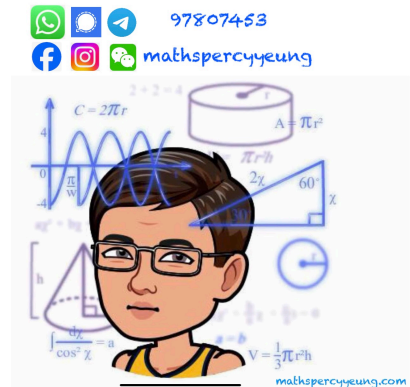


MSC F3 2024-25 Math E2 P1

2024-2025 Second Term Examination

F. 3 Mathematics

Paper 1



Time allowed : 1 hour 30 minutes

Full mark : 80

This question-answer book consists of 17 printed pages.

Instructions to candidates:

1. This paper must be answered in English with a blue / black ball pen, unless otherwise specified.
2. Write your name, class and class number in the spaces provided on this cover.
3. This paper consists of TWO sections, A and B.
Section A carries 40 marks and Section B carries 40 marks.
4. Answer 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. All diagrams / graphs / charts as part of the answers must be clearly drawn with an HB pencil.
6. Graph paper and supplementary answer sheets will be supplied on request. Write your name, class and class number on each sheet, and fasten them INSIDE this book.
7. Unless otherwise specified, all working must be clearly shown.
8. The diagrams in this paper are not necessarily drawn to scale.
9. Unless otherwise specified, numerical answers must be exact or correct to 3 significant figures.
10. Calculator pad printed with the “HKEA Approved” / “HKEAA Approved” label is allowed.
Remove the calculator cover / jacket.

Section A (40 marks)

1. Simplify $\frac{(m^4 n^{-5})^3}{mn^2}$ and express your answer with positive indices. (3 marks)

2. Factorize

(a) $x^2 + 2xy - 3y^2$,

(b) $x^2 + 2xy - 3y^2 - 4x + 4y$.

(3 marks)

3. (a) Solve the inequality $\frac{6x+1}{2} + 8 > x$.

(b) Write down the least integer satisfying the inequality in (a).

(3 marks)

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4. A sum of \$40 000 is deposited at an interest rate of 3% per annum for 5 years, compounded half-yearly.
Find the interest obtained correct to the nearest dollar. (3 marks)

5. (a) Simplify $\frac{1 - \sin^2(90^\circ - \theta)}{\tan \theta} [\tan^2(90^\circ - \theta) + 1]$.

(b) Hence, solve $\frac{1 - \sin^2(90^\circ - \theta)}{\tan \theta} [\tan^2(90^\circ - \theta) + 1] = 2 \cos 30^\circ$ without using a calculator.

(5 marks)

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6. The table below shows the distribution of the numbers of books borrowed by a group of students

Number of books borrowed	3	4	5	6	7	8
Number of students	10	9	4	3	4	k

If a student is randomly selected from the group, then the probability that the student borrowed more than 6 books is $\frac{5}{18}$.

- (a) Find the value of k .
(b) Write down the mean, the median and the mode of the distribution.

(5 marks)

7. The following table shows the ratings of a gym room in five aspects. It is given that the weighted mean rating of the gym room is 11.5.

	Cleanliness	Facility	Location	Price	Service
Rating	11	12	8	16	10
Weight	5	r	1	2	4

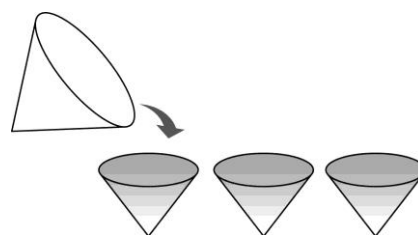
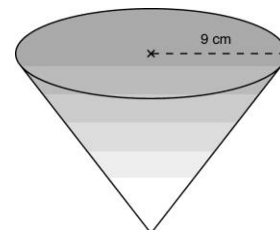
- (a) Find the value of r .
- (b) According to the above information, which aspect is the most important?

(3 marks)

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8. The base radius of a right conical vessel is 9 cm. The curved surface area of the vessel is $135\pi \text{ cm}^2$. The vessel is fully filled with water.
- (a) Find the height of the vessel.
- (b) The water in the vessel is poured into three identical paper cups which are similar in shape as the vessel. If the water just fills up the three cups without overflow, find the base radius of the paper cup. (Give your answer to 3 significant figure.) (5 marks)



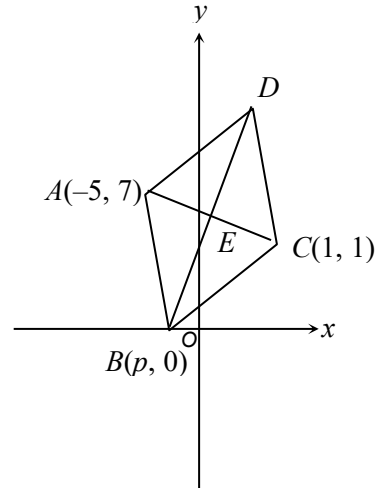
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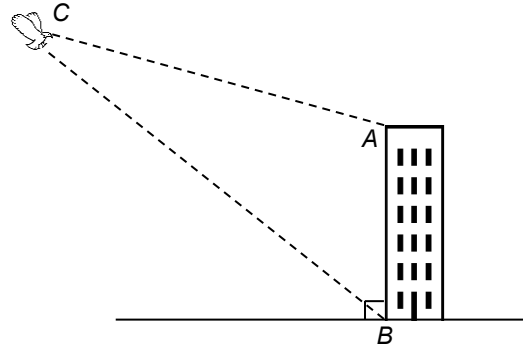
9. $ABCD$ is a rhombus. The diagonals AC and BD intersect at E . B lies on the x -axis. The coordinates of A and C are $(-5, 7)$ and $(1, 1)$ respectively.

- (a) Find the coordinates of E .
- (b) Hence, find the coordinates of B .

(4 marks)



10. A tower AB with 80 m high standing on a horizontal ground. The angles of depression of the top A and the bottom B of the tower from an airship C are 12° and 26° respectively. Find the height of the airship C above the ground correct to 3 significant figures. (6 marks)



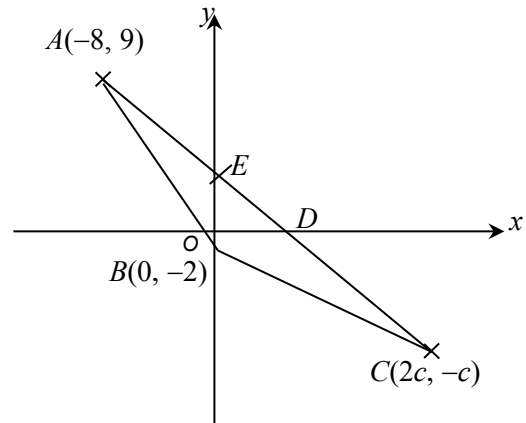
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Section B (40 marks)

11. The coordinates of the points A , B and C are $(-8, 9)$, $(0, -2)$ and $(2c, -c)$ respectively, where c is a positive integer. AC cuts the x -axis and y -axis at D and E respectively such that $AE : ED = 2 : 1$.

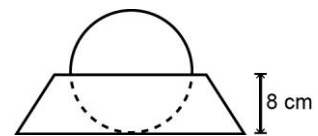
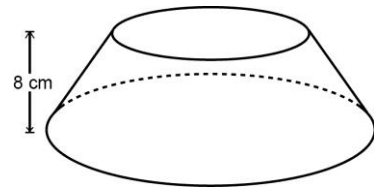
- (a) Find the coordinates of E . (2 marks)
- (b) Find the value of c . (2 marks)
- (c) Find the ratio $AD : DC$. (2 marks)
- (d) Find the shortest distance between the point B and the line AC . (4 marks)



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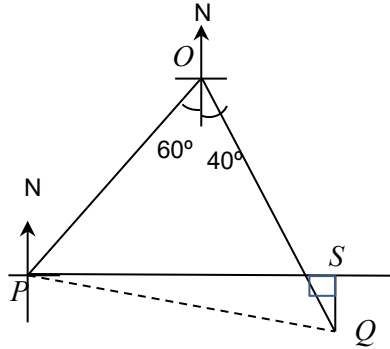
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12. (a) A container of height 8 cm which is in the shape of a frustum. The container is made by cutting off a right circular cone with a base radius 12 cm from a hollow circular cone with a base radius 18 cm. The container is fully filled with water. Find the volume of the water in the container in terms of π . (3 marks)
- (b) A solid sphere is placed in the container and the water inside overflows. It is known that the radius of the sphere is equal to the height of the container.
- (i) Find the volume of the sphere.
- (ii) Alvin claims that the ratio of the volume of the water remaining in the container to the volume of the water flowing out is greater than 2 : 1. Do you agree? Explain your answer. (7 marks)



13. Car A and car B leave town O at noon. Car A travels in the direction $S60^\circ W$ at a speed of 40 km/h, while car B travels in the direction $S40^\circ E$ at the same speed. At $1:15$ pm, car A and car B reach points P and Q respectively.

- (a) Find the distance between the two cars. (4 marks)
- (b) Find the true bearing of car B from car A at $1:15$ pm. (1 marks)
- (c) After $1:15$ pm, car A travels due east from P while car B stops at Q .
When will the car A be the closest to car B ? (5 marks)



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14. A box contains 3 red balls, 2 blue balls and 1 green ball. In a lucky draw, a participant draws a ball randomly from the box and a gift will be given according to the table below:

Colour of the ball drawn	Value of the gift given
Red (R)	\$5
Blue (B)	\$20
Green (G)	\$50

- (a) (i) Find the probabilities of drawing a green ball, a blue ball and a red ball.
(ii) Find the expected value of the gift given in one draw. (4 marks)
- (b) If the lucky draw is changed, two balls are randomly drawn without replacement. The value of the new gift given will be the sum of the values given according to the colours of the balls drawn.
(i) Find the probabilities of getting two red balls and two blue balls.
(ii) Find the expected value of the gift given in the lucky draw.
(Give your answer to 1 decimal place.) (6 marks)

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End of Paper

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