MOCK EXAM 3

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. $\dfrac{(3x^3)^3}{3x^5} =$

   A. $3x$.

   B. $3x^4$.

   C. $9x^4$.

   D. $9x^{22}$.

2. If $4a - 1 = 4(b - 5)$, then $b =$

   A. $a + 1$.

   B. $a + 4$.

   C. $a + \dfrac{19}{4}$.

   D. $a - \dfrac{21}{4}$.

3. $pr - qr - ps + qs - pt + qt =$

   A. $(p + q)(r - s + t)$.

   B. $(p + q)(r - s - t)$.

   C. $(p - q)(r - s + t)$.

   D. $(p - q)(r - s - t)$.

4. Let $f(x)$ be a polynomial. When $f(x)$ is divided by $x + 2$, the remainder is 4. If $f(x)$ is divisible by $x - 2$, find the remainder when $f(x)$ is divided by $x^2 - 4$.

   A. $-x - 2$

   B. $-x + 2$

   C. $x - 2$

   D. $x + 2$

5. Let k be a constant. Solve the equation $(x + k)(x – k + 1) = x + k$.

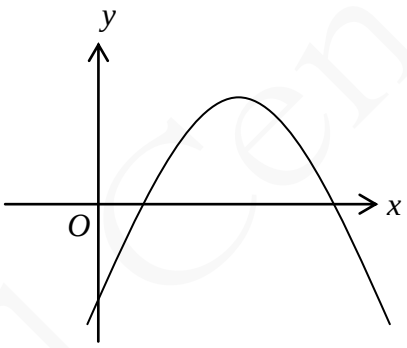
   A. $x = k – 1$

   B. $x = k$

   C. $x = –k$ or $x = k – 1$

   D. $x = –k$ or $x = k$

6. The figure shows the graph of $y = –x^2 – mx + n$, where m and n are constants. Which of the following is true?



   A. $m < 0$ and $n < 0$

   B. $m < 0$ and $n > 0$

   C. $m > 0$ and $n < 0$

   D. $m > 0$ and $n > 0$

7. The solution of $6(x – 2) \geq 2(x + 4)$ or $25 – 5x < 10$ is

   A. $x \geq 5$

   B. $x \leq 5$

   C. $x > 3$

   D. $x < 3$

8. If a, b and c are non-zero constants such that $a(x + 1) + b(x + 6) \equiv c(x + 3)$, then $a : b =$

   A. 4 : 7.

   B. 7 : 4.

   C. 2 : 3.

   D. 3 : 2.

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9. If the base radius and the height of a circular cone are decreased by x% and 20% respectively so that its volume is decreased by 71.2%, then x =

   A. 36.
   B. 40.
   C. 60.
   D. 64.

10. A sum of $30 000 is deposited at an interest rate of 3% per annum for two years, compounded monthly. Find the interest correct to the nearest dollar.

   A. $1 800
   B. $1 825
   C. $1 848
   D. $1 853

11. It is given that y partly varies as x and partly varies inversely as x^2. When $x = 1$, $y = -7$ and when $x = 2$, $y = 7$. When $x = -2$, y =

   A. –13.
   B. –7.
   C. 7.
   D. 13.

12. Peter drives a car from city A to city B for 9 hours. His driving speed for the first 5 hours and the last 4 hours are 54 km per hour and 63 km per hour respectively. Find his average driving speed for the 9 hours.

   A. 13 km per hour
   B. 42 km per hour
   C. 58 km per hour
   D. 59 km per hour

13. $\sqrt{123}$ =

A. 11.090 (correct to 3 decimal places).

B. 11.09 (correct to 2 significant figures).

C. 11.0 (correct to 1 decimal places).

D. 11 (correct to the nearest integer).

14. The weight of a pack of flour is measured as 100 kg correct to the nearest kg. If the flour is packed into n bags such that the weight of each bag is measured as 500 g correct to the nearest 5 g, find the greatest possible value of n.

A. 196

B. 200

C. 202

D. 204

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

I. $a < 0$

II. $b < 0$

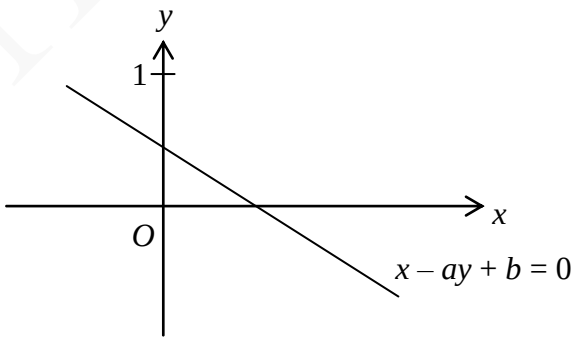
III. $a < b$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III



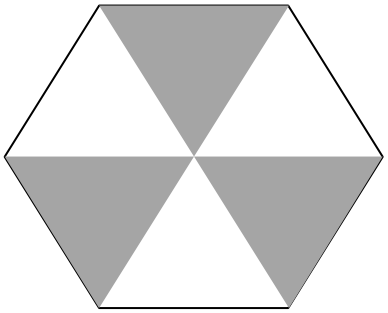
16. In the figure, the regular hexagon is divided into six identical isosceles triangles and three of them are shaded. The number of axes of reflectional symmetry of the hexagon is

A. 2.

B. 3.

C. 6.

D. 12.



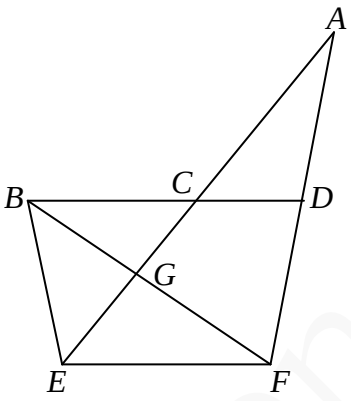
17. In the figure, *BEFD* is a trapezium. *C* is a point on *BD* such that *BC* : *CD* = 3 : 2. *DF* and *EC* are produced to meet at *A*. It is given that *EF* : *BD* = 9 : 10. If the area of Δ *ACD* is 16 cm^2, then the area of quadrilateral *CDFG* is

A. 27 cm^2.

B. 38 cm^2.

C. 65 cm^2.

D. 81 cm^2.



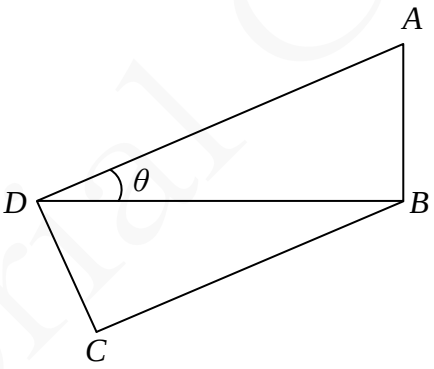
18. In the figure, $\angle ABD = \angle ADC = \angle BCD = 90^o$. If $CD = \lambda$, then AB =

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

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

C. $\lambda \sin\theta \tan\theta$.

D. $\lambda \cos\theta$.



19. $\dfrac{\sin 60^o}{1+\sin(90^o+\theta)} + \dfrac{\sin 240^o}{1+\sin(270^o+\theta)} =$

A. $-\dfrac{1}{\sin^2\theta}$.

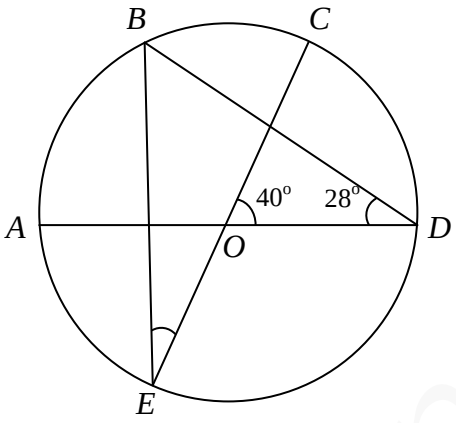
B. $-\dfrac{1}{\sin\theta\tan\theta}$.

C. $-\dfrac{\sqrt{3}}{\sin\theta\tan\theta}$.

D. $-\dfrac{\sqrt{3}}{\sin^2\theta}$.

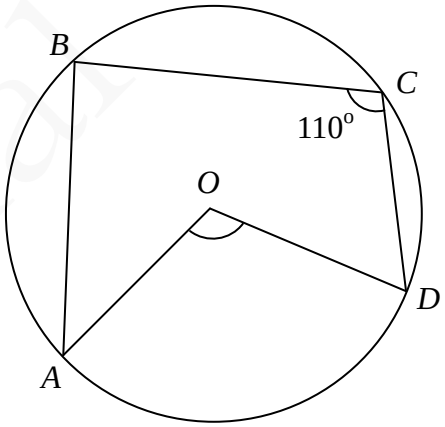
20. In the figure, O is the centre of the circle $ABCDE$. If $\angle COD = 40^o$ and $\angle ADB = 28^o$, then $\angle BEC =$

A. 38^o.
B. 40^o.
C. 42^o.
D. 44^o.



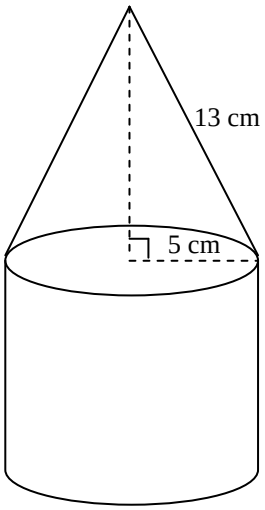
21. In the figure, O is the centre of the circle $ABCD$. If $\overset{\frown}{AB} : \overset{\frown}{BC} : \overset{\frown}{CD} = 3 : 3 : 2$ and $\angle BCD = 110^o$, then $\angle AOD =$

A. 84^o.
B. 96^o.
C. 112^o.
D. 136^o.



22. In the figure, the solid consists of a right circular cone and a cylinder with a common base and the same height. The base radius and the slant height of the cone are 5 cm and 13 cm respectively. Find the total surface area of the solid.

A. 180π cm^2
B. 210π cm^2
C. 235π cm^2
D. 400π cm^2



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23. For $0^o \le \theta \le 90^o$, the largest value of $\frac{5}{2\cos^2\theta + 4\cos^2(90^o - \theta)}$ is

A. 5.

B. $\frac{5}{2}$.

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

D. $\frac{5}{6}$.

24. The coordinates of the point A are (–3, 6). A is translated downwards 12 units to the point B. B is then rotated anticlockwise about the origin through 90^o to the point C. Find the y-coordinate of C.

A. –6

B. –3

C. 3

D. 6

25. Denote the circle $5x^2 + 5y^2 + 15x - 25y - 18 = 0$ by C. Which of the following are true?

I. The origin lies inside C.

II. The area of C is less than 40 square units.

III. The perpendicular distance from the centre of C to the y-axis is 1.5.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

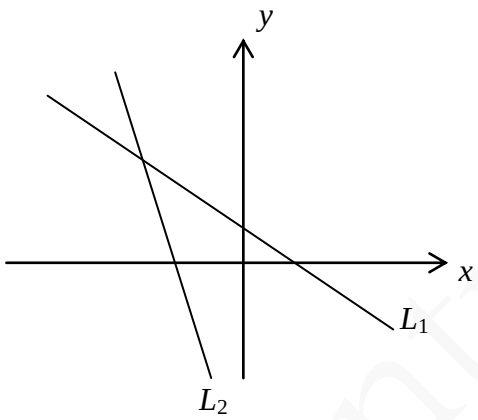
26. In the figure, the equations of the straight lines L_1 and L_2 are $ax + y = b$ and $cx + y = d$ respectively. Which of the following are true?

I. $a > 0$

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

27. Ken has three \$100 banknotes, one \$500 banknote and one \$1 000 banknote in his wallet. If Ken draws out three banknotes randomly from his wallet, find the probability that he gets at most \$1 200.

A. $\frac{7}{10}$

B. $\frac{1}{10}$

C. $\frac{9}{10}$

D. $\frac{59}{60}$

28. $\{ b - 8, b - 5, b + 1, b + 3, b + 7, b + 9 \}$ and $\{ b - 7, b - 4, b - 1, b + 5, b + 6, b + 8 \}$ are two groups of numbers. Which of the following is/are true?

I. The two groups of number have the same mean.

II. The two groups of number have the same median.

III. The two groups of number have the same range.

A. I only

B. II only

C. I and II only

D. I and III only

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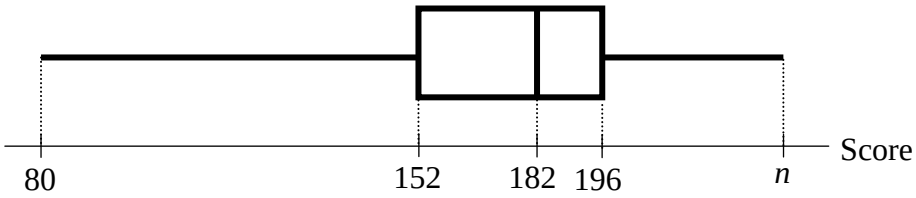
29. The box-and-whisker diagram below shows the distribution of the scores in a competition by a group of contestants. If the inter-quartile range of the distribution is one-fourth of its range, find n.



A. 200

B. 256

C. 313

D. 372

30. Consider the following data:

29 20 20 21 21 23 24 24 25 26 27 27 28 m n

If the median and the mean of the above data are 25, which of the following are true?

I. $m \geq 25$

II. $m + n = 60$

III. $n \leq 35$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Section B

31. The L.C.M. of $a^2 - 6a + 9$, $a^2 - 9$ and $a^3 - 27$ is

    A. $a - 3$.

    B. $(a - 3)^2(a + 3)(a^2 - 3a + 9)$.

    C. $(a - 3)^2(a + 3)(a^2 + 3a + 9)$.

    D. $(a - 3)^3(a + 3)(a^2 + 3a + 9)$.

32. The figure shows the graph of $y = \log_a x$ and the graph of $y = \log_b x$ on the same rectangular coordinate system, where a and b are positive constants. If a vertical line L cuts the graph of $y = \log_a x$, the graph of $y = \log_b x$ and the x-axis at A, B and C respectively, which of the following are true?

    I. $a > b$

    II. $ab > 1$

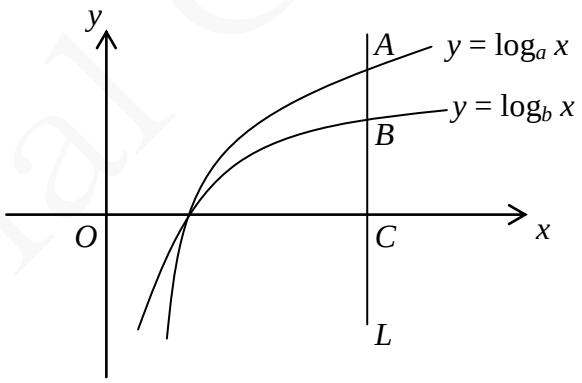
    III. $\dfrac{AC}{BC} = \log_a b$

    A. I and II only

    B. I and III only

    C. II and III only

    D. I, II and III



33. $12 \times 16^{14} + 18 \times 16^{13} + 16^2 + 18 =$

    A. $C1200000000022_{16}$.

    B. $D2000000000112_{16}$.

    C. $C12000000000022_{16}$.

    D. $D20000000000112_{16}$.

34. If the roots of the quadratic equation $x^2 - 5x + 3 = 0$ are α and β, then $\alpha^2 + 5\beta =$

    A. 22.

    B. 12.

    C. –18.

    D. –28.

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35. The real part of $4i + 3i^2 + 2i^3 + i^4$ is

    A. –2.

    B. 2.

    C. –4.

    D. 4.

36. Considering the following system of inequalities:

$$\begin{cases} x \geq 0 \\ y \geq 0 \\ 2x + 3y \leq 30 \\ 3x + y \leq 17 \\ 5x + y \leq 25 \end{cases}$$

    Let D be the region which represents the solution of the above system of inequalities. If (x, y) is a point lying in D, then the greatest value of $2y + 3x – 24$ is

    A. –6.

    B. 1.

    C. 6.

    D. 10.

37. The nth term of a sequence is $3n + 4$. If the sum of the first m terms of the sequence is less than 2016, then the greatest value of m is

    A. 34.

    B. 35.

    C. 38.

    D. 39.

38. If $(a^2)^x = b^{\frac{1}{x}}$, then $x^2 =$

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

B. $2\log\frac{b}{a}$.

C. $\frac{1}{2}\log_a b$.

D. $\frac{1}{2}\log_b a$.

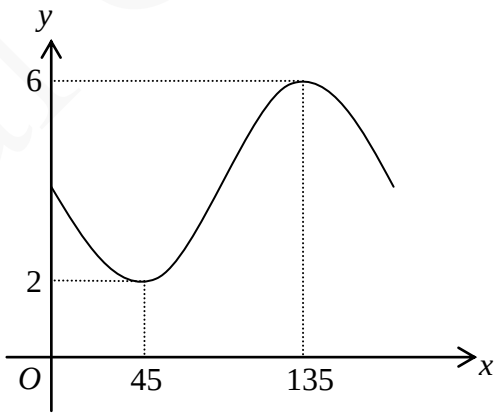
39. The figure shows

A. the graph of $y = 4 - 2\sin 2x^o$.

B. the graph of $y = 4 - 2\sin \frac{x^o}{2}$.

C. the graph of $y = 4 + 2\sin 2x^o$.

D. the graph of $y = 4 + 2\sin \frac{x^o}{2}$.



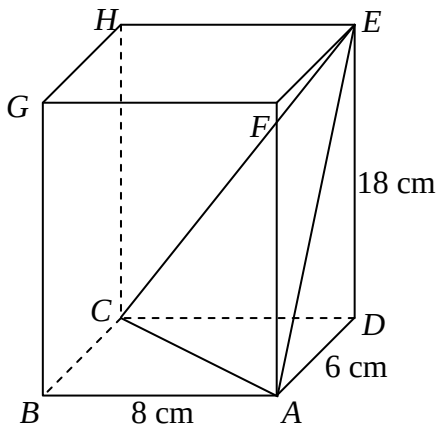
40. The figure shows a rectangular block *ABCDEFGH*. If the angle between the triangle *ACE* and the plane *ABCD* is θ, then $\tan\theta =$

A. 3.

B. $\frac{18}{5}$.

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

D. $\frac{15}{4}$.



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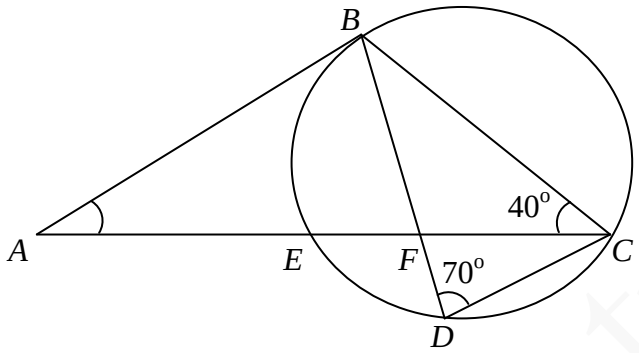
41. In the figure, AB is the tangent to the circle $BCDE$. If $\angle BDC = 70^o$ and $\angle BCA = 40^o$, then $\angle BAE =$

A. 30^o.
B. 40^o.
C. 50^o.
D. 70^o.



42. Find the range of values of k such that the circle $x^2 + y^2 - 3x + 6y + 8 = 0$ and the straight line $2x + 3y = k$ intersect.

A. $-\frac{25}{2} \le k \le \frac{1}{2}$
B. $-\frac{25}{2} < k < \frac{1}{2}$
C. $k \le -\frac{25}{2}$ or $k \ge \frac{1}{2}$
D. $k < -\frac{25}{2}$ or $k > \frac{1}{2}$

43. There are 13 girls and 9 boys in a singing club. If a team of 6 students is selected from the club to take part in a competition and the team consists of at least one boy, how many different teams can be formed?

A. 11 583
B. 72 897
C. 74 529
D. 74 613

44. If 7 girls and 2 boys stand in a line randomly, find the probability that the two boys stand next to each other.

A. $\frac{1}{9}$

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

C. $\frac{1}{3}$

D. $\frac{1}{27}$

45. Let m_1, r_1 and s_1 be the median, the range and the standard deviation of a group of numbers { x_1, x_2, x_3,..., x_{50} } respectively. If m_2, r_2 and s_2 be the median, the range and the standard deviation of a group of numbers { x_1, x_2, x_3,..., x_{50}, m_1 } respectively, which of the following must be true?

I. $m_1 = m_2$

II. $r_1 = r_2$

III. $s_1 = s_2$

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

END OF PAPER

