MOCK EXAM 10

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

   A. 2^{6n+8}.

   B. 2^{6n+10}.

   C. 2^{9n+10}.

   D. 2^{9n+12}.

2. If $x(y - x) = y(x - 1)$, then $y =$

   A. $-x^2$.

   B. x^2.

   C. $-x$.

   D. $2x$.

3. $(x - 1)(x^2 - x + 1) =$

   A. $x^3 - 1$.

   B. $(x - 1)^3$.

   C. $x^3 - x^2 + x - 1$.

   D. $x^3 - 2x^2 + 2x - 1$.

4. $\frac{8}{x-8}-\frac{9}{x-9}=$

A. $\frac{x}{(x-8)(x-9)}$.

B. $\frac{x}{(8-x)(x-9)}$.

C. $\frac{x+144}{(x-8)(x-9)}$.

D. $\frac{x+144}{(8-x)(x-9)}$.

5. If x = 2.023 (correct to 3 decimal places), find the range of values of x.

A. $2.022 < x \leq 2.024$

B. $2.022 \leq x < 2.024$

C. $2.0225 < x \leq 2.0235$

D. $2.0225 \leq x < 2.0235$

6. If x and y are non-zero numbers such that $\frac{2x+3y}{2x+y}=\frac{4}{3}$, then $x : y =$

A. 2 : 5.

B. 13 : 14.

C. 14 : 13.

D. 5 : 2.

7. Let f(x) = (x – h)(x – 8) + k, where h and k are constants. If f(2) = f(12) = 40, find k.

A. 16

B. 6

C. –6

D. –16

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8. If k is a constant such that $x^3 + kx^2 - 8x + 4$ is divisible by $x + 2$, then k =

   A. –5.

   B. –3.

   C. 1.

   D. 5.

9. 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.

10. The solution of $-4x < 56 < 7x$ is

    A. $x > -14$.

    B. $x > 0$.

    C. $x > 8$.

    D. $-14 < x < 8$.

11. If x and y are non-zero numbers such that $(6x + y) : (4y - 3x) = 4 : 5$, then $x : y$ =

    A. 1 : 2.

    B. 2 : 1.

    C. 11 : 42.

    D. 16 : 39.

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

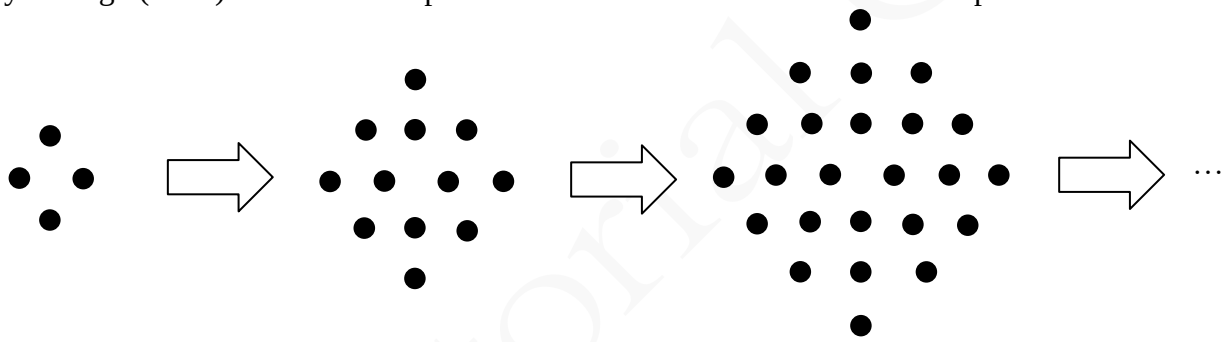
    A. $\frac{\sqrt{x}}{yz}$

    B. $\frac{x}{y^4z^2}$

    C. $\frac{y}{x^2z^4}$

    D. $\frac{y}{x^4z^2}$

13. In the figure, the 1st pattern consists of 4 dots. For any positive integer n, the $(n + 1)$th pattern is formed by adding $4(n + 1)$ dots to the nth pattern. Find the number of dots in the 9th pattern.



    A. 112

    B. 144

    C. 180

    D. 220

14. Which of the following statements about the graph of $y = (x – 3)(x + 5) + 7$ is/are true?

    I. The graph opens upwards.

    II. The graph passes through the point (3, 6).

    III. The x-intercepts of the graph are –4 and 2.

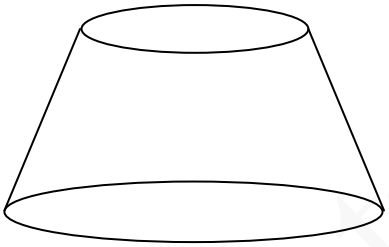
    A. I only

    B. II only

    C. I and III only

    D. II and III only

15. In the figure, the frustum is formed by cutting off the upper part of a right circular cone. The radius of the top surface is 3 cm and the radius of the bottom surface is 6 cm. If the height of the frustum is 4 cm, then the total surface area of the frustum is



A. 54π cm^2.
B. 69π cm^2.
C. 90π cm^2.
D. 105π cm^2.

16. The sum of the total volumes of two hemispheres is 630π cm^3. If the ratio of the radius of the smaller hemisphere to the radius of the larger hemisphere is 2 : 3, then the difference between the surface areas of the two hemispheres is

A. 135π cm^2.
B. 180π cm^2.
C. 351π cm^2.
D. 468π cm^2.

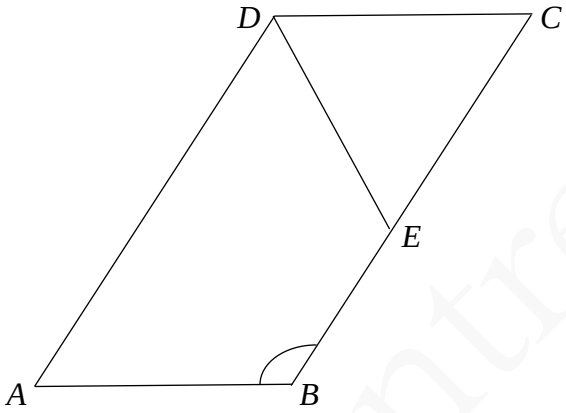
17. The area of the sector OAB is 3π cm^2, where O is the centre of the sector OAB. If $\angle AOB = 120^\circ$, which of the following are true?

I. The radius of the sector OAB is 3 cm.
II. The area of the circle passing through O, A and B is 9π cm^2.
III. The perimeter of the sector OAB is 2π cm.

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

18. In the figure, *ABCD* is a parallelogram. *E* is a point lying on *BC* such that *DC* = *DE*. If $\angle CDE = 68^o$, then $\angle ABE =$

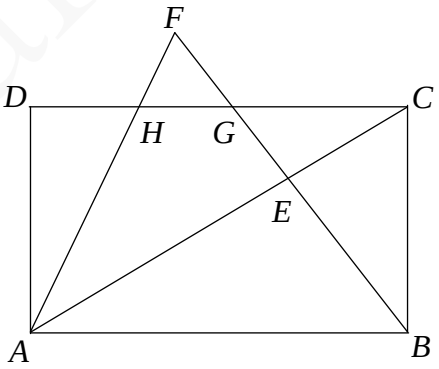
A. 112^o
B. 124^o
C. 136^o
D. 148^o



19. In the figure, *ABCD* is a rectangle. *E* is a point lying on *AC* such that *BE* is perpendicular to *AC*. *BE* is produced to the point *F* such that *AF* = *CD*. Denote the point of intersection of *BF* and *CD* by *G* and the point of intersection of *AF* and *CD* by *H*. Which of the following are true?

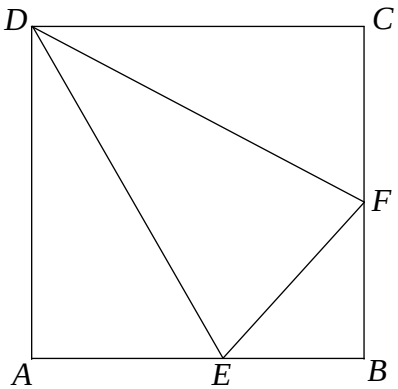
I. $\angle ACB = \angle FGH$
II. $\triangle CGE \sim \triangle AFE$
III. *ABCF* is a cyclic quadrilateral.

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



20. In the figure, *ABCD* is a square. *E* and *F* are points lying *AB* and *BC* respectively such that 2*AE* = 3*BE* and *F* is the mid-point of *BC*. If the area of $\triangle DEF$ is 35 cm^2, then the area of $\triangle ADE$ is

A. 40 cm^2.
B. 30 cm^2.
C. 28 cm^2.
D. 25 cm^2.



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21. If *ABCDEF* is a regular hexagon, which of the following are true?

I. $AE \parallel BD$

II. $BF = AC$

III. $2\angle BDE = 3\angle AEC$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

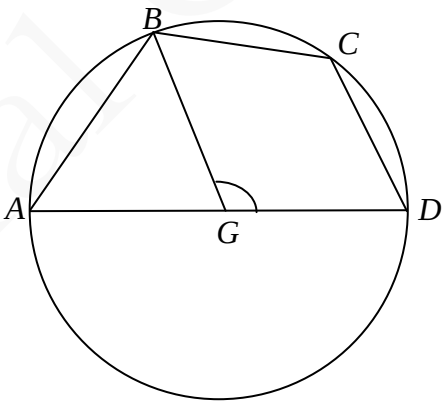
22. In the figure, *AGD* is a diameter of the circle *ABCD* where *G* is the centre. If $BC = CD$ and $\angle ABC = 118^o$, then $\angle BGD =$

A. 112^o.

B. 118^o.

C. 124^o.

D. 130^o.



23. The rectangular coordinates of the point *P* are $(-\sqrt{3}, -1)$. If *P* is reflected with respect to the *y*-axis, then the polar coordinates of its image are

A. $(2, 300^o)$.

B. $(2, 330^o)$.

C. $(4, 300^o)$.

D. $(4, 330^o)$.

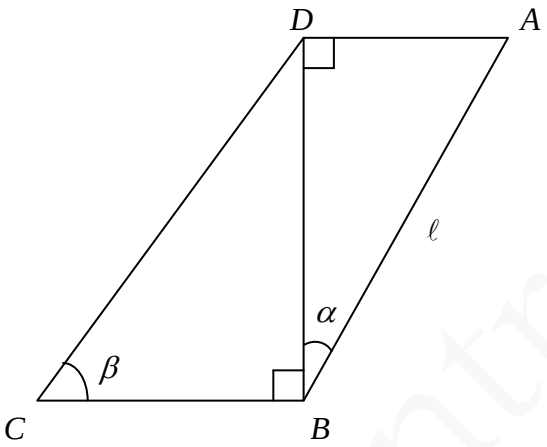
24. In the figure, $AB = \ell$, then $CD =$

A. $\dfrac{\ell \sin \beta}{\cos \alpha}$.

B. $\dfrac{\ell \cos \beta}{\sin \alpha}$

C. $\dfrac{\ell \sin \alpha}{\cos \beta}$.

D. $\dfrac{\ell \cos \alpha}{\sin \beta}$.



25. The equations of the straight lines L_1 and L_2 are $x + y - 3 = 0$ and $2x + y + 6 = 0$ 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. circle.

B. parabola.

C. pair of straight lines.

D. straight line.

26. The coordinates of the points A, B and C are (2, 1), (7, 4) and (9, 6) respectively. Let O be the centroid of $\triangle ABC$. Find the equation of the straight line which passes through A and O.

A. $2x - 3y - 1 = 0$

B. $x + y - 3 = 0$

C. $x + y - 13 = 0$

D. $x - y - 1 = 0$

27. The slope of the straight line L is 3. It is given that L and the circle $x^2 + y^2 + hx + ky - 20 = 0$ intersect at the points P and Q. If the coordinates of the mid-point of PQ are (3, 8), which of the following must be true?

A. $h + 3k + 27 = 0$

B. $h + 3k - 27 = 0$

C. $h + 3k + 54 = 0$

D. $h + 3k - 54 = 0$

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28. The stem-and-leaf diagram below shows the distribution of the heights (in cm) of a group of students.

Stem (tens)	Leaf (units)							
14	5	5	6	7				
15	1	1	2	3	4	8		
16	0	2	3	4	8	8	9	
17	2	2	2	4	5	6	8	8

If a student is randomly selected from the group, find the probability that the height of the selected student is not more than the upper quartile of the distribution.

A. $\frac{19}{25}$

B. $\frac{17}{25}$

C. $\frac{1}{5}$

D. $\frac{4}{5}$

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. If the mean of 32 integers is 60 and the mean of another 48 integers is 50, then the mean of all these integers is

A. 54.

B. 55.

C. 58.

D. 60.

Section B

31. The H.C.F. and the L.C.M. of three expressions are xy^2z^2 and $x^3y^4z^5$ respectively. If the first expression and the second expression are $x^2y^3z^2$ and $x^3y^2z^4$ respectively, then the third expression is

    A. xy^4z^5.

    B. $x^2y^4z^5$.

    C. xy^3z^4.

    D. $x^2y^3z^4$.

32. $6 \times 2^9 + 3 \times 2^6 + 7 \times 2^2 - 3 \times 2^2 =$

    A. 11001101000_2.

    B. 11001100100_2.

    C. 110011001000_2.

    D. 110011010000_2.

33. Let a, b and c be positive constants. On the same rectangular coordinate system, the graph of $y = \log_c x$ and the graph of $y = x - \log_a b$ cut the x-axis at the points S and T respectively. Denote the origin by O. Find $OS : OT$.

    A. $c^{\,a} : 1$

    B. $c^{\,b} : 1$

    C. $\log a : \log b$

    D. $\log b : \log a$

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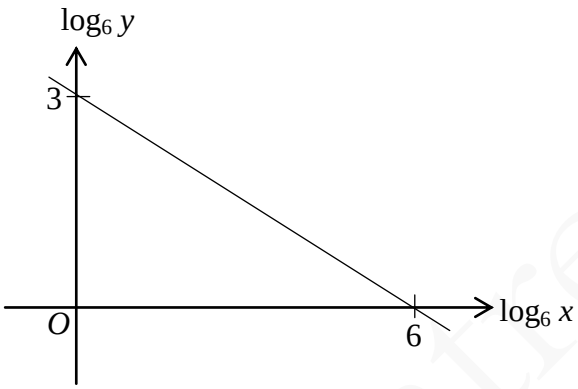
34. The graph in the figure shows the linear relation between $\log_6 x$ and $\log_6 y$. Which of the following must be true?



A. $\frac{y}{x^2} = 6^6$

B. $\frac{y^2}{x} = 6^6$

C. $xy^2 = 6^6$

D. $x^2y = 6^6$

35. If k and $\frac{k}{1+i} - 2 + 3i$ are real numbers, then k =

A. 6

B. 4

C. –4

D. –6

36. If a, b, c, d is an arithmetic sequence, which of the following must be true?

I. $a + d = b + c$

II. $ad = bc$

III. $a < b < c < d$

A. I only

B. II only

C. I and III only

D. II and III only

37. Let k be a constant. Find the range of values of k such that $x^2 - 2kx + 3k + 10 \geq 0$ for any real number x.

A. $-5 \leq k \leq 2$

B. $-2 \leq k \leq 5$

C. $k \leq -5$ or $k \geq 2$

D. $k \leq -2$ or $k \geq 5$

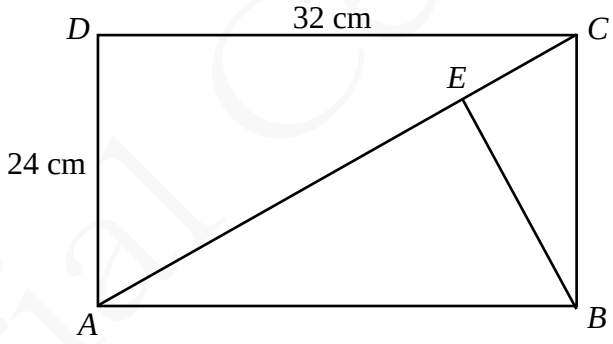
38. In the figure, $ABCD$ is a rectangle. If E is a point lying on AC such that $CE = 10$ cm, then $BE =$

A. $2\sqrt{73}$ cm.

B. $2\sqrt{97}$ cm.

C. $2\sqrt{119}$ cm.

D. $2\sqrt{193}$ cm.



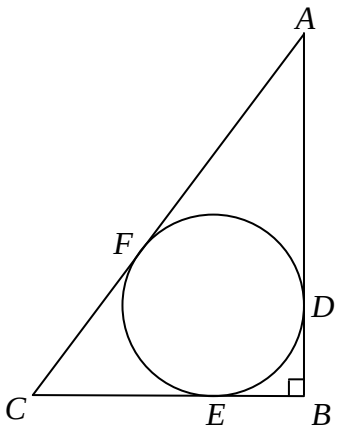
39. In the figure, AB, BC and AC are the tangents to the circle at D, E and F respectively. If $\angle ABC = 90^\circ$, $BC = 8$ cm and $AD = 12$ cm, then the diameter of the circle is

A. 3 cm.

B. 4 cm.

C. 5 cm.

D. 6 cm.



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40. If the straight line $4x - 3y + 2 = 0$ and the circle $x^2 + y^2 + 6x - 10y - 16 = 0$ intersect at the points A and B, then the equation of the circle with AB as a diameter is

    A. $(x - 1)^2 + (y - 2)^2 = 25$.

    B. $(x - 2)^2 + (y - 1)^2 = 25$.

    C. $(x - 1)^2 + (y - 2)^2 = 100$.

    D. $(x - 2)^2 + (y - 1)^2 = 100$.

41. Let O be the origin. The coordinates of the point A are (22, 6). If the coordinates of the orthocentre of ΔOAB are (21, 3), then the x-coordinate of B is

    A. –24.

    B. –8.

    C. 24

    D. 8

42. There are 16 boys and 14 girls in a class. If 8 students are selected to form a team in a competition consisting of at least 4 boys, how many different teams can be formed?

    A. 1 821 820

    B. 3 361 215

    C. 2 491 710

    D. 4 313 530

43. A bag contains 7 red marbles, 4 green marbles and 6 blue marbles. If one marble is drawn at a time randomly from the bag without replacement until a green marble is drawn. Find the probability that at least two draws are needed.

    A. $\frac{13}{68}$.

    B. $\frac{29}{68}$.

    C. $\frac{39}{68}$.

    D. $\frac{13}{17}$.

44. In an examination, the scores (in marks) of the students are as follows:

    82 56 58 60 62 65 71 75 76 78 80 81

    Which of the following is/are true?

    I. The standard score of each student in the examination is larger than –2.

    II. The median of the examination scores of the students is 68 marks.

    III. The standard deviation of the examination scores of the students exceeds 9 marks.

    A. I only

    B. II only

    C. I and III only

    D. II and III only

45. The variance of a set of numbers is 18. Each number of the set is multiplied by 5 and then 5 is subtracted from each resulting number to form a new set of numbers. Find the variance of the new set of numbers.

    A. 85

    B. 90

    C. 445

    D. 450

END OF PAPER

