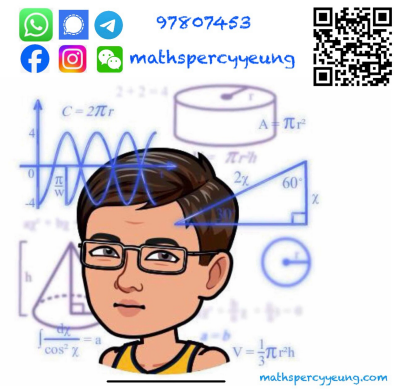
**2023-2024 S6**
**MOCK EXAM**
**MATH CP**
**PAPER 2**
MC




2023 – 2024
S6 Mock Examination

# MATHEMATICS Compulsory Part

# PAPER 2

23rd January, 2024
11:00 am – 12:15 pm (1 hour 15 minutes)
Total Marks: 45

## INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should insert the information required in the spaces provided.

2. When told to open this book, you should check that all the questions are there. Look for the words '**END OF PAPER**' after the last question.

3. All questions carry equal marks.

4. **ANSWER ALL QUESTIONS**. You should use an HB pencil to mark all your answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.

5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.

6. No marks will be deducted for wrong answers.

**There are 30 questions in Section A and 15 questions in Section B.**
**The diagrams in this paper are not necessarily drawn to scale.**
**Choose the best answer for each question.**

**Section A**

1. If $\frac{a-b}{ab}=1$, then $b=$

   A. $\frac{a}{a+1}$.

   B. $\frac{a}{1-a}$.

   C. $\frac{a}{a-1}$.

   D. $\frac{a+1}{a}$.

2. $(4^{n+1}\cdot 8^{2n})^2=$

   A. $2^{8n+1}$.
   B. $2^{8n+2}$.
   C. $2^{16n+4}$.
   D. $2^{16n+6}$.

3. $10ab-cd+5bc-2ad=$

   A. $(2a+c)(b-5d)$.
   B. $(2a-c)(5b-d)$.
   C. $(2a-c)(b-5d)$.
   D. $(2a+c)(5b-d)$.

4. $0.03578624=$

   A. 0.035 (corr. to 3 decimal places).
   B. 0.0358 (corr. to 4 significant figures).
   C. 0.03579 (corr. to 5 decimal places).
   D. 0.035786 (corr. to 6 significant figures).

5. If $x$ is an integer satisfying $2(1-x)>6x$ and $x\le\frac{4x+1}{-2}$, then the greatest value of $x$ is

   A. 1.
   B. $-\frac{1}{6}$.
   C. $-1$.
   D. $-2$.

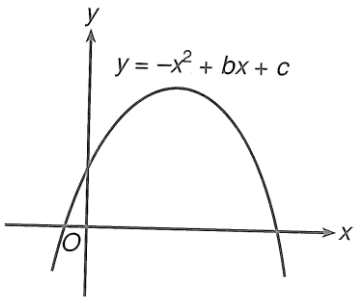
6. If $f(x)=1-x^2$, then $f(x+1)-f(x)=$

   A. 1.
   B. $x^2+1$.
   C. $x+2$.
   D. $-(2x+1)$.

7. Let $a$ and $b$ be constants. Given that $x^2+a(x-3)+b\equiv(x-3)(x+4)+1$, then $b=$

   A. 1.
   B. –4.
   C. –8.
   D. –11.

8. The figure shows the graph of $y = -x^2 + bx + c$. Which of the following is true?




A. $b < 0$ and $c < 0$

B. $b < 0$ and $c > 0$

C. $b > 0$ and $c < 0$

D. $b > 0$ and $c > 0$

9. When $8x^3 + kx^2 - 2x + 7$ is divided by $x - 2$ and $2x - 1$ respectively, the remainders are the same. Find $k$.

A. $-16$

B. $-4$

C. 12

D. 16

10. If $z$ varies directly as the square of $x$ and directly as $y$, which of the following must be a constant?

A. $\dfrac{x^2 y}{z}$

B. $\dfrac{x^2}{yz}$

C. $(x^2 + y)z$

D. $\dfrac{x^2 + y}{z}$

11. If $x$, $y$ and $z$ are non-zero numbers such that $\dfrac{x}{y} = \dfrac{3}{4}$ and $\dfrac{2y}{z} = \dfrac{5}{3}$, then $\dfrac{x + y}{y + z} =$

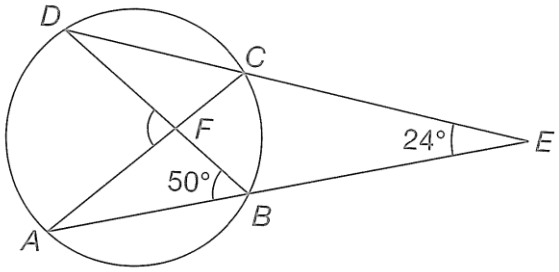
A. 7 : 44.

B. 7 : 432.

C. 35 : 44.

D. 35 : 132.

12. In the figure, $A$, $B$, $C$ and $D$ are points on the circle, $ABE$, $DCE$, $AFC$ and $BFD$ are straight lines. If $\angle ABD = 50°$ and $\angle AEC = 24°$, find $\angle AFD$.




A. 74°

B. 76°

C. 82°

D. 98°

13. The scale of a map is 1 : 30000. If the actual area of a playground is $9000\,\text{m}^2$, find its area on the map.

A. $0.1\ \text{cm}^2$

B. $10\ \text{cm}^2$

C. $30\ \text{cm}^2$

D. $0.3\ \text{m}^2$

14. It is given that $z$ varies directly as $x$ and inversely as $y^2$. If $x$ decreases by 28% and $y$ decreases by 20%, then $z$

A. decreases by 10%.
B. decreases by 12.5%.
C. increases by 10%.
D. increases by 12.5%.

15. A sum of \$13 000 is borrowed from a bank at an interest rate of 12% p.a. compounded monthly. Find the interest to be paid after 5 years.

A. \$7 800
B. \$9 910 (corr. to the nearest dollar)
C. \$10 617 (corr. to the nearest dollar)
D. \$23 617 (corr. to the nearest dollar)

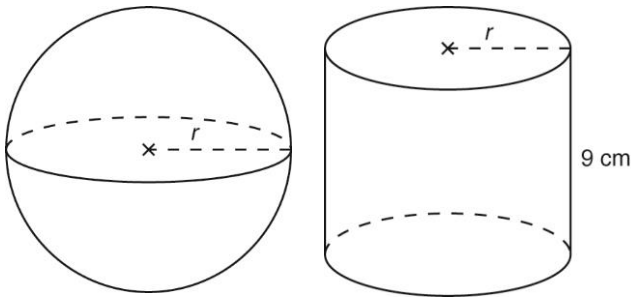
16. For $0° \le x < 360°$, the maximum value of $y = 4\sin 2x - 1$ is

A. –5.
B. 3.
C. 5.
D. 7.

17. A circle $C$ touches the $y$-axis. If the coordinates of the centre of $C$ are (–3, 4), then the equation of $C$ is

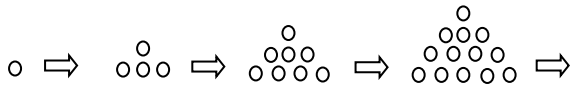
A. $(x + 3)^2 + (y - 4)^2 = 16$.
B. $(x - 3)^2 + (y + 4)^2 = 16$.
C. $(x - 3)^2 + (y + 4)^2 = 9$.
D. $(x + 3)^2 + (y - 4)^2 = 9$.

18. The figure shows a sphere and a cylinder with the dimensions as shown. It is given that their total surface areas are equal. Find the volume of the sphere.



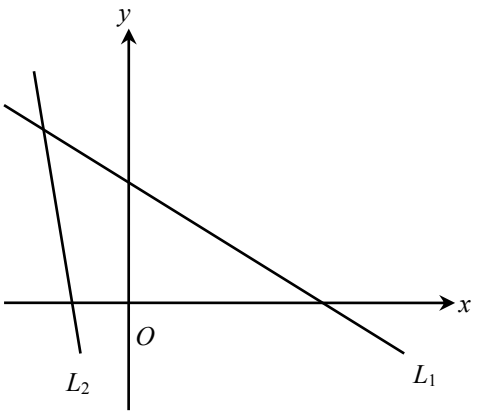

A. $108\pi$ cm$^3$
B. $324\pi$ cm$^3$
C. $486\pi$ cm$^3$
D. $972\pi$ cm$^3$

19. In the figure, the 1st pattern consists of 1 dot. For any positive integer $n$, the $(n+1)^{\text{th}}$ pattern is formed by adding $(n + 2)$ dots to the $n^{\text{th}}$ pattern. Find the number of dots in the 8th pattern.



A. 34
B. 43
C. 53
D. 64

20. In the figure, the equations of the straight lines $L_1$ and $L_2$ are $ax+y+b=0$ and $cx+y+d=0$ respectively. Which of the following are true?




I. $c>0$

II. $a<c$

III. $b<d$

IV. $ad<bc$

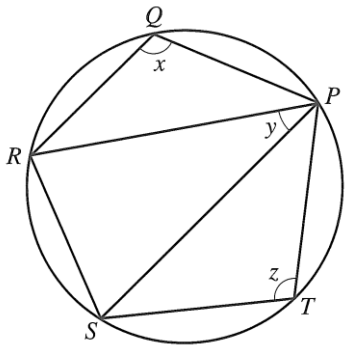
A. I, II and III only

B. I, II and IV only

C. I, III and IV only

D. II, III and IV only

21. In the figure, *PQRST* is a pentagon inscribed in the circle. Which of the following must be true?



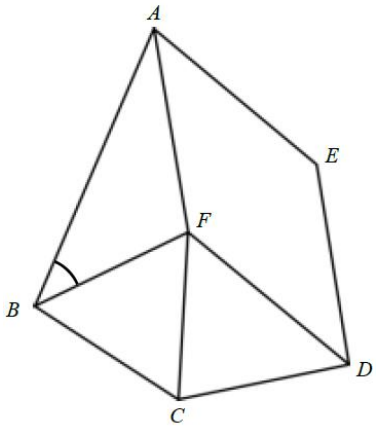

A. $y=x-z$

B. $x=z$

C. $x+y+z=180°$

D. $x-y+z=180°$

22. In the figure, *AFDE* is a parallelogram, *BCF* is an equilateral triangle and *CDF* is an isosceles triangle with *CF* = *CD*. If $\angle DCF=74°$, $\angle EDF=40°$ and $\angle BAF=30°$, then $\angle ABF=$




A. 27°.

B. 33°.

C. 43°.

D. 47°.

23. The equations of the straight lines $L_1$ and $L_2$ are $x+2y=0$ and $2x-y=0$ respectively. If *P* is a moving point in the rectangular coordinate plane such that the perpendicular distance from *P* to $L_1$ is equal to the perpendicular distance from *P* to $L_2$, then the locus of *P* is a

A. pair of parallel lines.
B. pair of perpendicular lines.
C. straight line.
D. circle.

24. The rectangular coordinates of the point $P$ are $(2,-2\sqrt{3})$. If $P$ is rotated anticlockwise about the origin through $90°$, then the polar coordinates of its image are

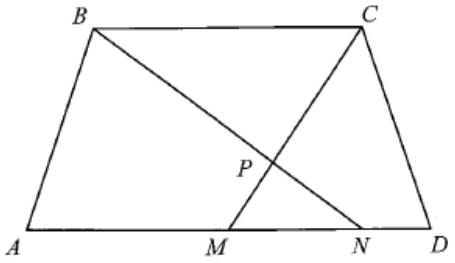
A. $(2,30°)$.

B. $(2,300°)$.

C. $(4,30°)$.

D. $(4,300°)$.

25. In the figure, *ABCD* is a trapezium with *AD* // *BC*. Let *M* and *N* be points on *AD* such that *AM: MN* : *ND* = 3 : 2 : 1. *BN* and *CM* intersect at point *P*. If the area of the quadrilateral *ABPM* and area of the quadrilateral *CDNP* are 39 $m^2$ and 21 $m^2$ respectively, find the area of the trapezium *ABCD*.




A. 79.5 $m^2$

B. 86.7 $m^2$

C. 90 $m^2$

D. 103.5 $m^2$

26. There are 2 gold coins, 3 silver coins and 2 bronze coins in a box. In a game, two coins are randomly drawn at the same time from the box. If two coins of the same type are drawn, \$84 will be gained; otherwise, \$42 will be gained. Find the expected gain of the game.

A. \$18

B. \$52

C. \$59

D. \$74

27. The equation of circle $C$ is $4x^2+4y^2+24x+32y+75=0$. Which of the following is true?

A. *C* lies in quadrant III.

B. The origin lies inside *C*.

C. The circumference of *C* is less than 15.

D. The coordinates of the centre of *C* are (−6, −8).

28. A bus is 15 km due north of a museum. If the bus moves in the direction of S48°W, find the shortest distance between the bus and the museum correct to the nearest km.

A. 10 km

B. 11 km

C. 14 km

D. 15 km

29. $\{a-7,\ a-1,\ a,\ a+2,\ a+4,\ a+8\}$ and $\{a-9,\ a-2,\ a-1,\ a+3,\ a+4,\ a+6\}$ are two groups of numbers. Which of the following is/are true?

I. The two groups of numbers have the same mean.
II. The two groups of numbers have the same median.
III. The two groups of numbers have the same range.

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

30. Consider the following data:

9 11 11 12 13 13 14 15 19 $a$ $b$ $c$

Let $x$, $y$ and $z$ be the range, median and inter-quartile range of the above data respectively. If the mode of the data is 9, and the mean of the data is not less than 12.5, which of the following must be true?

I. $x = 10$
II. $y = 12.5$
III. $z = 4.5$

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

**Section B**

31. The H.C.F. and the L.C.M. of three expressions are $xy^3$ and $9x^5y^8z^3$ respectively. If the first and the second expressions are $3x^2y^3$ and $x^5y^5z^2$ respectively, then the third expression is

A. $3x^3y^3z^3$.
B. $3xy^8z^3$.
C. $9x^3y^3z^3$.
D. $9xy^8z^3$.

32. If $\alpha$ and $\beta$ are the two roots of the equation $x^2+8x-k=0$, then $\alpha^2-3\alpha\beta+\beta^2=$

A. $64 + 3k$.
B. $64 - 3k$.
C. $64 + 5k$.
D. $64 - 5k$.

33. $2^{11}+2^{10}-2^4+3\times2^3+2=$

A. $11000000101_2$.
B. $11000010101_2$.
C. $110000101010_2$.
D. $110000001010_2$.

34. It is given that three positive numbers $x$, $y$ and $z$ are in geometric sequence. Which of the following must be true?

I. $x^3, y^3, z^3$ are in geometric sequence.
II. $3^x, 3^y, 3^z$ are in geometric sequence.
III. $\log x^2, \log y^2, \log z^2$ are in arithmetic sequence.

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

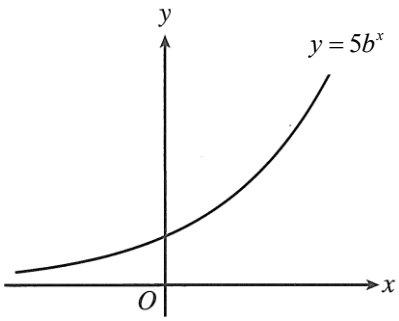
35. In a sports club, there are 8 male and 10 female members. If 5 members of the same gender are selected from the club to form a team, how many different teams can be formed?

A. 308
B. 8 568
C. 14 112
D. 36 960

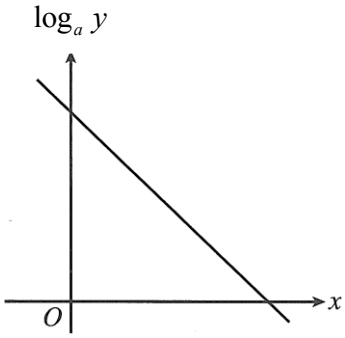
36. Find the imaginary part of $\dfrac{2i^{12}+3i^{13}+4i^{14}+5i^{15}+6i^{16}}{1-i}$.

A. $-3$
B. $-1$
C. 1
D. 3

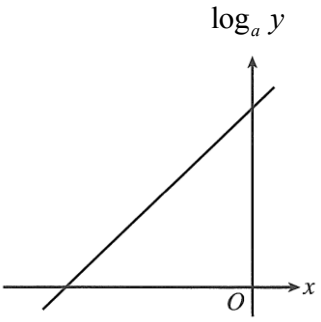
37. Let $a$ and $b$ be constants. The figure shows the graph of $y=5b^x$. If $a > b$, which of the following graphs may represent the relation between $x$ and $\log_a y$ ?



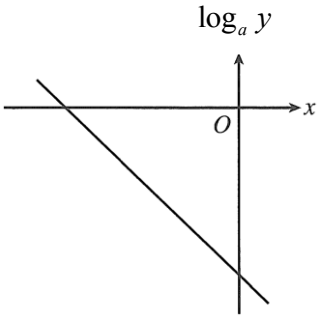

A.



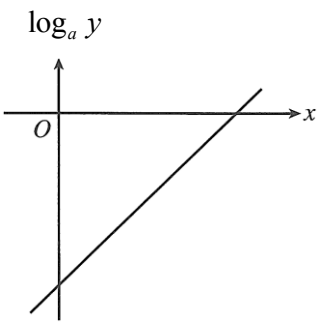

B.




C.




D.



38. Consider the following system of inequalities:

$$\begin{cases} 4x - y - 18 \le 0 \\ 3x + 2y - 41 \le 0 \\ x \ge 0 \\ y \ge 0 \end{cases}$$

Let $D$ be the region which represents the solution of the above system of inequalities. Find the constant $m$ such that the greatest value of $5x + 6y + m$ is 150, where $(x, y)$ is a point lying in $D$.

A. 27
B. 30
C. 55
D. 127.5

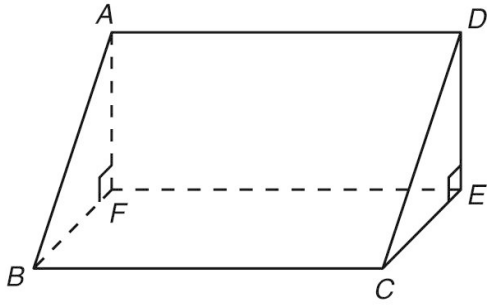
39. Find the number of solutions of the equation $2\sin^2 x + \cos x + 1 = 0$ for $0° \le x \le 360°$.

A. 1
B. 2
C. 3
D. 4

40. In a test, the sum of the test scores of two students and the sum of their standard scores are 168 marks and 8 respectively. If the mean score of the test is 68 marks, find the standard deviation of the test scores in the test.

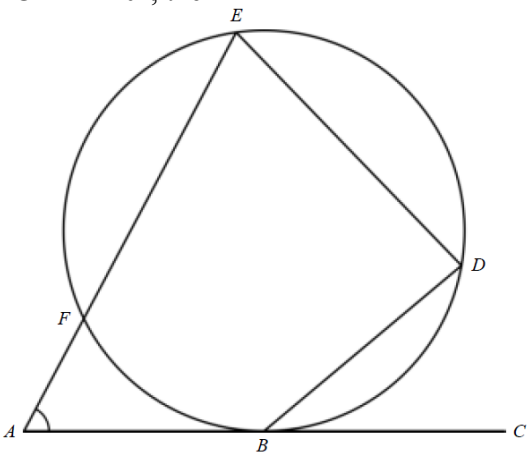
A. 4 marks
B. 8 marks
C. 16 marks
D. 40 marks

41. The figure shows a right triangular prism $ABCDEF$, where both $\Delta ABF$ and $\Delta DCE$ are right-angled isosceles triangles. If $AB = \sqrt{10}$ and $BC = 5$, find the angle between the line $AE$ and the plane $ABCD$, correct to the nearest degree.




A. 45°
B. 22°
C. 19°
D. 17°

42. In the figure, $AC$ is the tangent to the circle $BDEF$ at the point $B$. It is given that $AFE$ is a straight line. If $DE = EF$, $\angle BDE = 88°$ and $\angle CBD = 40°$, then $\angle BAF =$




A. 46°.
B. 52°.
C. 56°.
D. 62°.

43. A box contains 2 red cards, 3 blue cards and 4 yellow cards. Mary repeats drawing one card at a time randomly from the box with replacement until a red card is drawn. Find the probability that Mary needs at least three draws.

A. $\frac{5}{12}$
B. $\frac{7}{12}$
C. $\frac{49}{81}$
D. $\frac{343}{729}$

44. If (2, 3) is a point lying on the graph of $y = f(x)$, which of the following equations must have real root(s)?

A. $f(x+3)-3=0$
B. $f(x-3)+2=0$
C. $f(x-2)+3=0$
D. $f(x-2)-2=0$

45. Let $m_1$, $r_1$ and $s_1$ be the median, the range and the standard deviation of a group of distinct numbers $\{x_1, x_2, x_3, x_4, x_5, x_6\}$ respectively while $m_2$, $r_2$ and $s_2$ be the median, the range and the standard deviation of the group of numbers
$\{3x_1+2,\ 3x_2+2,\ 3x_3+2,\ 3x_4+2,\ 3x_5+2,\ 3x_6+2\}$
respectively. Which of the following must be true?

I. $m_2 = 3m_1 + 2$
II. $r_2 = 3r_1 + 2$
III. $s_2 > s_1$

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

**END OF PAPER**