MOCK EXAM 5
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. $(2u + v)(2u - v)(2u + 1) =$

    A. $8u^3 - 4u^2 + 2uv^2 - v^2$.

    B. $8u^3 - 4u^2 - 2uv^2 + v^2$.

    C. $8u^3 + 4u^2 + 2uv^2 - v^2$.

    D. $8u^3 + 4u^2 - 2uv^2 - v^2$.

2. $\dfrac{(3x)^2}{(9x^{-3})^{-1}} =$

    A. x^5.

    B. $81x^5$.

    C. $\dfrac{1}{x}$.

    D. $\dfrac{81}{x}$.

3. If $2p + 3q = 3$ and $3p + 5q = 7$, then $p =$

    A. 6.

    B. 3.

    C. –3.

    D. –6.

4. Let $f(x) = x^3 + kx^2 - 3x + 12$, where k is a constant. If $f(x)$ is divisible by $x + k$, find the remainder when $f(x)$ is divided by $x - 2$.

    A. –6

    B. –4.

    C. –2.

    D. 0.

5. If $a > b$ and $k < 0$, which of the following must be true?

    I. $ak^2 > bk^2$

    II. $a^2 > b^2$

    III. $a - k > b - k$

        A. I only

        B. II only

        C. I and III only

        D. II and III only

6. The solution of $7 - 2x < 9$ or $3x + 8 > -1$ is

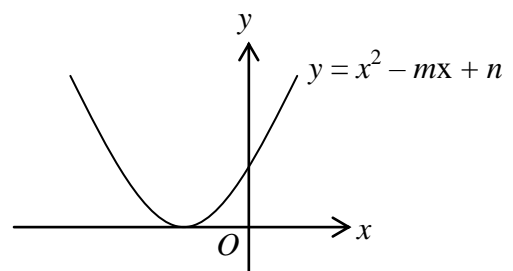   A. $x > -3$.

        B. $x > -1$.

        C. $x > 1$.

        D. $-3 < x < -1$.

7. 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 $n > 0$


8. If α is a root of the equation $5x^2 - 2x + 4 = 0$, then $1 + 6\alpha - 15\alpha^2 =$

        A. 11.

        B. 13.

        C. 15.

        D. 17.

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9. If the price of a car is increased by 80% and then decreased by 70%, find the percentage change in the price of the car.

    A.   –46%

    B.   –44%

    C.   10%

    D.   26%

10. In a company, 60% of the staff are females and y% of the females wear glasses. It is known that 60% of the male staff also wear glasses. In the company, the number staff wearing glasses and the number of female staff are equal. Find y.

    A.   10.

    B.   40.

    C.   60.

    D.   90.

11. Let a, b and c are non-zero numbers. If $a : b = 5 : 8$ and $a : c = 3 : 4$, then $(b - a) : (c - a) =$

    A.   3 : 1.

    B.   9 : 5.

    C.   6 : 5.

    D.   5 : 9.

12. In the figure, the 1st pattern consists of 3 dots. For any positive integer n, the $(n + 1)$th pattern is formed by adding $n + 2$ dots to the nth pattern. Find the number of dots in the 6th pattern.
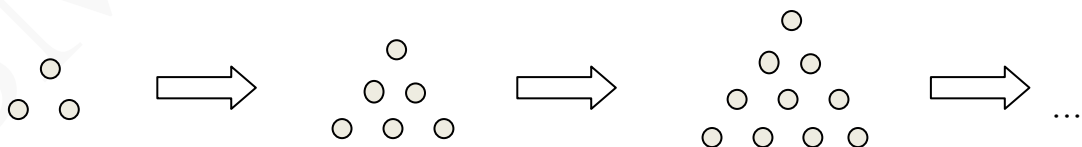

    A.   21

    B.   28

    C.   30

    D.   36

13. $0.002016789 =$

    A.   0.002016 (correct to 6 decimal places).

    B.   0.002017 (correct to 6 decimal places).

    C.   0.002017 (correct to 6 significant figures).

    D.   0.00201678 (correct to 6 significant figures).

14. In the figure, *ABCDEF* is a hexagon, where all the measurements are correct to the nearest cm. Let $y \ \text{cm}^2$ be the actual area of the octagon. Find the range of values of *y*.

    A. $66 < y < 86$

    B. $66 < y < 94$

    C. $74 < y < 86$

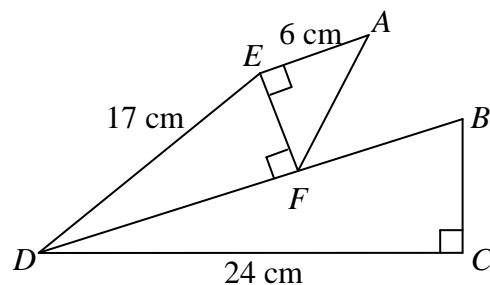   D. $74 < y < 94$
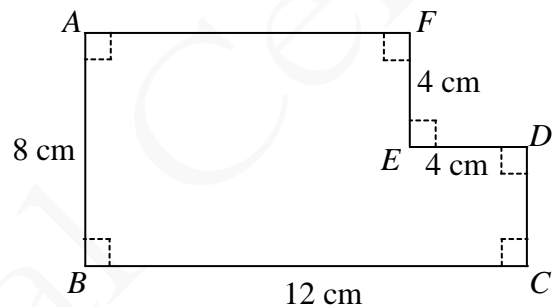
15. It is given that *z* varies directly as x^2 and inversely as y^3. When $x = 2$ and $y = 1$, $z = 32$. When $x = -1$ and $y = 2$, $z =$

    A.   32.

    B.   1.

    C.   –1.

    D.   –32.

16. In the figure, *F* is a point lying on *BD*. If $EF = 8$ cm and $AF = BF$, then the area of $\triangle BCD$ is

    A. $24 \ \text{cm}^2$.

    B. $60 \ \text{cm}^2$.

    C. $84 \ \text{cm}^2$.

    D. $168 \ \text{cm}^2$.
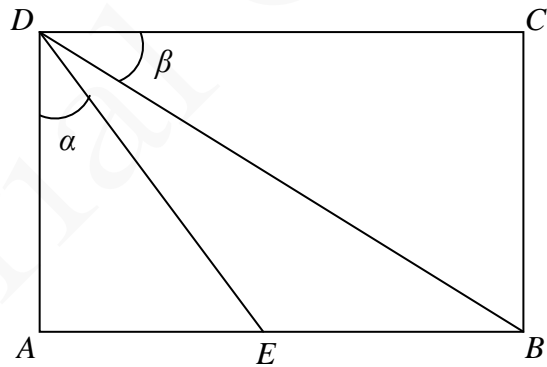
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17. In the figure, *ABCD* and *AEFG* are parallelograms. It is given that *BE* : *EF* : *FC* = 5 : 2 : 3. *BD* cuts *AE* and *FG* at the points *X* and *Y* respectively. If the area of *BEX* is 25 cm^2, then the area of the quadrilateral *CDYF* is

    A.   75 cm^2.

    B.   96 cm^2.

    C.   100 cm^2.

    D.   101 cm^2.
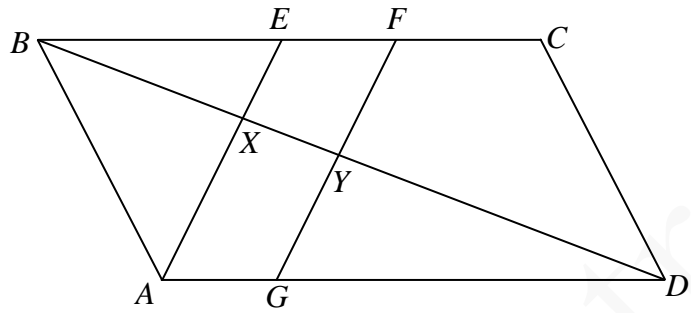
18. In the figure, *ABCD* is a rectangle. *E* is a point lying *AB*. Find $\dfrac{DE}{DB}$.

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

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

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

    D. $\sin\alpha\cos\beta$
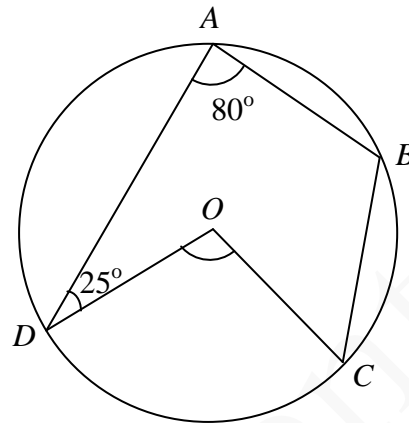
19. $\dfrac{\sin 150^{o}}{1-\sin(90^{o}+\theta)}+\dfrac{\sin 330^{o}}{1-\sin(270^{o}+\theta)}=$

    A.   0.

    B. $\dfrac{1}{\cos\theta}$.

    C. $\dfrac{1}{\sin^{2}\theta}$.

    D. $\dfrac{\cos\theta}{\sin^{2}\theta}$.

20. In the figure, O is the centre of the circle $ABCD$. If $\angle BAD = 80^o$, $\angle ADO = 25^o$ and $AB = BC$, then

    $\angle COD =$
    - A. 90°.
    - B. 100°.
    - C. 105°.
    - D. 115°.

21. The chords AC and BD of the circle $ABCD$ intersect at the point E. If $\angle AEB = 90^o$, $CE = 3$ cm,

    $DE = 4$ cm and $BD = 10$ cm, then the area of $\Delta\, AEB$ is
    - A. 6 cm^2.
    - B. 12 cm^2.
    - C. 24 cm^2.
    - D. 48 cm^2.

22. If an interior angle of a regular polygon is larger than an exterior angle of the polygon by 90°, which of
   the following is/are true?
    I. Each interior angle of the polygon is 135°.
    II. The number of diagonals of the polygon is 16.
    III. The number of folds of rotational symmetry is 8.
    - A. I only
    - B. II only
    - C. I and III only
    - D. II and III only

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

    A. $(1, 210^\circ)$.

    B. $(1, 240^\circ)$.

    C. $(2, 210^\circ)$.

    D. $(2, 240^\circ)$.

24. If P is a moving point in the rectangular coordinate plane such that the distance between P and the point $(2, 6)$ is equal to 10, then the locus of P is a

    A. circle.

    B. straight line.

    C. parabola.

    D. square.

25. It is given that A and B are two distinct points lying on the circle $x^2 + y^2 - 4x - 8y + 10 = 0$. Let P be a moving point in the rectangular coordinate plane such that $AP = BP$. The equation of the locus of P is $3x + 2y + k = 0$, where k is a constant. Find k.

    A. -16

    B. -14

    C. 14

    D. 16

26. In the figure, the equations of the straight lines L_1 and L_2 are $cy = 1$ and $ax + by = 1$ respectively. Which of the following are true?

I. $c < 0$

II. $b < c$

III. $a > 0$

    A. I and II only

    B. I and III only

    C. II and III only

    D. I, II and III
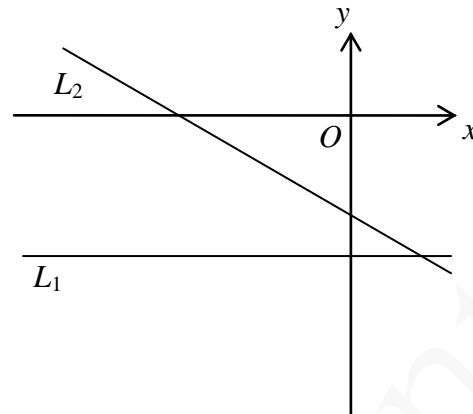
27. A fair coin is thrown three times in a game. If 3 heads are obtained, 80 tokens will be awarded; otherwise, 8 tokens will be awarded. Find the expected number of tokens of the game.
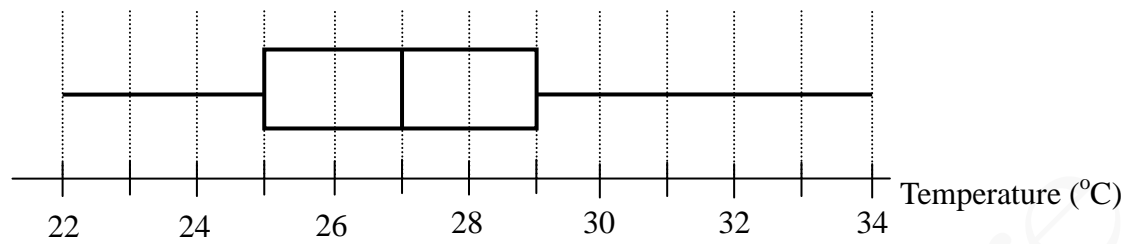
    A. 17

    B. 18

    C. 70

    D. 71

28. The bar chart below shows the distribution of the number of bags owned by a group of girls. Find the probability that a randomly selected girl from the group owns less than 2 bags.

    A. $\dfrac{1}{5}$

    B. $\dfrac{3}{7}$

    C. $\dfrac{5}{14}$

    D. $\dfrac{11}{14}$
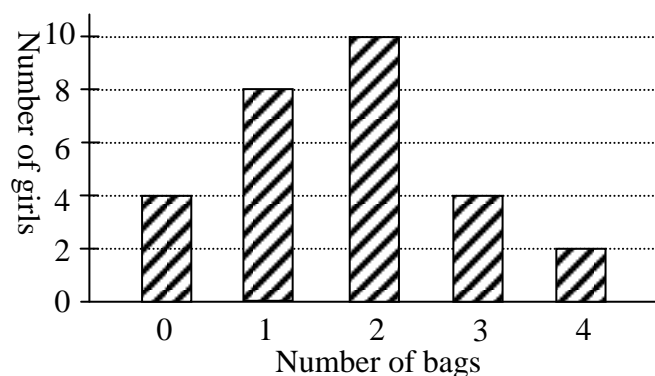
29. The box-and-whisker diagram drawn below shows the distribution of the temperatures in a month. Find the inter-quartile range of the distribution.

   A.   4 $^{\circ}$C

   B.   5 $^{\circ}$C

   C.   7 $^{\circ}$C

   D.   9 $^{\circ}$C

30. Consider the following integers:

   11   12   12   13   14   14   14   14   16   16   19   19   20   20   20   21 k

   Let a, b and c be the mean, the median, and the mode of the above integers respectively. If $14 \le k \le 16$, which of the following must be true?

   I. $a > c$

   II. $b > c$

   III. $a > b$

      A.   I only

      B.   II only
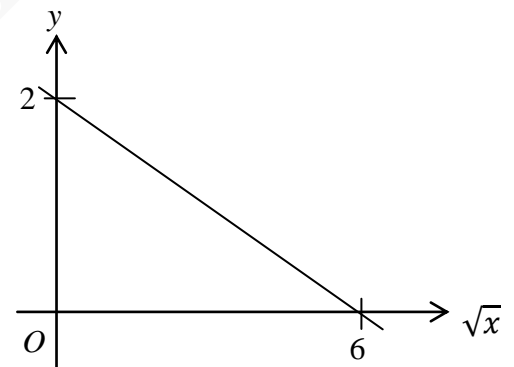
      C.   I and III only

      D.   II and III only

Section B

31. $\dfrac{1}{x^2 - 5x + 6} + \dfrac{1}{x^2 - 7x + 12} =$

  A. $\dfrac{2}{(x-2)(x-3)}$.

  B. $\dfrac{2}{(x-2)(x-4)}$.

  C. $\dfrac{2}{(x-3)(x-4)}$.

  D. $\dfrac{x-6}{(x-2)(x-3)(x-4)}$.

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

  A. $x = y^2 + 4y + 4$

  B. $x = y^2 - 4y + 4$

  C. $x = 9y^2 + 36y + 36$

  D. $x = 9y^2 - 36y + 36$

33. $21 + 2^7 + 2^8 + 2^{12} =$

  A. 1000110010101_2.

  B. 1001101010101_2.

  C. 10000110010101_2.

  D. 10001101010101_2.

34. Let k be a constant. If the roots of the quadratic equation $x^2 - kx - 4 = 0$ are α and β, then $\alpha^3 + \beta^3 =$

  A. k^3.

  B. $k^3 + 8k$.

  C. $k^3 + 12k$.

  D. $k^3 - 12k$.

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35. Let $f(x) = 4x^2 + kx + 20$, where k is a constant. If the y-coordinate of the vertex of the graph of $y = f(x)$ is 16, then $k =$

    A.   4.

    B.   4 or –4.

    C.   8 or –8.

    D.   16 or –16.

36. Let β is a real number. Define $u = z + \dfrac{1}{z}$ and $v = z - \dfrac{1}{z}$ where $z = \dfrac{\beta - i}{\beta + i}$. Which of the following must be true?

    I.   The imaginary part of u is 0.

    II.   The imaginary part of v is equal to the imaginary part of $2z$.

    III. v is a real number.

    A.   I and II only

    B.   I and III only

    C.   II and III only

    D.   I, II and III

37. Which of the following are arithmetic sequences?

    I. $\log x, \log x^3, \log x^5$

    II. π^2, π^4, π^6

    III. $y - \log x, 2y - \log x^2, 3y - \log x^3$

    A.   I only

    B.   I and II only

    C.   I and III only

    D.   I, II and III only

38. For $0^\circ \le x \le 360^\circ$, how many roots does the equation $3\cos^2 x + \sin x = 3$ have?
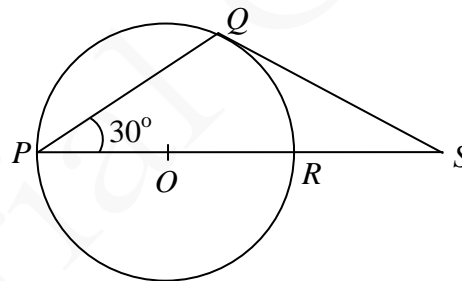
    A.   2

    B.   3

    C.   4

    D.   5

39. Let f(x) be a quadratic function. The figure below may represent the graph of $y = $ f(x) and

    A. the graph of $y = -4$f(x).
    B. the graph of $y = $ f($-4x$).
    C. the graph of $y = -$f($x - 6$).
    D. the graph of $y = $ f($-x + 6$).
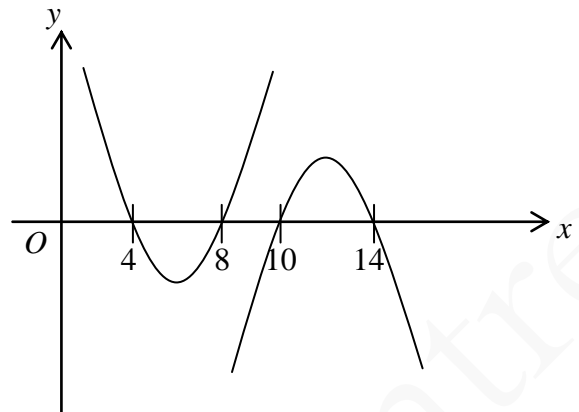
40. In the figure, O is the centre of the circle PQR. If $PORS$ is a straight line and QS is a tangent to the circle with radius 3 cm, find the length of QS.

    A. 1.5 cm
    B. $\sqrt{3}$ cm
    C. $2\sqrt{3}$ cm
    D. $3\sqrt{3}$ cm

41. Find the values of k such that the circle $x^2 + y^2 + kx - 4y + 6 = 0$ and the straight line $x - y + 6 = 0$ intersect at only one point.

    A. -4 or -20
    B. -4 or 20
    C. 4 or 20
    D. 4 or -20

42. Let O be the origin. If the coordinates of points A and B are (0, 36) and (24, 0) respectively, then the x-coordinate of the circumcentre of $\triangle OAB$ is

    A. 12.
    B. 18.
    C. 24.
    D. 36.

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43. Amy and Bill form a queue with 7 other students. If Amy and Bill are not next to each other, how many different queues can be formed?

    A.   10 080

    B.   80 640

    C.   282 240

    D.   322 560

44. When John shoots a basketball, the probability that he scores is 0.6. If he shoots the basketball 5 times, find the probability that he scores at least once.

    A.   0.01024

    B.   0.4

    C.   0.6

    D.   0.98976

45. Let x_1, y_1 and z_1 be the median, the inter-quartile range and the standard deviation of a group of numbers $\{a, b, d, e\}$ respectively while x_2, y_2 and z_2 be the median, the inter-quartile range and the standard deviation of a group of numbers $\{a + 1, b + 1, c + 1, d + 1, e + 1\}$ respectively where $a < b < c < d < e$. Which of the following must be true?

I. $x_1 < x_2$

II. $y_1 = y_2$

III. $z_1 > z_2$

    A.   I and II only

    B.   I and III only

    C.   II and III only

    D.   I, II and III only

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