

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2024

MATHEMATICS Compulsory Part PAPER 1

Question-Answer Book

8:30 am – 10:45 am (2¼ hours)
This paper must be answered in English

INSTRUCTIONS

- (1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5, 7, 9 and 11.
- (2) This paper consists of THREE sections, A(1), A(2) and B.
- (3) 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.
- (4) 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.
- (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.
- (8) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

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Candidate Number



	A(1) (35 marks)	
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3.	Facto	orize	
	(a)	$6r^2 - 13rs - 28s^2$,	
	(b)	$4r - 14s + 6r^2 - 13rs - 28s^2 .$	(3 marks)

	determination of		
)	E nntableaddeadaith		
4.	(a)	Find the range of values of x which satisfy both $\frac{5x+7}{4}-1<2x$ and $3x+9\geq 0$.	
	(b)	Write down the least integer satisfying both inequalities in (a).	(4 marks)

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Let a , b	and c be	non-zero	numbers st	ich that	5a = 6c	and	$\frac{2b+7c}{b+c}$	-=4.	rına	$\frac{5a+8b}{2b+3c}$	(4 marks)
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In a are	polar coordinate system, $O$ is the pole. The polar coordinates of the points $P$ , $Q$ and $R$ (11,59°), (60,149°) and (144,239°) respectively.
(a)	Find $\angle POQ$ .
(b)	Are $P$ , $O$ and $R$ collinear? Explain your answer.
(c)	Find the perimeter of $\Delta PQR$ .
	(4 marks)
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8. In Figure 1, E is the point of intersection of AC and BD. It is given that  $\angle ACB = \angle ADB = 90^{\circ}$  and AD = BC.

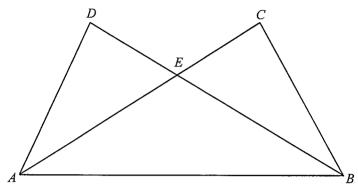


Figure 1

- (a) Prove that  $\triangle ABC \cong \triangle BAD$ .
- (b) If AD = 12 cm and DE = 9 cm, find the area of the pentagon ABCED.

(5 marks)

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9. The table below shows the distribution of the numbers of keys owned by a group of housewives.

Number of keys	3	4	5	6	7	8
Number of housewives	10	9	4	3	4	k

If a housewife is randomly selected from the group, then the probability that she owns more than 6 keys is  $\frac{5}{18}$ .

(a) Find k.

Answers written in the margins will not be marked.

(b) Write down the mean, the mode and the median of the distribution.

(5 marks)

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SECT	ΓΙΟΝ A(2) (35 marks)	
0.	It is given that $g(x)$ is partly constant and partly varies as $x$ . Suppose the and $g(7) = 9$ .	at $g(-3) = -21$
	(a) Find $g(x)$ .	(3 marks)
	(b) Let $h(x) = x g(x) + k$ , where k is a real constant. If all the roots of the equation real numbers, find the range of values of $k$ .	on $h(x) = 0$ are (3 marks)

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The	mean of the distribution is 30.
(a)	Find $a$ and $b$ . (3 m
(b)	Write down the least possible range of the distribution. (1 n
(c)	Find the greatest possible inter-quartile range of the distribution. (3 m
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the x-coordinate of B. A vertical line which passes through B cuts the straight line $y = mx$ at the point C such that $AB = BC$ , where m is a positive constant. Let D be a point such that $ABCD$ is a square. Express the slope of OD in terms of m. (3 marks)  (b) The coordinates of the points M and N are (6,5) and (10,0) respectively. Let P and Q be points lying on OM and MN respectively while R and S be points lying on the x-axis. If	12. Der	note the origin by $O$ .
<ul> <li>(3 marks)</li> <li>(b) The coordinates of the points M and N are (6,5) and (10,0) respectively. Let P and Q be points lying on OM and MN respectively while R and S be points lying on the x-axis. If</li> </ul>	(a)	A and B are points lying on the positive x-axis such that the x-coordinate of A is greater than the x-coordinate of B. A vertical line which passes through B cuts the straight line $y = mx$ at
be points lying on $OM$ and $MN$ respectively while $R$ and $S$ be points lying on the $x$ -axis. If		the point $C$ such that $AB = BC$ , where $m$ is a positive constant. Let $D$ be a point such that $ABCD$ is a square. Express the slope of $OD$ in terms of $m$ . (3 marks)
	(b)	The coordinates of the points $M$ and $N$ are $(6,5)$ and $(10,0)$ respectively. Let $P$ and $Q$ be points lying on $OM$ and $MN$ respectively while $R$ and $S$ be points lying on the $x$ -axis. If the quadrilateral $PQRS$ is a square, find the $x$ -coordinate of $P$ . $(4 \text{ marks})$
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The p	pase of a solid right pyramid is a square of side $64  \mathrm{cm}$ . The height of the pyramid is $24  \mathrm{cm}$ appraximal is divided into a frustum $X$ and a pyramid $Y$ by a plane which is parallel to its base. It is that the height of $Y$ is $18  \mathrm{cm}$ .
(a)	Find the volume of $X$ . (3 marks)
(b)	The base of another solid right pyramid is a square. This pyramid is divided into a frustum $Z$ and a pyramid by a plane which is parallel to its base. The height and the total surface area of $Z$ are 3 cm and 960 cm ² respectively. Are $X$ and $Z$ similar? Explain your answer. (4 marks)
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4.	Let is 40	$F(x) = (6x^2 + x + p)(qx^2 + rx - 10)$ , where p, q and r are constants. The constant term of $F(x)$ .
	(a)	Write down the value of $p$ . (1 mark)
	(b)	When $F(x)$ is divided by $x+1$ , the remainder is $-12$ . It is given that $x-2$ is a factor of $F(x)$ .
-		(i) Find $q$ and $r$ .
		(ii) How many irrational roots does the equation $F(x) = 0$ have? Explain your answer. (7 marks)
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TION B (35 ma	rks)	
It is given that	$\log_9 y$ is a linear function of $\log_3 x$. Denote the graph of the linear function by	, L
	is 4 and L passes through the point $(5,22)$. Express y in terms of x. (3 ms)	

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. In	a bag, there are 16 red cups and 4 white cups. If 5 cups are randomly drawn from the me time, find	bag at the
(a)) the probability that exactly 1 white cup is drawn;	(2 marks
(b)	the probability that at most 3 red cups are drawn.	(2 marks

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	17.	The	coordinates of the points Q and R are $(10,-1)$ and $(-4,-9)$ respectively.
		(a)	Let P be a moving point in the rectangular coordinate plane such that $PQ = PR$. Denote the locus of P by Γ .
			(i) Describe the geometric relationship between Γ and QR .
			(ii) Find the equation of Γ . (3 marks)
		(b)	Let C be the circle which passes through Q , R and the point $(4,3)$.
			(i) Find the equation of C .
			(ii) The coordinates of the point U are $(10,4)$. It is found that U lies outside C . UV and UW are the tangents to C at the points V and W respectively. Is the area of the circumcircle of ΔUVW greater than 100? Explain your answer. (5 marks)
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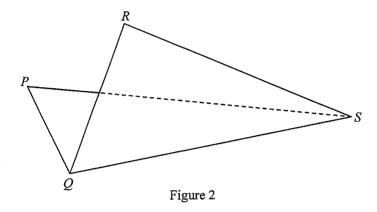
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- 18. (a) PQRS is a thin quadrilateral metal sheet, where $PQ=12~\rm cm$, $PS=10~\rm cm$, $QR=13~\rm cm$, $\angle QPS=82^{\circ}$ and $\angle QRS=65^{\circ}$. Find
 - (i) the length of QS,
 - (ii) $\angle RQS$.

(4 marks)

(b) The metal sheet PQRS described in (a) is now folded along QS (see Figure 2). It is given that the angle between the plane PQS and the plane QRS is 80° .



- (i) Find the shortest distance from R to the plane PQS.
- (ii) Let X be any point lying on the plane QRS. Someone claims that the distance between P and X exceeds 8 cm. Is the claim correct? Explain your answer.

(4 marks)

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	19.		$f(x) = 2x^2 + 4mx + 8x + 2m^2 + 8m + n$, where m and n are real constants such that $mn < 0$. te the vertex of the graph of $y = f(x)$ by P .
		(a)	Using the method of completing the square, express the coordinates of P in terms of m and n . (2 marks)
		(b)	Describe the geometric meaning represented by transforming $f(x)$ to $f\left(\frac{x}{5}\right) + 7$. (2 marks)
		(c)	Denote the vertex of the graph of $y = f\left(\frac{x}{5}\right) + 7$ by Q . Let (a_1, b_1) and (a_2, b_2) be the coordinates of P and Q respectively. It is given that $a_1, 1+n, a_2$ is an arithmetic sequence and $b_1, 4-m, b_2$ is a geometric sequence.
			(i) Find the coordinates of P and Q .
ırked.			(ii) The coordinates of the points R and S are $(3t+27,t)$ and $(3t+3,2t-3)$ respectively, where t is a real number. Is it possible that $PQRS$ is a rhombus? Explain your answer.
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