MOCK EXAM 1
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. $(a + b)(a^2 - ab - b^2) =$
    A. $(a + b)^3$.
    B. $a^3 + b^3$.
    C. $a^3 - 2ab^2 - b^3$.
    D. $a^3 - 2a^2b - 2ab^2 - b^3$.

2. $\dfrac{(8y^{10})^2}{4y^7} =$
    A. $4y^6$.
    B. $16y^6$.
    C. $4y^{13}$.
    D. $16y^{13}$.

3. If $a = 5 - \dfrac{6}{b-3}$, then $b =$
    A. $\dfrac{21-3a}{5-a}$.
    B. $\dfrac{21+3a}{5-a}$.
   C. $\dfrac{21-3a}{5+a}$.
    D. $\dfrac{21+3a}{5+a}$.

4. $1.09876504 =$

    A.   1.098765 (correct to 7 significant figures).

    B.   1.09876 (correct to 6 decimal places).

    C.   1.0987 (correct to 5 significant figures).

    D.   1.098 (correct to 4 decimal places).

5. If $7m + 3n = 3m - 2n = 23$, then $n =$

    A. -5.

    B. -4.

    C.   4.

    D.   5.

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

    A. $\dfrac{11}{7}$.

    B. $\dfrac{4}{3}$.

    C. $\dfrac{55}{26}$.

    D. $\dfrac{70}{39}$.

7. Let m be a constant. Solve the equation $x^2 - 5x = (m - 2)^2 - 5(m - 2)$.

    A. $x = m - 2$ or $x = m - 7$

    B. $x = m - 2$ or $x = 7 - m$

    C. $x = 2 - m$ or $x = m - 7$

    D. $x = 2 - m$ or $x = 7 - m$

8. If $f(x) = 2x^2 - 4x + 2$. Then $f(2k - 3) =$
   A. $4k^2 - 8k + 8$.
   B. $4k^2 - 8k + 32$.
   C. $8k^2 - 32k + 8$.
   D. $8k^2 - 32k + 32$.

9. Let $f(x) = x^3 + x^2 + kx + 9$. If $x + 3$ is a factor of $f(x)$, then $k =$
   A. -15.
   B. -9.
   C. -3.
   D. 3.

10. The solution of $-4x < 12 - x$ and $7x - 14 > 0$ is
    A. $x > -4$.
    B. $x > 2$.
    C. $-4 < x < 2$.
    D. $x < -4$ or $x > 2$.

11. In a factory, 54.5% of the workers are male. If 75% of the female workers and 50% of the male workers are married, then find the number of unmarried workers given that there are 273 married female workers.
    A. 218
    B. 273
    C. 309
    D. 364

12. Let a_n be the nth term of a sequence. If $a_4 = 34$, $a_6 = 89$ and $a_{n+2} = a_{n+1} + a_n$ for any positive integer n, then $a_7 =$

    A. 144.

    B. 133.

    C. 123.

    D. 55.

13. It is given that z varies directly as x and inversely as y^2. If x is decreased by 20% and z is increased by 25%, then y

    A. is increased by 25%.

    B. is increased by 75%.

    C. is decreased by 20%.

    D. is decreased by 80%.

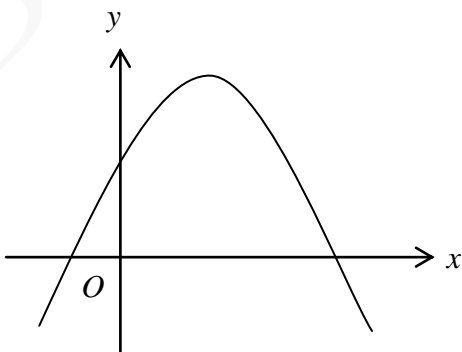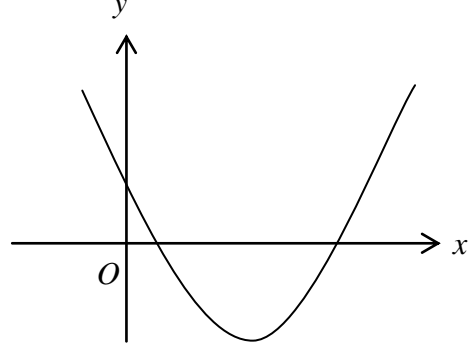14. If $0 < a < 4$, which of the following may represent the graph of $y = -(ax + 2)^2 + a$?

    A.

    B.

    C.

    D.

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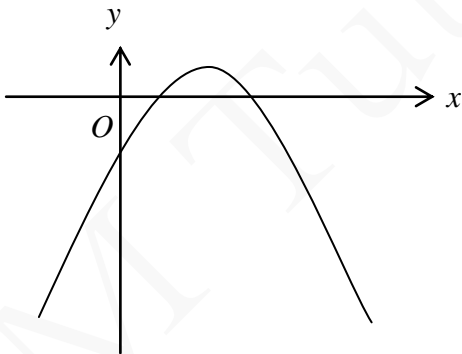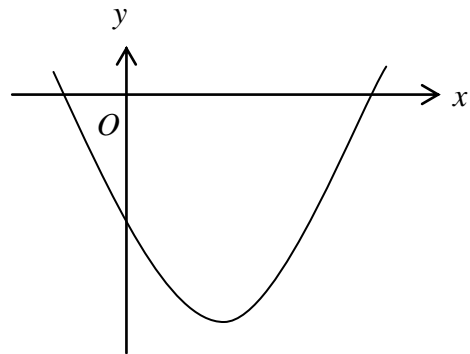
15. The scale of a map is 1 : 5000. If the area of a park on the map is 12 cm^2, then the actual area of the park is

    A. 3×10^8 m^2.

    B. 7.2×10^5 m^2.

   C. 6×10^4 m^2.

    D. 3×10^4 m^2.

16. The ratio of the radius of a right circular cylinder to the radius of a right circular cone is 5:9 while the ratio of the volume of the right circular cylinder to the volume of the right circular cone is 25:27. If the height of the circular cone is 45 cm, then the height of the cylinder is

    A. 30 cm.

    B. 35 cm.

    C. 40 cm.

    D. 45 cm.

17. In the figure, *BDEF* is a parallelogram. *D* and *F* are points lying on *AB* and BC respectively such that $AD : DB = 4 : 5$. If the area of $\triangle EFC$ is 5 cm^2, then the area of $\triangle ABC$ is

    A. 11.2 cm^2.

    B. 12.2 cm^2.

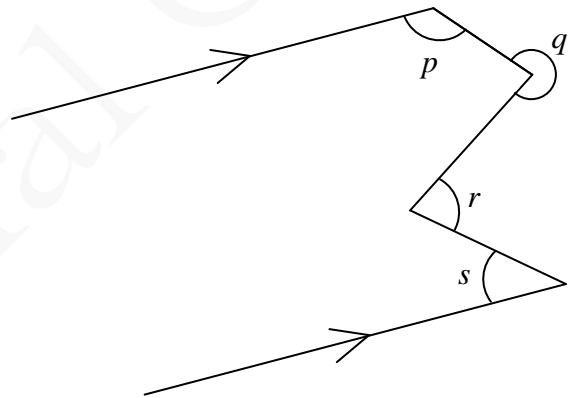   C. 16.2 cm^2.

    D. 19 cm^2.
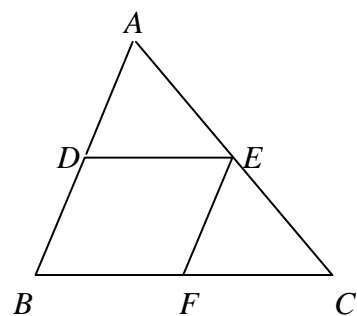
18. In the figure, AB = 12 cm, AE = 5 cm, DE = 84 cm and BC = 36 cm. If $\angle BAE = \angle BED = \angle BCD = 90^{\circ}$, find the perimeter of the quadrilateral $BCDE$.

    A.   186 cm

    B.   198 cm

    C.   210 cm

    D.   214 cm
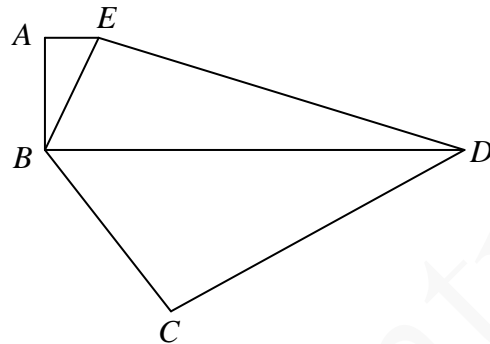
19. According to the figure, which of the following must be true?

    A. $p + q - r = 90^{\circ}$

    B. $p + r - s = 180^{\circ}$

    C. $p + q - r - s + 180^{\circ} = 0^{\circ}$

    D. $p - q - r + s + 180^{\circ} = 0^{\circ}$

20. If the sum of the interior angles of a regular polygon is 1260°, which of the following is/are true?

   I.   The number of diagonals of the polygon is 9.

   II.   The number of axes of reflectional symmetry of the polygon is 9.

   III. The exterior angle of the polygon is 40°.

    A.   I only

    B.   II only

    C.   I and III only

    D.   II and III only

21. In the figure *ABCD* is a rhombus. The point of intersection of *AC* and *BD* is *E*. Let *F* be a point such that *EF // AG* and *BFGH* is a rectangle, where *G* and *H* are points lying on *AB* produced and *DB* produced respectively. Denote the point of intersection of *BC* and *EF* by *I*. Which of the following must be true?

   I. $BI = FI$

   II. $\angle BGH = \angle CDE$

   III. $\triangle ADE = \triangle GBH$

     A.   I and II only

     B.   I and III only

     C.   II and III only

     D.   I, II and III
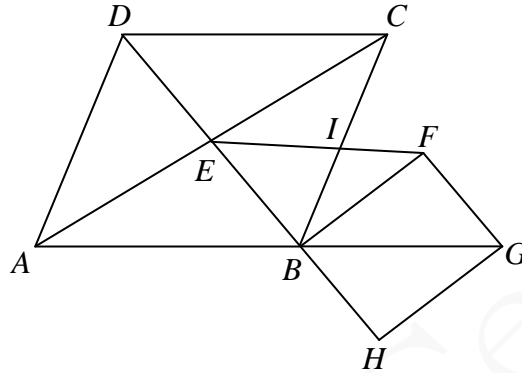
22. In the figure, *O* is the centre of the semi-circle *ABCD*. If $\overset{\frown}{BC} = 2\overset{\frown}{AD}$ and $\angle COD = 66^{o}$, then $\angle ACO =$

     A. 33°

     B. 38°

     C. 57°

     D. 66°
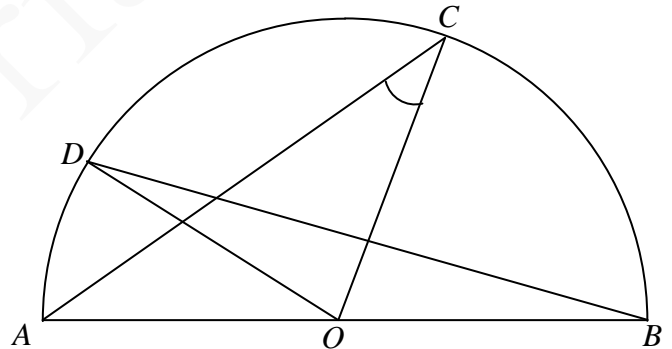
23. In the figure, *BCD* is a straight line. $\dfrac{BC}{AD} =$

     A. $\tan \alpha \sin \beta$

     B. $\tan \alpha \cos \beta$

     C. $\sin \alpha \cos \beta$

     D. $\cos \alpha \sin \beta$
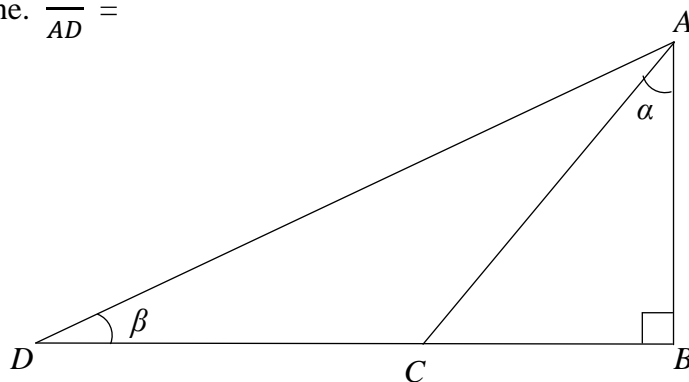
24. The rectangular coordinates of the point P are $(-\sqrt{3}, -1)$. If P is rotated clockwise about the origin through 90°, then the polar coordinates of its image are
    A. $(2, 120^\circ)$.
    B. $(2, 150^\circ)$.
    C. $(4, 120^\circ)$.
    D. $(4, 150^\circ)$

25. The coordinates of the points A and B are $(3, 6)$ and $(-5, 8)$ respectively. If P is a point lying on the straight line $x - y + 5 = 0$ such that $AP = PB$, then the x-coordinate of P is
    A. 3.
    B. 2.
    C. –2.
    D. –3.

26. Find the constant k such that the straight lines $6x - ky = 24$ and $9x + 6y = 5k$ do not intersect with each other.
    A. –9
    B. –4
    C. 4
    D. 9

27. 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

28. Two dice are thrown at the same time. Find the probability that the product of the numbers on the dice is more than 18.

    A. $\dfrac{5}{18}$

    B. $\dfrac{13}{18}$

    C. $\dfrac{2}{9}$

    D. $\dfrac{7}{9}$

29. Which of the following cannot be obtained from any box-and-whisker diagram?

    I.   Mean

    II. Median

    III. Mode

       A. I and II only

       B. I and III only

       C. II and III only

       D. I, II and III

30. Consider the following positive integers:

    12   12   12   15   15   16   16   19 m n

    Let a, b and c be the median, the mode and the standard deviation of the above positive integers respectively. If the mean of the above positive integers is 13, which of the following must be true?

    I. $a < 15$

    II. $b = 12$

    III. $c > 3.52$

       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 $x^3y^2z^2$, $x^4y^3z^4$ and $x^3y^4z^5$ is

 A. $x^3y^4z^5$.

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

 C. $x^3y^2z^2$.

 D. xyz.

32. $11010100000011100_2 =$

 A. $53 \times 2^{11} + 28$.

 B. $53 \times 2^{11} + 56$.

 C. $53 \times 2^{12} + 28$.

 D. $53 \times 2^{12} + 56$.

33. If $x = \log_3 y + 2$ and $(\log_3 y)^2 = \log_3 y - 3x + 5$, then $y =$

 A. -1

 B. $\dfrac{1}{3}$

 C. -1 or $\dfrac{1}{3}$

 D. $\dfrac{1}{3}$ or 1

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34. It is given that $\log_8 y$ is a linear function of $\log_2 x$. The intercepts on the vertical axis and horizontal axis of the graph of the linear function are 5 and –4 respectively. Which of the following is true?

    A. $x^4 y^{15} = 2^{60}$

    B. $x^{15} y^4 = 2^{60}$

    C. $\dfrac{x^{15}}{y^4} = 2^{60}$

    D. $\dfrac{y^4}{x^{15}} = 2^{60}$

35. Let $z = (a - 10)i + \dfrac{(a-3)i}{2-i}$. If a and z are real numbers, then $a + z =$

    A. 7

    B. 8

    C. 9

    D. 10

36. The sum of the first n terms of a sequence is $n(20 - 2n)$. Which of the following are true?

    I. –20 is a term of the sequence.

    II. The nth term of the sequence is $22 - 4n$.

    III. The sequence is an arithmetic sequence.

    A. I and II only

    B. I and III only

    C. II and III only

    D. I, II and III

37. Consider the following system of inequalities:

$$\begin{cases} x - y \geq -1 \\ 2x + y \leq 13 \\ x + 5y \geq -7 \end{cases}$$

Let R be the region which represents the solution of the above system of inequalities. Find the constant c such that the greatest value of $3x + 4y + c$ is 100, where (x, y) is a point lying in R.

    A.   110

    B.   88

    C.   68

    D.   60

38. In the figure, *TA* is the tangent to the circle *ABCDE*. If $\angle TAD = 67^\circ$, $\angle EDA = 26^\circ$ and $\angle CBE = 77^\circ$, then $\angle CAD =$

    A. 32°.

    B. 36°.

    C. 40°.

    D. 44°
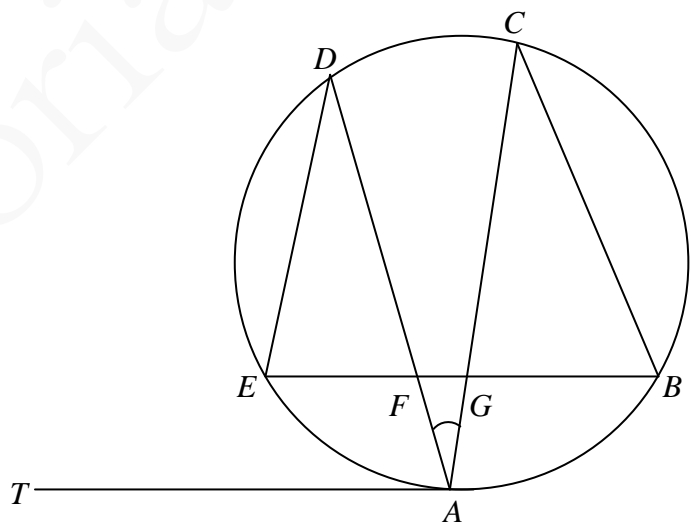
39. For $0^\circ \leq x \leq 360^\circ$, how many roots does the equation $\cos^2 x = \cos x$ have?

    A.   4

    B.   3

    C.   2

    D.   1

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40. If a side of a regular tetrahedron is 6 cm, then the volume of the tetrahedron is

    A. 12 cm^3.

    B. $12\sqrt{2} \text{ cm}^3$

    C. $18\sqrt{2} \text{ cm}^3$

    D. $18\sqrt{3} \text{ cm}^3$

41. Let G, H, I, and J be the centroid, the orthocenter, the in-centre and the circumcentre of ΔPQR respectively. If $\angle PQR = \angle PRQ = 52^{\circ}$, which of the following are true?

I. G lies inside ΔPQR.

II. H lies inside ΔPQR.

III. I, J and R are collinear.

    A.   I and II only

    B.   I and III only

    C.   II and III only

    D.   I, II and III

42. 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

43. 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. $\dfrac{7}{18}$

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

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

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

44. In a test, the mean of the test is 66 marks. Amy gets 86 marks in the test and her standard score is 2.5. If Billy gets 78 marks in the test, then his standard score is

    A. –2

    B. –1.5.

    C. 1.

    D. 1.5.

45. If the variance of the numbers x_1, x_2, x_3, x_4, x_5 and x_6 is 36, then the standard deviation of the numbers $4x_1 - 6$, $4x_2 - 6$, $4x_3 - 6$, $4x_4 - 6$, $4x_5 - 6$, and $4x_6 - 6$ is

    A. 18

    B. 24

    C. 138

    D. 144

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