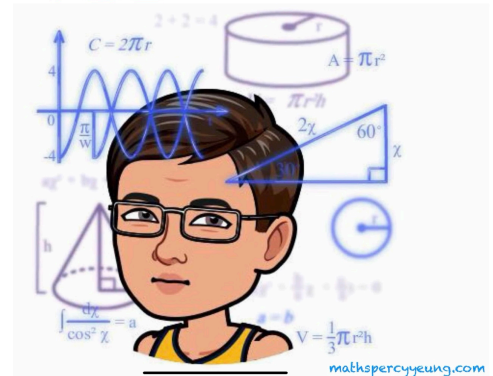


MSC F3 2022-23 Math E2 P2 QP

2022-2023 Second Term Examination

F. 3 Mathematics

Paper 2



Time allowed : 50 minutes

Full mark : 30

This question book consists of 8 printed pages.

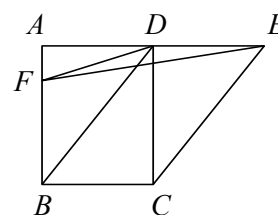
Instructions to candidates:

1. Write your name, class and class number in the space provided on this cover.
2. This paper consists of 30 multiple-choice questions. All questions carry equal marks.
3. Answer ALL questions. Mark your answers on the MC Answer Sheet provided with an HB pencil.
4. Choose the best answer for each question.
5. Read carefully the instructions on the MC Answer Sheet and insert the information required in the spaces provided.
6. When told to check the question paper, you should check that all the questions are there. Look for the words 'End of Paper' after the last question.
7. You should mark only ONE answer for each question. If you mark more than one answer, you will receive NO MARKS for that question.
8. No marks will be deducted for wrong answers.
9. The diagrams in this paper are not necessarily drawn to scale.
10. Calculator pad printed with the "HKEA Approved" / "HKEAA Approved" label is allowed. Remove the calculator cover / jacket.

- $2a^2 + ab - b^2 + 6a - 3b =$
 - $(2a - b)(a + b + 3)$.
 - $(2a - b)(a + b - 3)$.
 - $(a + b)(2a - b + 3)$.
 - $(a + b)(2a - b - 3)$.
- The greatest integer satisfying the inequality $2(x - 3) < \frac{-3x - 2}{4}$ is
 - 0.
 - 1.
 - 2.
 - 2.
- If the price of a souvenir is increased by 70% and then decreased by 60%, find the overall percentage change in the price of the souvenir.
 - 58%
 - 32%
 - 2%
 - 10%
- A sum of money is deposited in a bank at an interest rate of 10% p.a. compounded yearly. If the interest for the first year is \$500, find the interest to be obtained in the second year.
 - \$500
 - \$525
 - \$550
 - \$1050

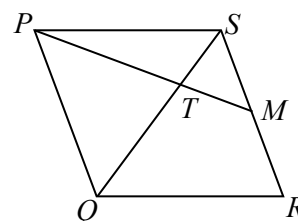
- In the figure, $ABCD$ is a rectangle and $BCED$ is a parallelogram. ADE is a straight line. F is a point lying on AB such that $AF : FB = 1 : 3$. If the area of $\triangle DEF$ is 15 cm^2 , find the area of $ABCD$.

- 45 cm^2
- 60 cm^2
- 90 cm^2
- 120 cm^2



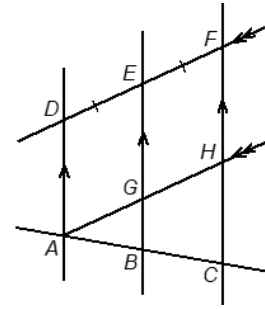
- In the figure, $PQRS$ is a parallelogram. M is the mid-point of RS . PM and QS intersect at point T . If the area of $\triangle PQT$ is 24 cm^2 , then the area of quadrilateral $MTQR$ is

- 24 cm^2 .
- 30 cm^2 .
- 36 cm^2 .
- 48 cm^2 .



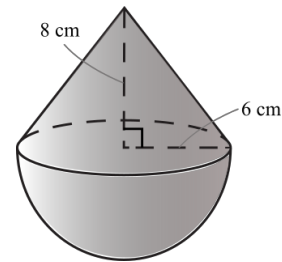
7. In the figure, ABC , AGH , DEF , BGE and CHF are straight lines. It is given that $AD \parallel BE \parallel CF$, $AH \parallel DF$ and $DE = EF$, $EG = 2x$, $GB = x + 1$. Express the length of CF in terms of x .

- A. $4x + 1$
 B. $4x + 2$
 C. $6x + 1$
 D. $6x + 2$



8. The figure shows a solid formed by a right circular cone and a hemisphere with a common base. The radius of the hemisphere is 6 cm and the height of the circular cone is 8 cm. Find the total surface area of the solid.

- A. $132\pi \text{ cm}^2$
 B. $168\pi \text{ cm}^2$
 C. $204\pi \text{ cm}^2$
 D. $240\pi \text{ cm}^2$

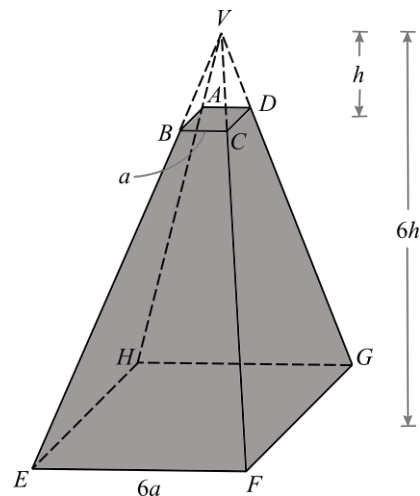


9. A copper sphere of surface area 598 cm^2 is melted and recast into three smaller spheres, where the ratio of their radii is $1 : 3 : 4$. Find the surface area of the smallest sphere among them. (Give your answer correct to 3 significant figures if necessary.)

- A. 6.5 cm^2
 B. 23 cm^2
 C. 29.3 cm^2
 D. 68.1 cm^2

10. In the figure, the frustum is formed by cutting away $VABCD$ from the regular pyramid $VEFGH$. The upper base $ABCD$ and lower base $EFGH$ are squares of sides a and $6a$ respectively. If the heights of pyramids $VEFGH$ and $VABCD$ are $6h$ and h respectively, find $\frac{\text{Volume of the frustum}}{\text{Volume of pyramid } V EFGH}$.

- A. $\frac{1}{64}$
 B. $\frac{7}{8}$
 C. $\frac{63}{64}$
 D. $\frac{215}{216}$



11. Three points $D(-5, -3)$, $E(12, -2)$ and $F(6, -4)$ are given. If the straight line passing through D and perpendicular to EF cuts the y -axis at T , find the coordinates of T .

- A. $(0, -18)$
- B. $(0, -12)$
- C. $(0, 3)$
- D. $(0, 9)$

12. It is given two points $A(6, a)$ and $B(-2, a)$, where $a > 0$. If $OA = \sqrt{5}OB$, find the value of a .

- A. 0
- B. 1
- C. 2
- D. 3

13. Three points $A(8, -1)$, $B(-8, 15)$ and $C(-10, -3)$ are given. M is the mid-point of AB . Which of the following are true?

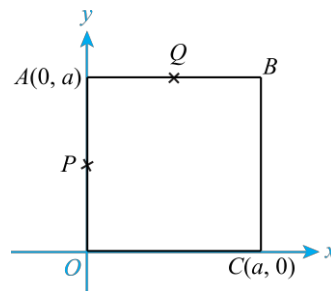
- I. M lies on the y -axis.
- II. $AB \perp CM$
- III. $\triangle ACM$ is an isosceles triangle.

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

14. In the figure, $OABC$ is a square. P and Q are the mid-points of OA and AB respectively. Which of the following must be true?

- I. $OQ \perp PC$
- II. $OQ = PC$
- III. $\triangle OCQ$ is an equilateral triangle.

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III



15. If x and y are acute angles such that $x + y = 90^\circ$, which of the following must be true?

- I. $\sin x = \cos y$
- II. $\tan x \tan y = 1$
- III. $\sin^2(90^\circ - x) = 1 - \cos^2 y \tan^2 y$

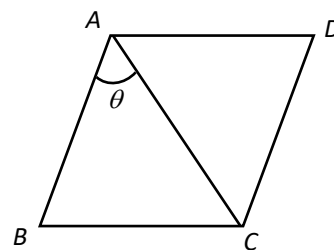
- A. I only
- B. I and II only
- C. II and III only
- D. I, II and III only

16. If $\tan \theta = \frac{x}{y}$ and $0^\circ < \theta < 90^\circ$, then $(\sin \theta - \cos \theta)^2 =$

- A. $\frac{x-y}{x+y}$.
- B. $\frac{1-2xy}{x^2+y^2}$.
- C. $\frac{(x-y)^2}{x^2+y^2}$.
- D. $\frac{x^2-y^2}{x^2+y^2}$.

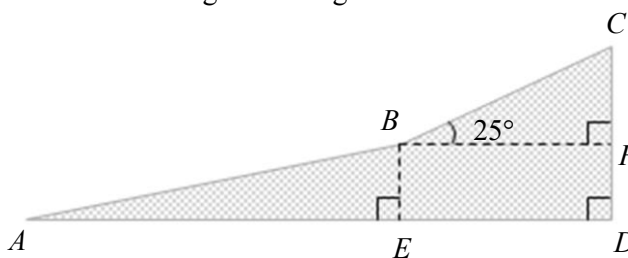
17. In the figure, $ABCD$ is a rhombus and AC is its diagonal. If $\angle BAC = \theta$, then $\frac{AD}{AC} =$

- A. $\frac{1}{\cos \theta}$.
- B. $\frac{1}{\sin \theta}$.
- C. $\frac{1}{2\cos \theta}$.
- D. $\frac{1}{2\sin \theta}$.



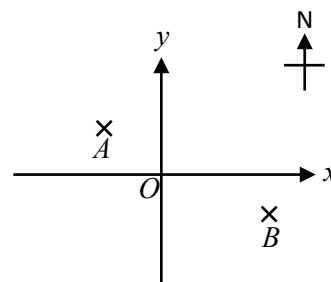
18. The figure shows a hillside. If the gradient of AB is $1 : 5$, $AB = 255$ m, $BC = 155$ m, $\angle CBF = 25^\circ$, find the vertical distance between A and C correct to 3 significant figures.

- A. 116 m
- B. 123 m
- C. 316 m
- D. 391 m



19. In the figure, $A(-200, 150)$ and $B(400, -120)$ are two points on a map with rectangular coordinate plane, where O is the origin, introduced. Find the true bearing of B from A correct to the nearest degree.

- A. 099°
- B. 114°
- C. 171°
- D. 294°

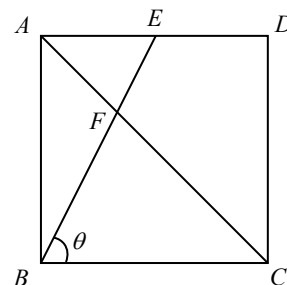


20. The angle of elevation of M from N is 76° . If M is located at a level of 20 cm above N , the distance between M and N is
- $20\sin 76^\circ$ cm.
 - $\frac{20}{\tan 14^\circ}$ cm.
 - $\frac{20}{\sin 14^\circ}$ cm.
 - $\frac{20}{\cos 14^\circ}$ cm.

21. $A(2, 8)$ and $B(6, 2)$ are two points. They formed a triangle with the origin O . Find the coordinates of the centroid G of $\triangle OAB$.

- $\left(\frac{3}{2}, \frac{1}{2}\right)$
- $\left(\frac{10}{3}, \frac{8}{3}\right)$
- $\left(2, \frac{5}{2}\right)$
- $\left(\frac{8}{3}, \frac{10}{3}\right)$

22. In the figure, $ABCD$ is a square. E is a point lying on AD . AC and BE intersect at point F . Denote $\angle CBF$ by θ . Find $AE : ED$.



- $1 : (\tan \theta - 1)$
- $1 : (\tan \theta + 1)$
- $1 : \left(1 - \frac{1}{\tan \theta}\right)$
- $1 : \left(1 + \frac{1}{\tan \theta}\right)$

23. The mean price of 15 kiwi fruits is \$16.8 and the mean price of some mangoes is \$17.6. If the mean price of all these fruits is \$17.1, find the number of mangoes.

- 3
- 6
- 9
- 12

24. The following table shows the number of days of absence for a group of students in a year. If the mean number of days of absence for the students is 1.6, find the median number of days of absence for the students.

Number of days of absence	0	1	2	3	4
Frequency	15	10	x	8	6

- A. 1
 B. 1.5
 C. 2
 D. 2.5
25. Consider the following data:
 13 1 5 4 1 3 12 a b c
 If the mean and the mode of the above data are 7 and 12 respectively, then the median of the above data is
- A. 5.
 B. 6.
 C. 7.
 D. 8.
26. The mode of a set of data is 24. If k is added to each datum, the mode of the data will increase by 62.5%. Find the value of k .
- A. 9
 B. 15
 C. 24
 D. 39
27. The table shows the consumption indices of four items in a city in 2020 and 2021. If the living index of the city is the weighted mean of these consumption indices, find the percentage increase in the living index of the city from 2020 to 2021 correct to 3 significant figures.

	2020	2021	Weight
Clothing	101	108	1
Food	120	125	3
Housing	130	140	4
Transportation	112	110	2

- A. 4.14%
 B. 4.32%
 C. 4.59%
 D. 4.81%

28. A number is randomly chosen among all integers from 1 to 50 inclusive. Find the probability that at least one of the digits of the chosen number is 3.

- A. $\frac{1}{10}$
- B. $\frac{3}{25}$
- C. $\frac{13}{50}$
- D. $\frac{7}{25}$

29. The following table shows the heights of a number of members randomly chosen from a fitness centre.

Height (cm)	151 - 155	156 - 160	161 - 165	166 - 170	171 - 175	176 - 180
Frequency	11	17	16	22	8	6

If a member is chosen at random from the fitness centre, estimate the probability that the height of the chosen member is 160.5 cm or above but below 170.5 cm.

- A. $\frac{5}{16}$
- B. $\frac{19}{40}$
- C. $\frac{23}{40}$
- D. $\frac{11}{16}$

30. There are 3 cards numbered 2, 5 and 9 in box M , and 3 cards numbered 4, 6 and 7 in box N . If a card is drawn at random from each box, find the probability that the sum of the two numbers on the card drawn is divisible by 2.

- A. $\frac{1}{3}$
- B. $\frac{4}{9}$
- C. $\frac{5}{9}$
- D. $\frac{2}{3}$

End of Paper