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

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

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. $a > 4$

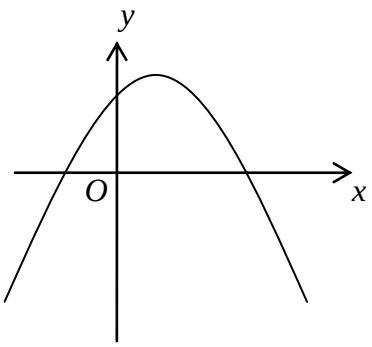
   D. $a < 4$

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. Let m and n be non-zero constants. If $(2m + n) : (3m - 2n) = 8 : 5$, then $m : n =$

   A. 2 : 3.

   B. 3 : 2.

   C. 21 : 34.

   D. 34 : 21.

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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. In a school, 59% of the students wear glasses. It is given that 40% of the students are girls and y% of the girls wear glasses. If 55% of the boys wear glasses, then y =

    A. 65.
    B. 55.
    C. 45.
    D. 35.

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.

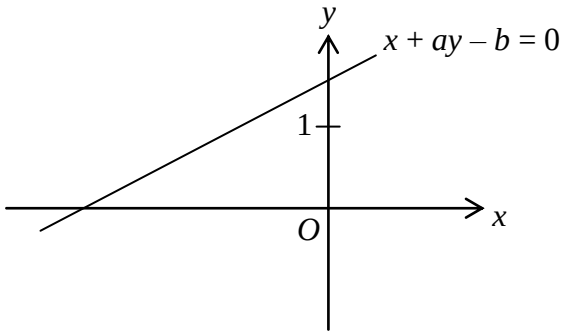
13. If z varies inversely as the cube of x and directly as y^2, which of the following must be a constant?

    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?

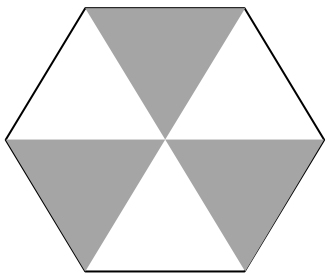
    I. $a < 0$
    II. $b < 0$
    III. $a < b$

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

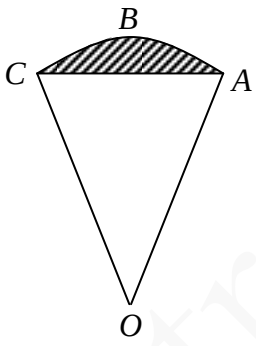


15. In the figure, the regular hexagon is divided into six identical isosceles triangles and three of them are shaded. The number of folds of rotational symmetry of the hexagon is

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

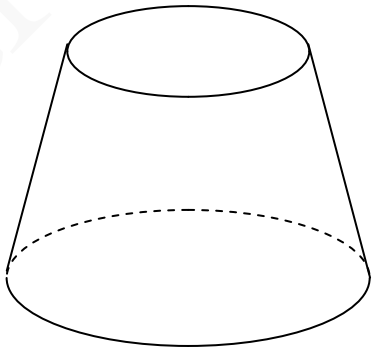


16. In the figure, O is the centre of the sector $OABC$. If the area of $\Delta\, OAC$ is 9 cm^2 and $\angle AOC = 30^o$, find the area of the shaded region.



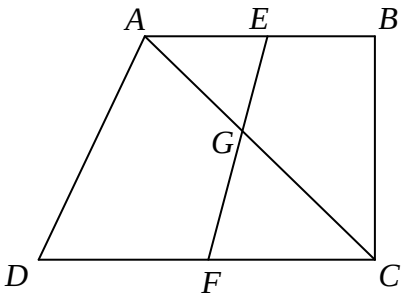
A. $3(\pi - 2)$ cm^2
B. $3(\pi - 3)$ cm^2
C. $6(\pi - 2)$ cm^2
D. $9(4\pi - 1)$ cm^2

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 $\Delta\, GFC$ 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.

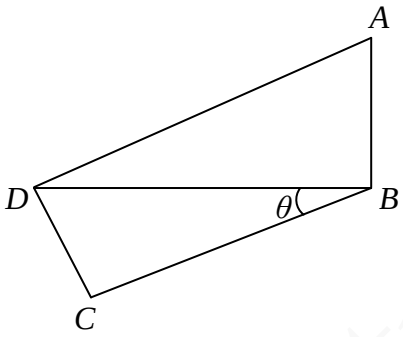
19. In the figure, $\angle ABD = \angle ADC = \angle BCD = 90^o$. If $CD = \lambda$, then $AB =$

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

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

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

D. $\lambda\sin\theta\tan\theta$.



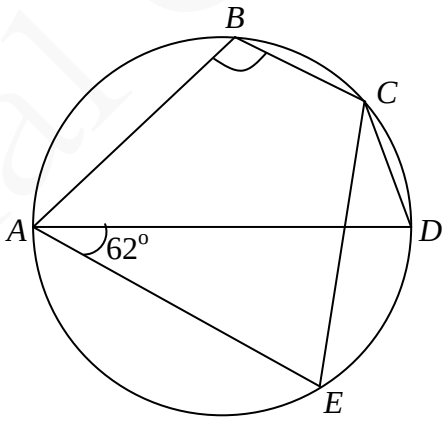
20. In the figure, AD is the diameter of the circle $ABCDE$. If $\angle DAE = 62^o$ and $\overset{\frown}{DE} = 2\overset{\frown}{CD}$, then $\angle ABC =$

A. 93^o.

B. 118^o.

C. 121^o.

D. 149^o.



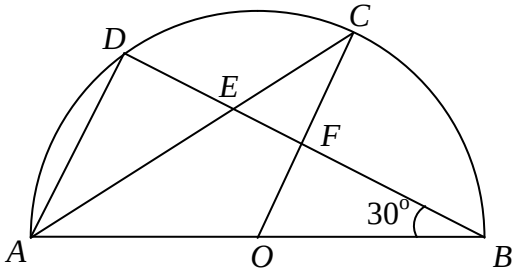
21. In the figure, O is the centre of the semi-circle $ABCD$. AC and BD intersect at E. If AD // OC and $AD = 1$ cm, then the area of ΔAED is

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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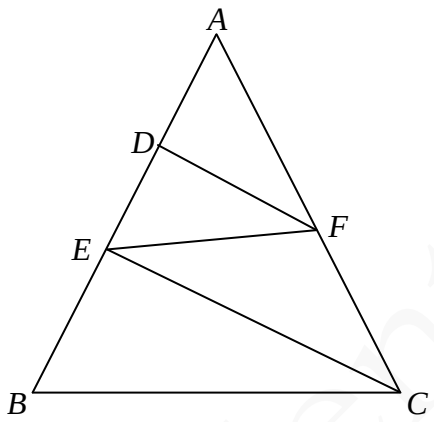
22. In the figure, ABC is an isosceles triangle with $AB = AC$. D and E are points lying on AB such that $9AD = 9DE = 4EB$ while F is a point lying on AC such that $DF \parallel EC$. If $\angle AEC = 90^o$ and $CE = 60$ cm, then $EF =$

A. 16 cm.
B. 24 cm.
C. 30 cm.
D. 34 cm



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

A. 9 : 40
B. 9 : 41
C. 40 : 9
D. 40 : 41

24. The equation of the straight line L is $5x - 2y - 4 = 0$. If P is a moving point in the rectangular coordinate plane such that the perpendicular distance from P to L is equal to 5, then the locus of P is

A. a circle.
B. a square.
C. a line segment.
D. a pair of straight lines.

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 a circle is $3x^2 + 3y^2 - 6x + 18y + 3 = 0$. Which of the following are true?

I. The coordinates of the centre of the circle are (1, –3).

II. The radius of the circle is 3.

III. The line $y = x$ cuts the circle at two points.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

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

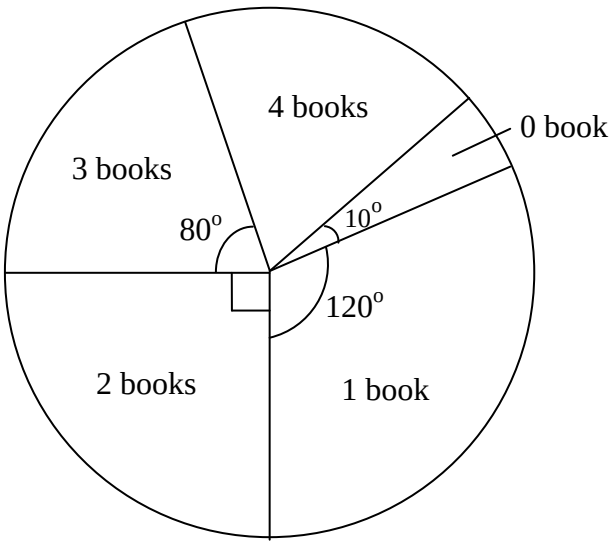
28. The pie chart shows the distribution of the number of books that a group of students read in a month. If a student is randomly selected from the group, find the probability that the selected student read more than 2 books.

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

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

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

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



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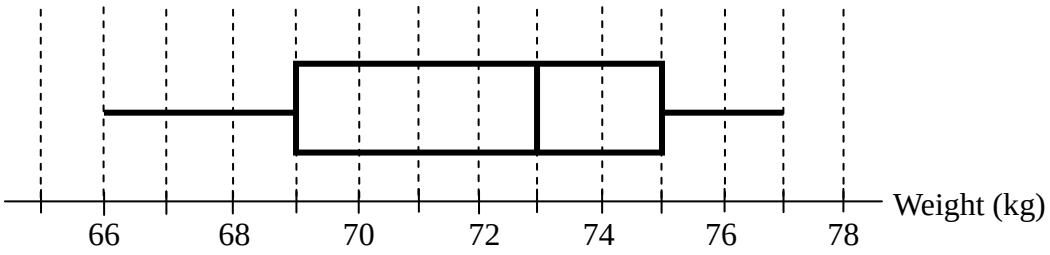
29. The box-and-whisker diagram below shows the distribution of the weights (in kg) of a group of workers.

Find the inter-quartile range of the distribution.



A. 4 kg

B. 6 kg

C. 8 kg

D. 11 kg

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. $0 \leq h \leq 5$

II. $5 \leq k \leq 9$

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

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

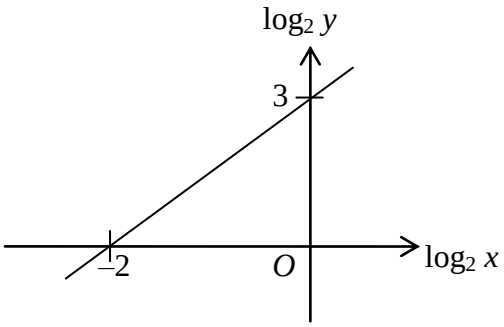
32. The graph in the figure shows the linear relation between $\log_2 x$ and $\log_2 y$. Which of the following must be true?

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

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

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

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



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 $\frac{3}{2\log x - 3} + 1 = \frac{2}{4 - \log x}$, then $\log \frac{1}{x} =$

A. $-\frac{1}{3}$ or 1.

B. –1 or $\frac{1}{3}$.

C. 3 or –1.

D. –3 or 1.

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. $b \geq 6 - a$

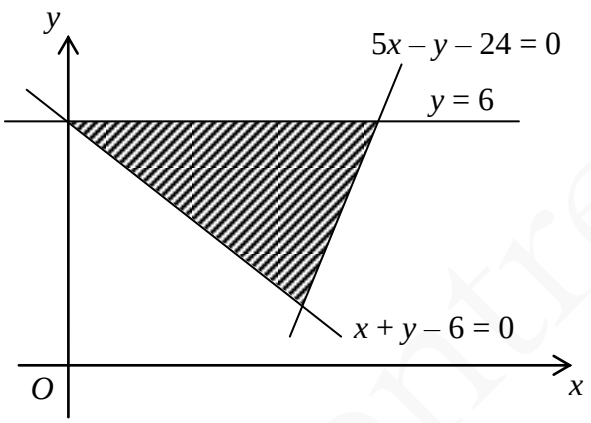
III. $b \leq 5a - 24$

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 $y = h + k \cos 2x^{\circ}$, where $0 \leq x \leq \alpha$. Which of the following are true?

I. $h > 0$

II. $k > 0$

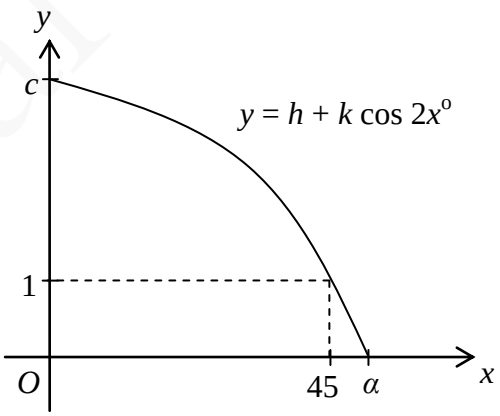
III. $\cos 2\alpha^{\circ} = \dfrac{1}{c-1}$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III



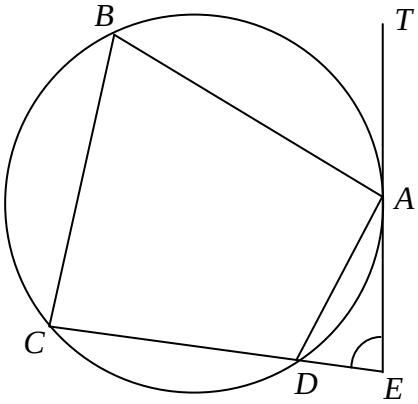
40. In the figure, TA is the tangent to the circle $ABCD$ at the point A. CD produced and TA produced meet at the point E. It is given that $AB = BC$, $\angle BAT = 48^{\circ}$ and $\angle EAD = 24^{\circ}$. Find $\angle AED$.

A. 48°.

B. 72°.

C. 84°.

D. 96°.



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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. A ten-character code is formed by a permutation of A, B, C, D and a permutation of 1, 3, 4, 6, 8, 9 respectively. How many different ten-character codes can be formed?

    A. 24

    B. 744

    C. 17 280

    D. 3 628 800

44. John plays three different games with Peter. The probabilities that John wins the games are 0.5, 0.6 and 0.7 respectively. Find the probability that Peter wins at most 2 games.

    A. 0.06
    B. 0.29
    C. 0.71
    D. 0.94

45. There are 72 terms in an arithmetic sequence. If the standard deviation of the first 9 terms of the sequence is 8, then the variance of the last 9 terms of the sequence is

    A. 8.
    B. 16.
    C. 64.
    D. 81.

END OF PAPER

