MOCK EXAM 6

MATHEMATICS Compulsory Part

PAPER 2

(1 $\frac{1}{4}$ hours)

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet.

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 are advised to use an HB pencil to mark all the 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. $(9 \cdot 27^{n-2})^3 =$

   A. 3^{6n-9}.

   B. 3^{6n-12}.

   C. 3^{9n-12}.

   D. 3^{9n-18}.

2. If $\frac{x+2}{a} = \frac{x-2}{b}$, then $x =$

   A. $\frac{2a-2b}{a+b}$.

   B. $\frac{2b-2a}{a+b}$.

   C. $\frac{2a+2b}{a-b}$.

   D. $\frac{2a+2b}{b-a}$.

3. $ad - bd + ac - bc - ae + be =$

   A. $(a + b)(c - d + e)$.

   B. $(a + b)(c - d - e)$.

   C. $(a - b)(c + d + e)$.

   D. $(a - b)(c + d - e)$.

4. Let k be a constant. Solve the equation $(k - x)^2 = 16k^2$.

   A. $x = -3k$

   B. $x = -15k$

   C. $x = -5k$ or $x = 3k$

   D. $x = -3k$ or $x = 5k$

5. Let a be a constant. Find the range of values of a such that the quadratic equation $x^2 + 4x + a = 1$ has unequal real roots.

   A. $a > 5$

   B. $a < 5$

   C. $a > 4$

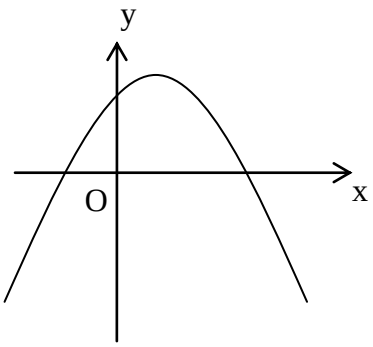
   D. $a < 4$

6. The figure shows the graph of $y = ax^2 + 2x + b$, where a and b are constants. Which of the following is/are true?

   I. $a < 0$

   II. $b < 0$

   III. $ab > 1$



   A. I only

   B. II only

   C. I and III only

   D. II and III only

7. If a, b and c are non-zero constants such that $x(x - 4a) - 2a \equiv x^2 - 3(bx + c)$, then $a : b : c =$

   A. 3 : 4 : 1.

   B. 3 : 4 : 2.

   C. 4 : 3 : 6.

   D. 6 : 3 : 4.

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8. 0.0002015999 =

   A. 0.0002016 (correct to 4 decimal places).
   B. 0.0002016 (correct to 4 significant figures).
   C. 0.0002016 (correct to 8 decimal places).
   D. 0.0002016 (correct to 8 significant figures).

9. Let $f(x) = x^{17} + x - k$, where k is a constant. If f(x) is divisible by x – 1, find the remainder when f(x) is divided by x + 1.

   A. –4
   B. –2
   C. 2
   D. 4

10. Peter sells two watches for $8 160 each. He gains 20% on one and loses 20% on the other. After the two transactions, Peter

   A. loses $680.
   B. loses $653.
   C. gains $408.
   D. has no gain or no loss.

11. A sum of $40 000 is deposited at an interest rate of 2% per annum for 4 years, compounded quarterly. Find the amount correct to the nearest dollar.

   A. $43 200
   B. $43 297
   C. $43 323
   D. $43 329

12. The actual area of an estate is 1728 m^2. If the area of the estate on a map is 192 cm^2, then the scale of the map is

    A. 1 : 9.
    B. 1 : 81.
    C. 1 : 300.
    D. 1 : 90 000.

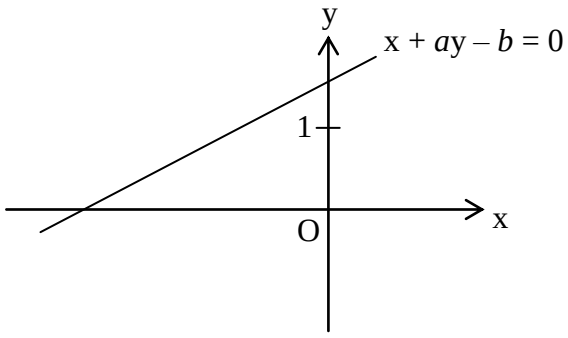
13. If z varies inversely as the cube of x and directly as y^2, which of the following must be a constant?

    A. $\frac{x^3}{y^2 z}$
    B. $\frac{x^3 y^2}{z}$
    C. $\frac{y^2}{x^3 z^3}$
    D. $\frac{y^2}{x^3 z}$

14. The figure shows the graph of the straight line $x + ay - b = 0$. Which of the following are true?

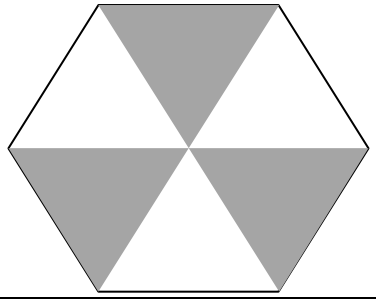
    I. $a < 0$
    II. $b < 0$
    III. $a < b$

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

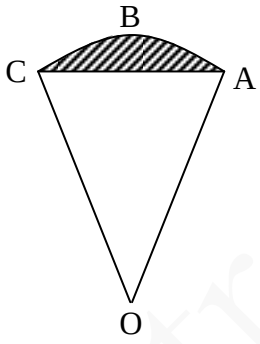


15. In the figure, the regular hexagon is divided into six identical isosceles triangles and three of them are shaded. The number of folds of rotational symmetry of the hexagon is

    A. 2.
    B. 3.
    C. 4.
    D. 6.



16. In the figure, O is the centre of the sector OABC. If the area of $\triangle OAC$ is 9 cm^2 and $\angle AOC = 30^o$, find the area of the shaded region.



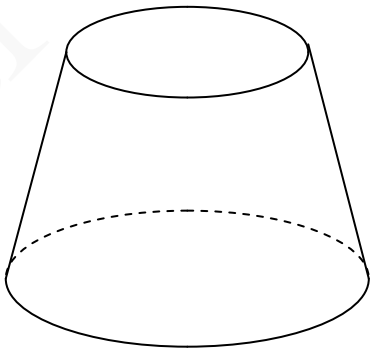
A. $3(\pi - 2)$ cm^2

B. $3(\pi - 3)$ cm^2

C. $6(\pi - 2)$ cm^2

D. $9(4\pi - 1)$ cm^2

17. The figure shows a frustum which is made by cutting off the upper part of a circular cone. The radius of the top surface is 8 cm and the radius of the bottom surface is 12 cm. If the height of the frustum is 15 cm, find the volume of the frustum.



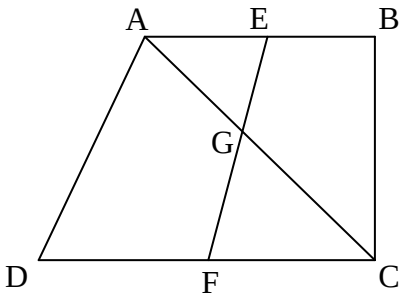
A. 720π cm^3

B. 1440π cm^3

C. 1520π cm^3

D. 4560π cm^3

18. In the figure, ABCD is a trapezium with AB // CD and AB : CD = 3 : 4. E and F are mid-points of AB and DC respectively. If the area of $\triangle GFC$ is 32 cm^2, then the area of trapezium ABCD is



A. 172 cm^2.

B. 178 cm^2.

C. 196 cm^2.

D. 224 cm^2.

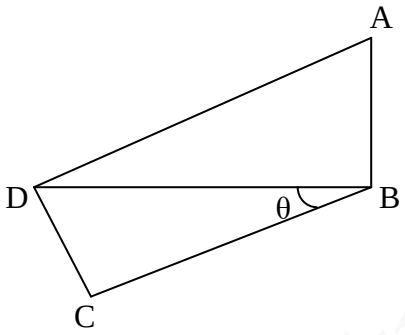
19. In the figure, $\angle ABD = \angle ADC = \angle BCD = 90^o$. If $CD = \ell$, then $AB =$

A. $\dfrac{\ell}{\sin\theta}$.

B. $\dfrac{\ell}{\cos\theta}$.

C. $\dfrac{\ell\tan\theta}{\cos\theta}$.

D. $\ell\sin\theta\tan\theta$.



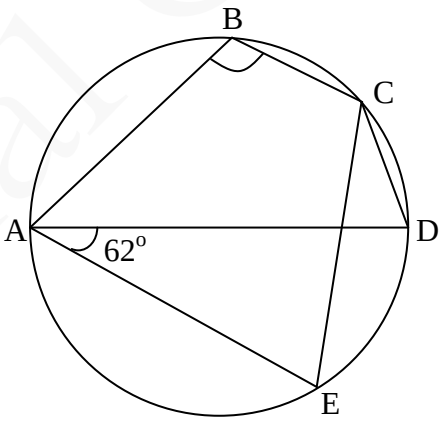
20. In the figure, AD is the diameter of the circle ABCDE. If $\angle DAE = 62^o$ and $\overset{\frown}{DE} = 2\overset{\frown}{CD}$, then $\angle ABC =$

A. 93^o.

B. 118^o.

C. 121^o.

D. 149^o.



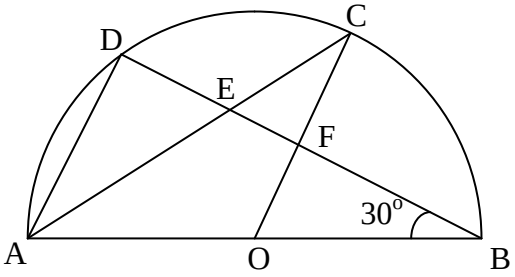
21. In the figure, O is the centre of the semi-circle ABCD. AC and BD intersect at E. If AD // OC and AD = 1 cm, then the area of $\triangle AED$ is

A. $\dfrac{\sqrt{3}}{6}$ cm^2.

B. $\dfrac{\sqrt{3}}{3}$ cm^2.

C. $\dfrac{\sqrt{3}}{2}$ cm^2.

D. 1 cm^2.



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22. If an interior angle of a regular n-sided polygon is 8 times an exterior angle of the polygon, which of the following is/are true?

    I. The value of n is 18.

    II. Each interior angle of the polygon is 160^o.

    III. The number of folds of rotational symmetry is 18.

    A. I and II only

    B. I and III only

    C. II and III only

    D. I, II and III

23. In $\triangle ABC$, AB : BC : AC = 9 : 40 : 41. Find cos A : cos C.

    A. 9 : 40

    B. 9 : 41

    C. 40 : 9

    D. 40 : 41

24. The coordinates of the points A and B are (5, 2) and (8, 6) respectively. If P is a moving point in the rectangular coordinate plane such that $\angle APB = 90^o$, then the locus of P is

    A. the circle with AB as a diameter.

    B. the straight line which passes through A and B.

    C. the perpendicular bisector of AB.

    D. the angle bisector of $\angle AOB$, where O is the origin.

25. If the point $(3, \sqrt{3})$ is reflected with respect to the straight line x = 1, then the polar coordinates of its image are

    A. $(2, 120^o)$.

    B. $(2, 150^o)$.

    C. $(4, 120^o)$.

    D. $(4, 150^o)$.

26. The equation of the circle C is $2x^2 + 2y^2 - 8x - 4y - 5 = 0$. The coordinates of the points A and B are (–1, –1) and (5, –5) respectively. Which of the following is/are true?

I. The radius of C is 5.

II. The mid-point of AB lies outside C.

III. If G is the centre of C, then $\angle AGB$ is an acute angle.

A. I only

B. II only

C. I and III only.

D. II and III only

27. Two fair dice are thrown in a game. If the sum of the two numbers thrown is greater than 10, \$14 will be gained; otherwise, \$2 will be gained. Find the expected gain of the game.

A. \$3

B. \$4

C. \$12

D. \$13

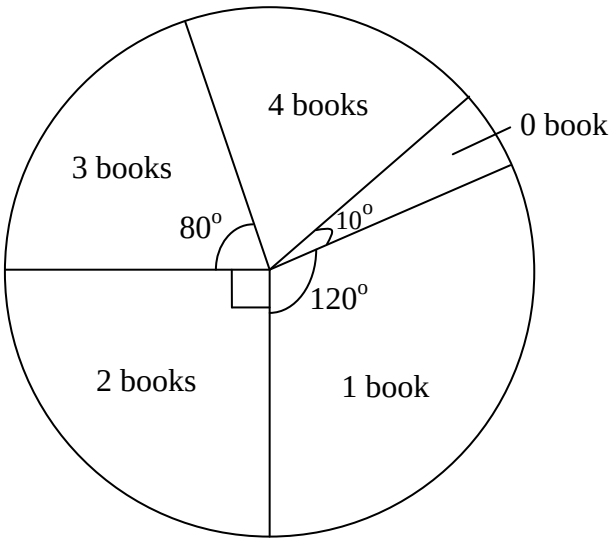
28. The pie chart shows the distribution of the number of books that a group of students read in a month. If a student is randomly selected from the group, find the probability that the selected student read more than 2 books.

A. $\frac{1}{6}$

B. $\frac{2}{9}$

C. $\frac{7}{18}$

D. $\frac{23}{36}$



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29. The range and the mode of the numbers 12, 4, 3, 3, 4, 6, x, y and z are 13 and 12 respectively. If all the numbers are positive, then the mean of these numbers is

    A. 7.

    B. 8.

    C. 9.

    D. 10.

30. The stem-and-leaf diagram below shows the distribution of the weights (in kg) of a group of children.

Stem (tens)	Leaf (units)
2	h 5 6 8
3	1 2 4 4 4 6 8
4	0 1 k

If the range of the above distribution is at least 24, which of the following must be true?

I. $0 \le h \le 5$

II. $5 \le k \le 9$

III. $4 \le k - h \le 9$

    A. I only

    B. II only

    C. I and III only

    D. II and III only

Section B

31. $\dfrac{1}{x^2-4x+4}-\dfrac{1}{x^2-4}=$

A. $\dfrac{1}{(x-2)(x+2)}$.

B. $\dfrac{1}{(x-2)^2(x+2)}$.

C. $\dfrac{4}{(x-2)^2(x+2)}$.

D. $\dfrac{2x}{(x-2)^2(x+2)}$.

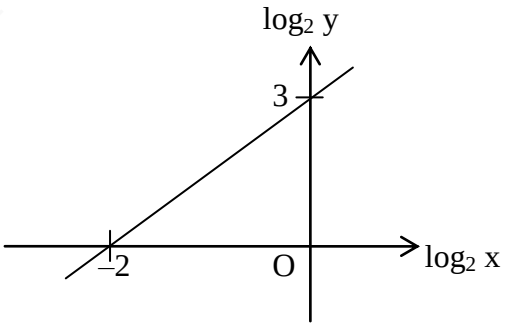
32. The graph in the figure shows the linear relation between $\log_2 x$ and $\log_2 y$. Which of the following must be true?

A. $y^2 = 64x^3$

B. $y^3 = 64x^2$

C. $x^2 = 64y^3$

D. $x^3 = 64y^2$



33. $B000000C0016_{16}$ =

A. $11 \times 16^{11} + 12 \times 16^4 + 22$.

B. $12 \times 16^{11} + 13 \times 16^4 + 22$.

C. $11 \times 16^{12} + 12 \times 16^5 + 352$.

D. $12 \times 16^{12} + 13 \times 16^5 + 352$.

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34. Let k be a constant. If the roots of the quadratic equation $x^2 + kx + 3 = 0$ are α and β, then $\alpha^2 + \beta^2 =$

A. $k^2 - 12$.

B. $k^2 - 6$.

C. k^2.

D. $k^2 + 6$.

35. If $x - \log y = x^2 - \log y^2 = -3$, then $y =$

A. -1 or 3.

B. 2 or 6.

C. $\frac{1}{1000000}$ or $\frac{1}{100}$.

D. 100 or $1\,000\,000$.

36. Let $z = (k - 4)i^{11} + (k + 2)i^{12}$, where k is a real number. If z is an imaginary number, then $k =$

A. -4.

B. -2.

C. 2.

D. 4.

37. Let a_n be the nth term of a geometric sequence. If $a_3 = 432$ and $a_5 = 243$, which of the following must be true?

I. $a_4 = 324$

II. $\frac{a_4}{a_6} > 1$

III. $a_1 + a_3 + a_5 + ... + a_{2n+1} < 2016$

A. I only

B. II only

C. I and II only

D. II and III only

38. The figure shows a shaded region. If (a, b) is a point lying in the shaded region, which of the following are true?

I. $b \leq 6$

II. $b \geq 6 - a$

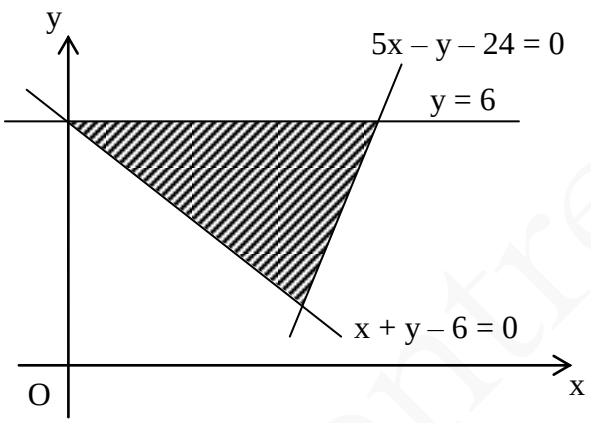
III. $b \leq 5a - 24$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III



39. Let h and k be constants. The figure shows the graph of $y = h + k \cos 2x^o$, where $0 \leq x \leq \alpha$. Which of the following are true?

I. $h > 0$

II. $k > 0$

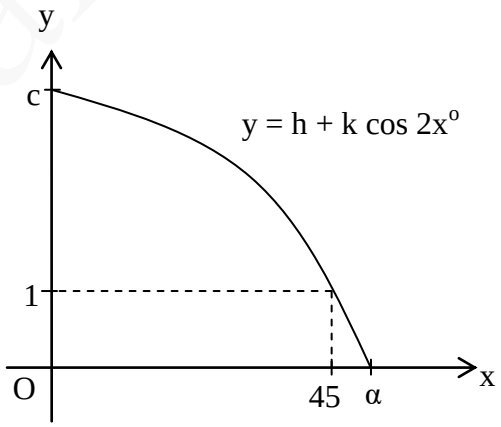
III. $\cos 2\alpha^o = \dfrac{1}{c-1}$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III



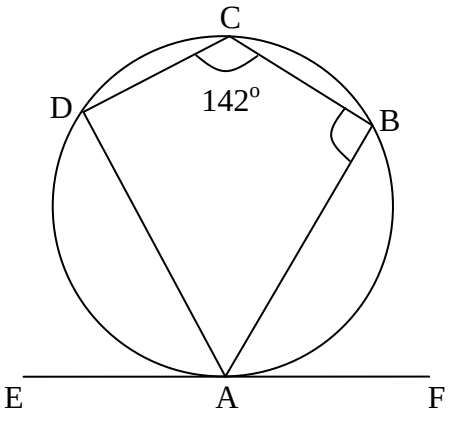
40. In the figure, EF is the tangent to the circle at A. If AB is the angle bisector of $\angle DAF$ and CB = CD, then $\angle ABC$ =

A. 142^o.

B. 123^o.

C. 114^o.

D. 104^o.



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41. Find the range of values of k such that the circle $x^2 + y^2 - 6x - 4y + 5 = 0$ and the straight line $x + y - k = 0$ intersect.

    A. $1 \leq k \leq 9$

    B. $1 < k < 9$

    C. $k \leq 1$ or $k \geq 9$

    D. $k < 1$ or $k > 9$

42. Let O be the origin. If the coordinates of points A and B are (0, 24) and (24, 0) respectively, then the x-coordinate of the centroid of $\triangle OAB$ is

    A. 0.

    B. 6.

    C. 8.

    D. 12.

43. Amy, Bill and 8 other students participate in a solo singing contest. If Amy performs after Bill, how many different ways of order of performance can be arranged?

    A. 80 640

    B. 362 880

    C. 1 814 400

    D. 3 628 800

44. Box A contains 2 black cards and 4 white cards. Box B contains 3 black cards and 1 white card. Box C contains 2 black cards and 6 white cards. If one box is randomly chosen and then a card is randomly drawn from the box, find the probability that a white card is drawn.

A. $\frac{7}{18}$

B. $\frac{11}{18}$

C. $\frac{4}{9}$

D. $\frac{5}{9}$

45. If the variance of the four numbers x_1, x_2, x_3, and x_4 is 18, then the variance of the four numbers $4x_1 + 5$, $4x_2 + 5$, $4x_3 + 5$ and $4x_4 + 5$ is

A. 72.

B. 77.

C. 288.

D. 293.

END OF PAPER

