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Candidate Number								

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

MATHEMATICS Compulsory Part

PAPER 1 (Sample Paper)

Question-Answer Book

Time allowed: 2 hours 15 minutes

This paper must be answered in English.

INSTRUCTIONS

1. Write your Candidate Number in the space provided on Page 1.
2. Stick barcode labels in the spaces provided on Pages 1, 3, 5, 7 and 9.
3. This paper consists of THREE sections, A(1), A(2) and B. Each section carries 35 marks.
4. Attempt ALL questions in this paper. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.
5. Graph paper and supplementary answer sheets will be supplied on request. Write your Candidate Number, mark the question number box and stick a barcode label on each sheet, and fasten them with string INSIDE this book.
6. Unless otherwise specified, all working must be clearly shown.
7. Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.
8. The diagrams in this paper are not necessarily drawn to scale.

	Marker's Use Only	**Examiner's Use Only**
	Marker No.	Examiner No.
Question No.	Marks	Marks
1 – 2		
3 – 4		
5 – 6		
7 – 8		
9		
10		
11		
12		
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14		
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16		
17		
18		
19		
Total		

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SECTION A(1) (35 marks)

1. Simplify $\frac{(xy)^2}{x^{-5}y^6}$ and express your answer with positive indices. (3 marks)

2. Make b the subject of the formula $a(b+7)=a+b$. (3 marks)

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3. Factorize

(a) $3m^2 - mn - 2n^2$,

(b) $3m^2 - mn - 2n^2 - m + n$.

(3 marks)

4. The marked price of a handbag is $\$560$. It is given that the marked price of the handbag is 40% higher than the cost.

(a) Find the cost of the handbag.

(b) If the handbag is sold at $\$460$, find the percentage profit.

(4 marks)

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5. In a football league, each team gains 3 points for a win, 1 point for a draw and 0 point for a loss. The champion of the league plays 36 games and gains a total of 84 points. Given that the champion does not lose any games, find the number of games that the champion wins. (4 marks)

6. Figure 1 shows a solid consisting of a hemisphere of radius r cm joined to the bottom of a right circular cone of height 12 cm and base radius r cm. It is given that the volume of the circular cone is twice the volume of the hemisphere.

(a) Find r.

(b) Express the volume of the solid in terms of π.

(4 marks)

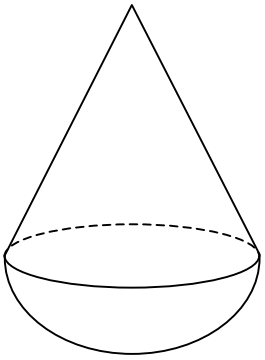

Figure 1

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7. In Figure 2, O is the centre of the semicircle $ABCD$. If $AB // OC$ and $\angle BAD = 38°$, find $\angle BDC$.
(4 marks)

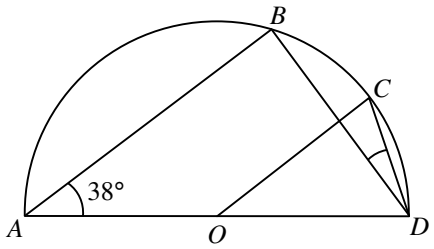

Figure 2

8. In Figure 3, the coordinates of the point A are $(-2, 5)$. A is rotated clockwise about the origin O through $90°$ to A'. A'' is the reflection image of A with respect to the y-axis.

(a) Write down the coordinates of A' and A''.

(b) Is OA'' perpendicular to AA'? Explain your answer.

(5 marks)

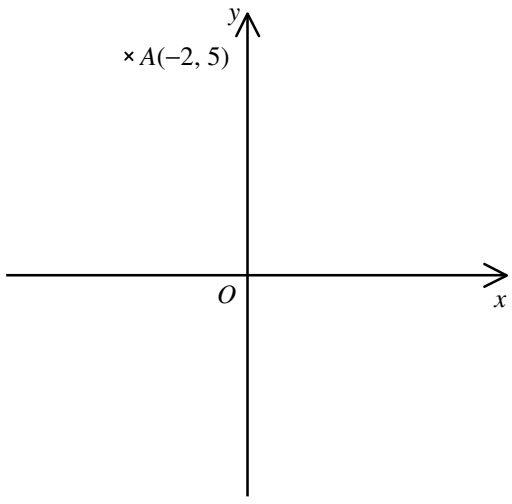

Figure 3

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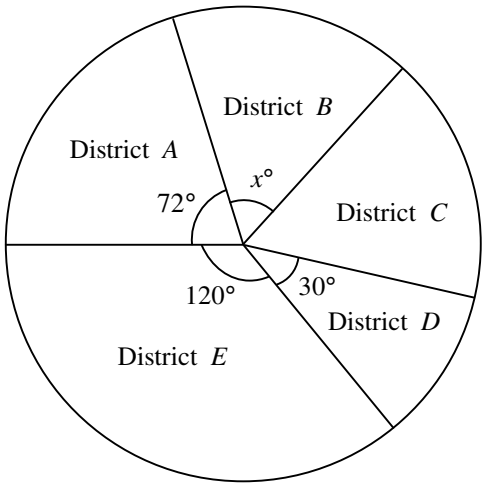
9. In Figure 4, the pie chart shows the distribution of the numbers of traffic accidents occurred in a city in a year. In that year, the number of traffic accidents occurred in District A is 20% greater than that in District B.



The distribution of the numbers of traffic accidents occurred in the city

Figure 4

(a) Find x.

(b) Is the number of traffic accidents occurred in District A greater than that in District C? Explain your answer.

(5 marks)

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Section A(2) (33 marks)

10. (a) Find the quotient when $5x^3 + 12x^2 - 9x - 7$ is divided by $x^2 + 2x - 3$. (2 marks)

(b) Let $g(x) = (5x^3 + 12x^2 - 9x - 7) - (ax + b)$, where a and b are constants. It is given that $g(x)$ is divisible by $x^2 + 2x - 3$.

(i) Write down the values of a and b.

(ii) Solve the equation $g(x) = 0$.

(4 marks)

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11. In a factory, the production cost of a carpet of perimeter s metres is $\$C$. It is given that C is a sum of two parts, one part varies as s and the other part varies as the square of s. When $s = 2$, $C = 356$; when $s = 5$, $C = 1\,250$.

(a) Find the production cost of a carpet of perimeter 6 metres. (4 marks)

(b) If the production cost of a carpet is $\$539$, find the perimeter of the carpet. (2 marks)

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12. Figure 5 shows the graph for John driving from town A to town D (via town B and town C) in a morning. The journey is divided into three parts: Part I (from A to B), Part II (from B to C) and Part III (from C to D).

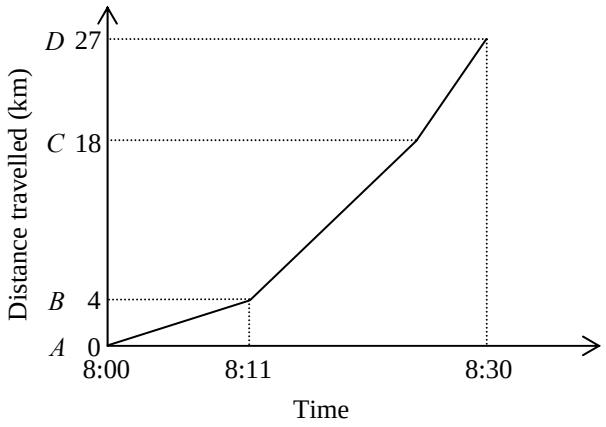

Figure 5

(a) For which part of the journey is the average speed the lowest? Explain your answer. (2 marks)

(b) If the average speed for Part II of the journey is 56 km/h , when is John at C ? (2 marks)

(c) Find the average speed for John driving from A to D in m/s . (3 marks)

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13. In Figure 6, the straight line $L_1: 4x-3y+12=0$ and the straight line L_2 are perpendicular to each other and intersect at A. It is given that L_1 cuts the y-axis at B and L_2 passes through the point $(4, 9)$.

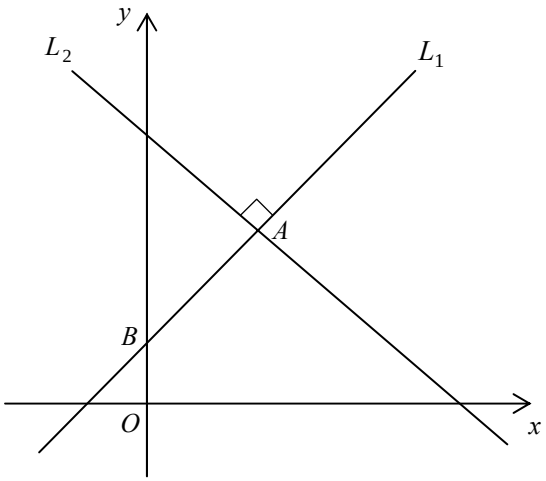

Figure 6

(a) Find the equation of L_2. (3 marks)

(b) Q is a moving point in the coordinate plane such that $AQ = BQ$. Denote the locus of Q by Γ.

(i) Describe the geometric relationship between Γ and L_2. Explain your answer.

(ii) Find the equation of Γ.

(6 marks)

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14. The data below show the percentages of customers who bought newspaper A from a magazine stall in city H for five days randomly selected in a certain week:

62% 63% 55% 62% 58%

(a) Find the median and the mean of the above data. (2 marks)

(b) Let a% and b% be the percentages of customers who bought newspaper A from the stall for the other two days in that week. The two percentages are combined with the above data to form a set of seven data.

(i) Write down the least possible value of the median of the combined set of seven data.

(ii) It is known that the median and the mean of the combined set of seven data are the same as that found in (a). Write down one pair of possible values of a and b.

(3 marks)

(c) The stall-keeper claims that since the median and the mean found in (a) exceed 50%, newspaper A has the largest market share among the newspapers in city H. Do you agree? Explain your answer. (2 marks)

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SECTION B (35 marks)

15. The seats in a theatre are numbered in numerical order from the first row to the last row, and from left to right, as shown in Figure 7. The first row has 12 seats. Each succeeding row has 3 more seats than the previous one. If the theatre cannot accommodate more than 930 seats, what is the greatest number of rows of seats in the theatre?

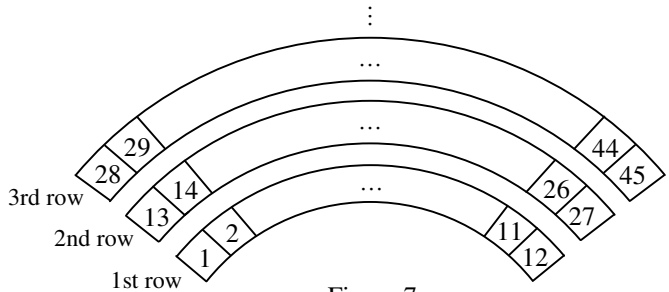

Figure 7

(4 marks)

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16. A committee consists of 5 teachers from school A and 4 teachers from school B. Four teachers are randomly selected from the committee.

(a) Find the probability that only 2 of the selected teachers are from school A. (3 marks)

(b) Find the probability that the numbers of selected teachers from school A and school B are different. (2 marks)

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17. A researcher defined Scale A and Scale B to represent the magnitude of an explosion as shown in t following table:

Scale	Formula
A	$M = \log_4 E$
B	$N = \log_8 E$

It is given that M and N are the magnitudes of an explosion on Scale A and Scale B respectively while E is the relative energy released by the explosion. If the magnitude of an explosion is 6.4 on Scale B, find the magnitude of the explosion on Scale A. (5 marks)

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18. In Figure 8(a), ABC is a triangular paper card. D is a point lying on AB such that CD perpendicular to AB. It is given that $AC = 20\text{ cm}$, $\angle CAD = 45°$ and $\angle CBD = 30°$.

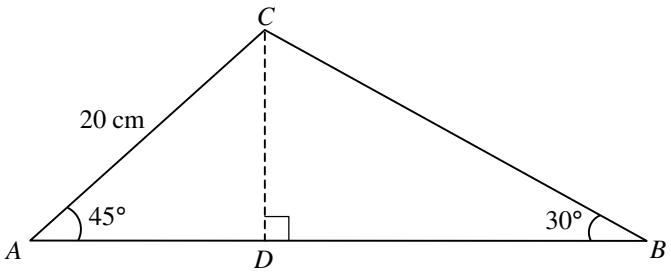

Figure 8(a)

(a) Find, in surd form, BC and BD. (3 marks)

(b) The triangular paper card in Figure 8(a) is folded along CD such that ΔACD lies on the horizontal plane as shown in Figure 8(b).

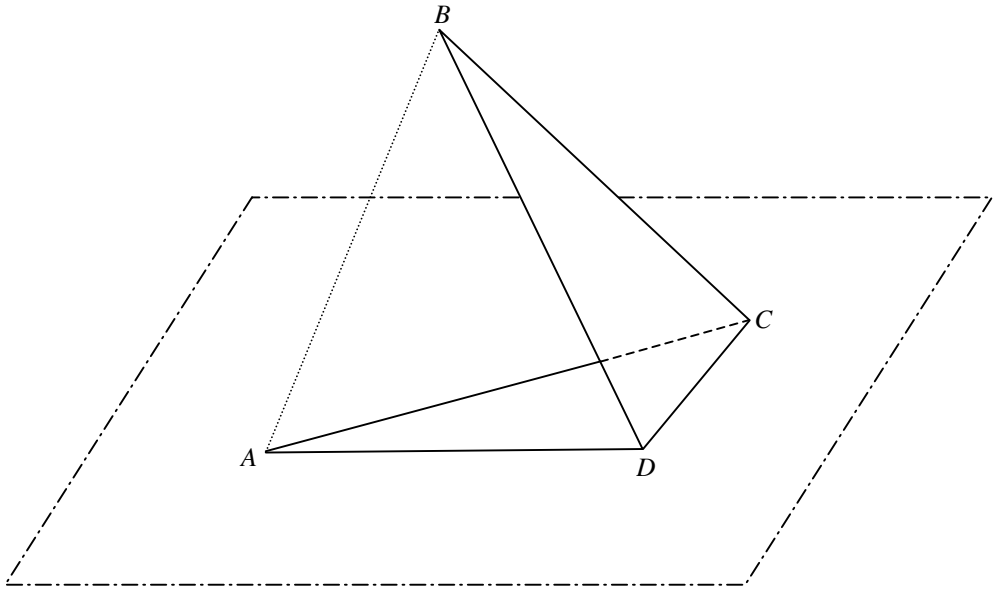

Figure 8(b)

(i) If the distance between A and B is 18 cm, find the angle between the plane BCD and the horizontal plane.

(ii) Describe how the volume of the tetrahedron $ABCD$ varies when $\angle ADB$ increases from $40°$ to $140°$. Explain your answer.

(5 marks)

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19. In Figure 9, the circle passes through four points A, B, C and D. PQ is the tangent to the circle at C and is parallel to BD. AC and BD intersect at E. It is given that $AB = AD$.

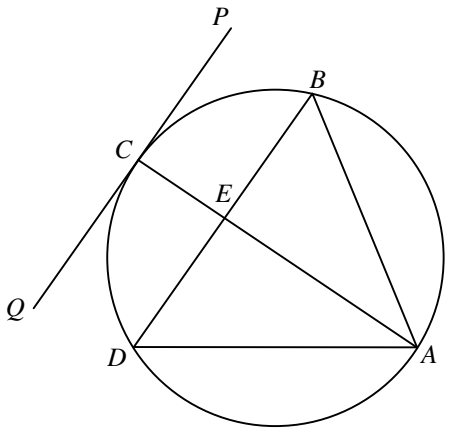

Figure 9

(a) (i) Prove that $\Delta ABE \cong \Delta ADE$.

(ii) Are the in-centre, the orthocentre, the centroid and the circumcentre of ΔABD collinear? Explain your answer.

(6 marks)

(b) A rectangular coordinate system is introduced in Figure 9 so that the coordinates of A, B and D are $(14, 4)$, $(8, 12)$ and $(4, 4)$ respectively. Find the equation of the tangent PQ. (7 marks)

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