=	$\frac{1}{3}$ × base area × height

SECTION A(1) (33 marks)
Answer ALL questions in this section and write your answers in the spaces provided.

1. Simplify $\frac{(a^{-1}b)^3}{b^2}$ and express your answer with positive indices. (3 marks)

2. Make x the subject of the formula $y = \frac{2}{a-x}$. (3 marks)

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3. A sum of \$ 5 000 is deposited at 2% p.a. for 3 years, compounded yearly. Find the interest correct to the nearest dollar. (3 marks)

4. In Figure 1 , the graph of $y = -x^2 + 10x - 25$ touches the x-axis at $A(a, 0)$ and cuts the y-axis at $B(0, b)$. Find a and b. (3 marks)

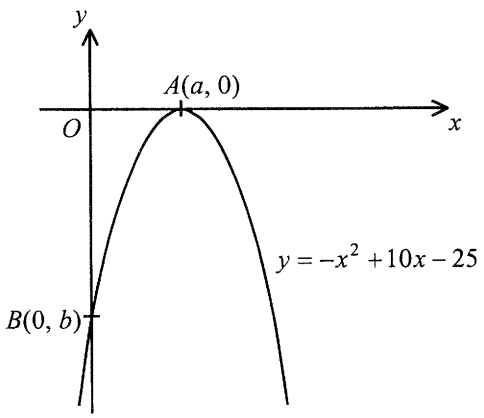

Figure 1

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5. In Figure 2, find the bearing of B from A. (3 marks)

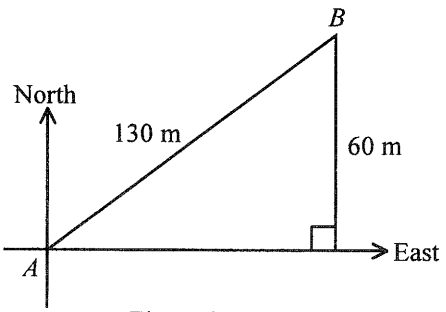

Figure 2

6. Factorize

(a) $a^2 - ab + 2a - 2b$,

(b) $169y^2 - 25$.

(4 marks)

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7. The prices of an orange and an apple are $ 2 and $ 3 respectively. A sum of $ 46 is spent buying some oranges and apples. If the total number of oranges and apples bought is 20, find the number of oranges bought. (4 marks)

8. A box contains nine cards numbered 1, 2, 3, 4, 5, 6, 7, 8 and 9 respectively.

(a) If one card is randomly drawn from the box, find the probability that the number drawn is odd.

(b) If two cards are randomly drawn from the box one by one with replacement, find the probability that the product of the numbers drawn is even.

(5 marks)

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9. In Figure 3, the area of the sector is $162\pi \text{ cm}^2$.

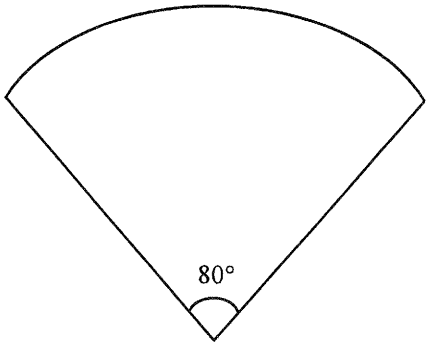

Figure 3

(a) Find the radius of the sector.

(b) Find the perimeter of the sector in terms of π.

(5 marks)

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Section A(2) (33 marks)
Answer ALL questions in this section and write your answers in the spaces provided.

10. It is known that y is the sum of two parts, one part varies as x and the other part varies as the square of x. When $x = 3$, $y = 3$ and when $x = 4$, $y = 12$.

(a) Express y in terms of x. (4 marks)

(b) If x is an integer and $y < 42$, find all possible value(s) of x. (4 marks)

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11. A large group of students sat in a Mathematics test consisting of two papers, Paper I and Paper II . The table below shows the mean, median, standard deviation and range of the test marks of these students in each paper:

Test paper	Mean	Median	Standard deviation	Range
Paper I	46.1 marks	46 marks	15.2 marks	91 marks
Paper II	60.3 marks	60 marks	11.6 marks	70 marks

A student, John, scored 54 marks in Paper I and 66 marks in Paper II .

(a) Assume that the marks in each paper of the Mathematics test are normally distributed. Relative to other students, did John perform better in Paper II than in Paper I ? Explain your answer. (4 marks)

(b) In a mark adjustment, the Mathematics teacher added 4 marks to the test mark of Paper I for each of these students. Write down the mean, the median and the range of the test marks of Paper I after the mark adjustment. (3 marks)

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12. In Figure 4, AEC, AFB, BCD and DEF are straight lines. $AB = AC$, $CD = CE$ and $\angle CDE = 36°$.

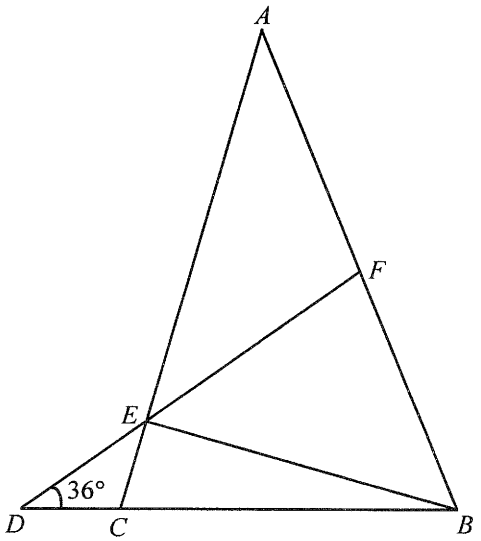

Figure 4

(a) Find

(i) $\angle AEF$,

(ii) $\angle BAC$.

(3 marks)

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(b) Suppose $AF = FB$.

(i) Prove that $\angle AEB$ is a right angle.

(ii) If $AE = 10$ cm, find the area of ΔABC.

(6 marks)

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13. In Figure 5 , $ABCD$ is a rhombus. The diagonals AC and BD cut at E .

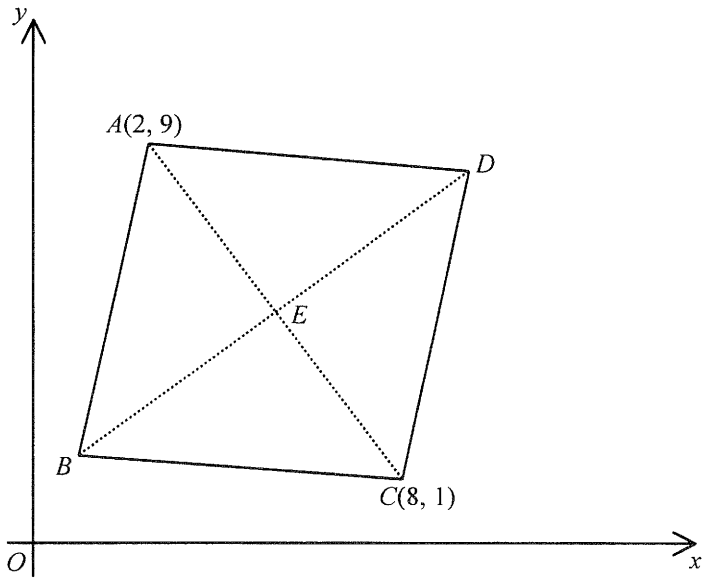

Figure 5

(a) Find

(i) the coordinates of E ,

(ii) the equation of BD .

(4 marks)

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(b) It is given that the equation of AD is $x+7y-65=0$. Find

(i) the equation of BC,

(ii) the length of AB.

(5 marks)

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SECTION B (33 marks)
Answer any THREE questions in this section and write your answers in the spaces provided.
Each question carries 11 marks.

14. In Figure 6 , a solid right circular cylinder of height h cm and volume $V\text{cm}^3$ is inscribed in a thin hollow sphere of radius 12 cm .

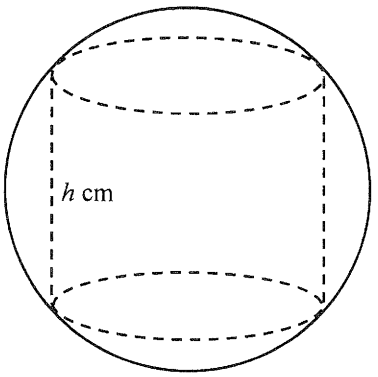

Figure 6

(a) Prove that $V = 144\pi h - \frac{\pi}{4}h^3$. (3 marks)

(b) Suppose $V = 600\pi$.

(i) Prove that there is a value of h lying between 4 and 5 .

(ii) Using the method of bisection, find h correct to 1 decimal place, where $4 < h < 5$. (4 marks)

(c) If the volume of the cylinder is 286π cm^3 , find the exact height(s) of the cylinder. (4 marks)

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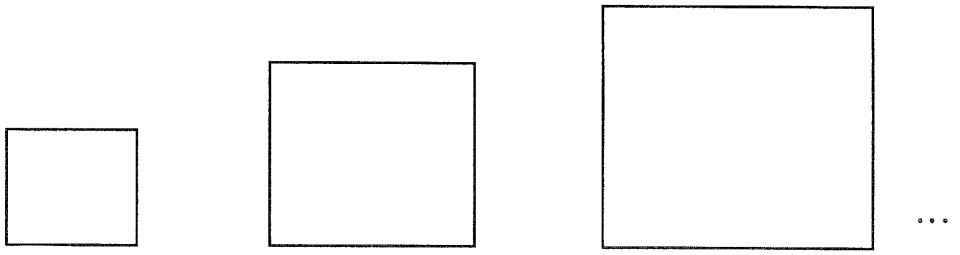
15. In Figure 7(a), F_1, F_2, F_3, ... are square frames. The perimeter of F_1 is 8 cm. Starting from F_2, the perimeter of each square frame is 4 cm longer than the perimeter of the previous frame.



F_1 F_2 F_3

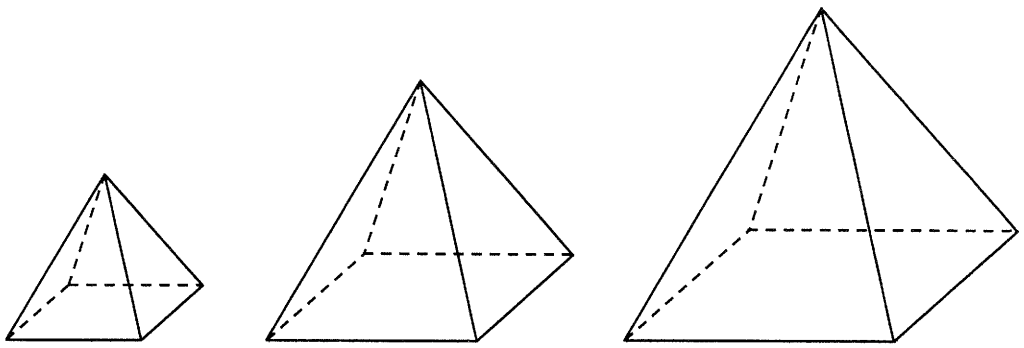
Figure 7(a)

(a) (i) Find the perimeter of F_{10}.

(ii) If a thin metal wire of length 1 000 cm is cut into pieces and these pieces are then bent to form the above square frames, find the greatest number of distinct square frames that can be formed.

(5 marks)

(b)



S_1 S_2 S_3

Figure 7(b)

Figure 7(b) shows three similar solid right pyramids S_1, S_2 and S_3. The total lengths of the four sides of the square bases of S_1, S_2 and S_3 are equal to the perimeters of F_1, F_2 and F_3 respectively.

(i) Do the volumes of S_1, S_2 and S_3 form a geometric sequence? Explain your answer.

(ii) When the length of the slant edge of S_1 is 5 cm, find the volume of S_3. Give the answer in surd form.

(6 marks)

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16. In Figure 8, BC is a tangent to the circle OAB with $BC // OA$. OA is produced to D such that $AD = OB$. BD cuts the circle at E.

(a) Prove that $\Delta ADE \cong \Delta BOE$. (3 marks)

(b) Prove that $\angle BEO = 2\angle BOE$. (3 marks)

(c) Suppose OE is a diameter of the circle $OAEB$.

(i) Find $\angle BOE$.

(ii) A rectangular coordinate system is introduced in Figure 8 so that the coordinates of O and B are $(0, 0)$ and $(6, 0)$ respectively. Find the equation of the circle $OAEB$. (5 marks)

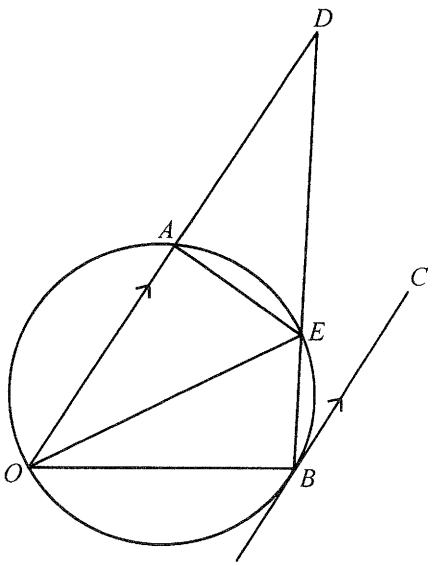

Figure 8

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17.

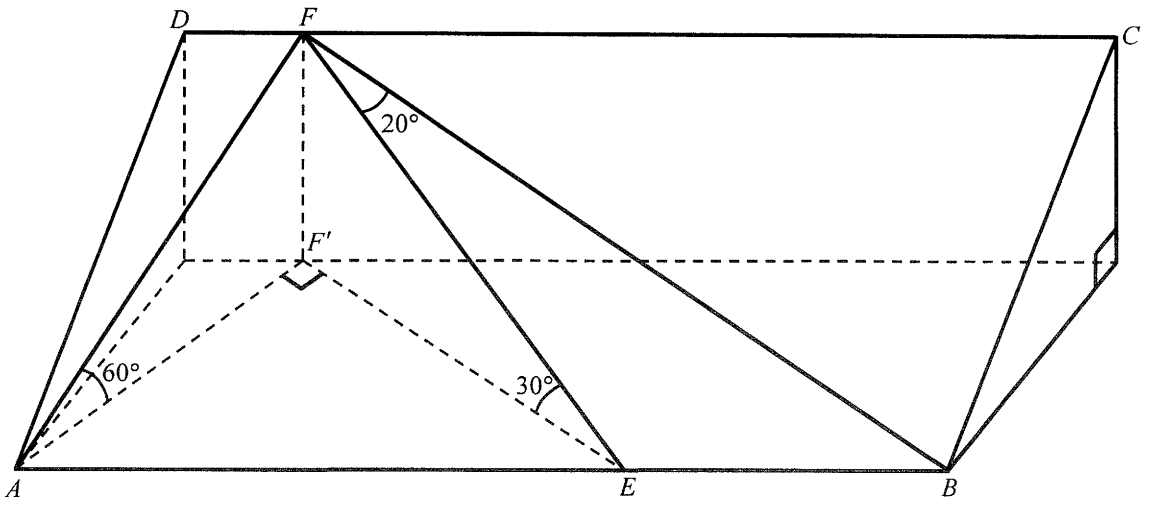

Figure 9

In Figure 9, $ABCD$ is a rectangular inclined plane. E and F are points on the straight lines AB and CD respectively. F' is vertically below F. A, E, B and F' are on the same horizontal ground. $\angle AF'E = 90°$, $\angle FAF' = 60°$, $\angle FEF' = 30°$, $\angle EFB = 20°$ and $EF = 20$ m.

(a) Find

(i) FF' and AE,

(ii) $\angle AEF$.

(7 marks)

(b) A small red toy car goes straight from E to B at an average speed of 2 m/s while a small yellow toy car goes straight from F to B at an average speed of 3 m/s. The two toy cars start going at the same time. Will the yellow toy car reach B before the red one? Explain your answer. (4 marks)

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