

District Level Mathematical Olympiad[DMO]-2023/024

- A trader purchased some goods and sold 50% of the goods at a profit of 40%, sold 25% goods at a profit of 30% and remaining goods at a loss of 30%. What was his actual gain or loss percentage in his total transaction?
 - 40% loss
 - 40% gain
 - 20% gain
 - Neither loss nor gain
- Which of the followings is the least value of $\frac{3+6+9+\dots+2022}{4+8+12+\dots+2696}$?
 - $\frac{2022}{2696}$
 - $\frac{18}{24}$
 - $\frac{2040}{2720}$
 - $\frac{3}{4}$
- The length and breadth of a rectangular playground are 120 m and 90m respectively. By what percentage should the length be decreased so that the playground becomes square in shape?
 - 30%
 - 25%
 - 50%
 - 20%
- The sum of first n terms of a sequence is given by $S_n = 3n^2 - 4n$. Which of the followings is the n^{th} term of the sequence ?
 - $6n + 7$
 - $6n - 7$
 - $5n + 6$
 - $4n + 5$
- A 60m long train is travelling with a uniform speed of 72 kmph. How much time does it take to cross a 240m long bridge?
 - 15 seconds
 - 10 seconds
 - 20 seconds
 - 25 seconds
- A man can row at the speed of 18 kmph in still water. What is the speed of a flowing river if the speed of rowing down is three times the speed of rowing up?
 - 9 kmph
 - 18 kmph
 - 13.5 kmph
 - 22.5 kmph
- Two ants are running along the lines $3x - 4y + 5 = 0$ and $6x - 8y + 35 = 0$. What is the distance between these two ants if the unit is in meter?
 - 4m
 - 7m
 - 5m
 - 2.5m
- If x is increased by 10%, by what percentage will x^3 increase ?
 - 30%
 - 33.1%
 - 32.1%
 - 31.1%
- A wooden cuboid has external dimensions $6m \times 3m \times 2m$. A rod is inserted into the cuboid. What should be the maximum length of the rod to pass through the cuboid?
 - 7m
 - 11m
 - 36m
 - 1m
- If $x + y + z = 9$ and $xy + yz + zx = 26$, what is the value of $x^2 + y^2 + z^2$?
 - 29
 - 39
 - 19
 - 49
- In a race of 1km among 3 persons A, B and C; if A beats B by 80m and B beats C by 90m. By what distance (in meter) is C beaten by A?
 - 170m
 - 85m
 - 162.8m
 - 172.8m
- The product of 99 integers is 99. Which of the followings can be the appropriate sum of these integers?
 - 999
 - 997
 - 199
 - 197
- There are 8 people in a village. They consume 8 coconuts altogether. Each man consumes 2 coconuts, each woman consumes half coconut and each child consumes a quarter coconut. What is the number of men there?
 - 3
 - 2
 - 1
 - 4
- A man travels 21km due north from a point. Then he turns to the east and travels 56 km along east and again he turns to the north and travels 21 km due north. At last, how far was he from the starting point?
 - 98km
 - 56km
 - 70km
 - 42km
- For any natural number n , which of the followings is exactly divisible by 8?
 - $3^n - 1$
 - $5^n + 1$
 - $3^{2n} - 1$
 - $3^{3n} - 1$
- If $a + b + c = 9$, $b + c + d = 12$, $a + b + d = 10$ and $a + c + d = 11$, what is the value of $a + b + c + d$?
 - 17
 - 15
 - 16
 - 14
- How many diagonals can be drawn in a decagon?
 - 35
 - 15
 - 20
 - 10

18. If 3 is related to 22, 4 is to 29, 5 is to 36, and so on; to which number is 64 related?
 a. 449 b. 9 c. 10 d. 8
19. How many divisors are there of the number 1028?
 a. 3 b. 4 c. 6 d. 7
20. If $x:y = 3:4$ and $y:z = 8:9$, what is the value of $x:y:z$?
 a. 6:8:9 b. 4:8:9 c. 3:8:9 d. 2:8:9
21. The ratio of milk and water in 60 liters of milk is 4:1. How much water should be added to the mixture so that the new ratio of milk and water in the mixture would be 8:5?
 a. 6 liters b. 18 liters c. 12 liters d. 24 liters
22. If x is a real number and $0 < x < 1$, then which of the following statements is true?
 a. $\sqrt{x} < x < x^2$ b. $x^2 < \sqrt{x} < x$ c. $x < x^2 < \sqrt{x}$ d. $x^2 < x < \sqrt{x}$
23. C takes thrice as much time as B takes to complete a piece of work and B takes twice as much time as A takes to complete the same work. If they work together, they can complete the work in 18 days. In how many days can A alone complete the same work?
 a. 20 days b. 40 days c. 30 days d. 25 days
24. What is the simplified value of: $\frac{1}{\sqrt{1}+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{4}} \dots + \frac{1}{\sqrt{99}+\sqrt{100}}$?
 a. 10 b. 9 c. 11 d. 100
25. If $5^x = 7^y = 1225$, what is the value of $\frac{x+y}{xy}$?
 a. 0.5 b. 2 c. 5 d. 7
26. If $\sqrt{x} + y = 7$ and $x + \sqrt{y} = 11$, what is the solution for x and y ?
 a. $x = 4$ and $y = 5$ b. $x = 9$ and $y = 2$ c. $x = 9$ and $y = 4$ d. $x = 4$ and $y = 9$
27. Which of the followings is the sum of all positive prime factors of 2023?
 a. 24 b. 41 c. 7 d. 36
28. At which of the following points is the function $f(x) = \frac{x-3}{x^2-3x+2}$ undefined ?
 a. $x = 3, x = 2$ b. $x = 2, x = 1$ c. $x = 1, x = 3$ d. $x = 3, x = 0$
29. Three identical squares are connected one after another as shown in **(Fig.1)** which point A is joined with the points G, F and E. Without measuring by any instrument, find the sum of the angles AGH, AFH and AEH in degrees.
 a. 90° b. 78.75° c. 22.5° d. 95°
30. A six –pointed regular star is painted as shown **(Fig. 2)**. What is the ratio the shaded region to the whole area?
 a. 0.67 b. 0.4 c. 0.5 d. 0.6
31. In the figure given alongside **(Fig. 3)**, ABCD is a cyclic quadrilateral with diagonals AC and BD. If $AB = 4\text{cm}$, $BC = 4.5\text{cm}$, $CD = 3.6\text{cm}$ and $AD = 2.8\text{cm}$, what is the value of $AC \times BD$ in sq. cm ?
 a. 54 b. 108 c. 181.44 d. 27

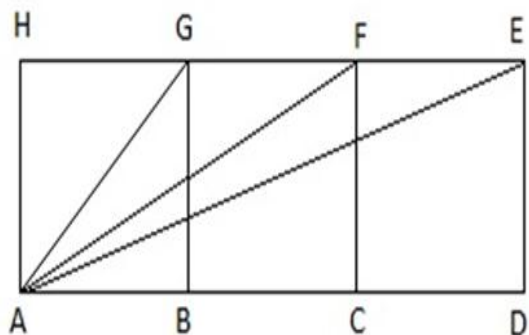


Fig. 1

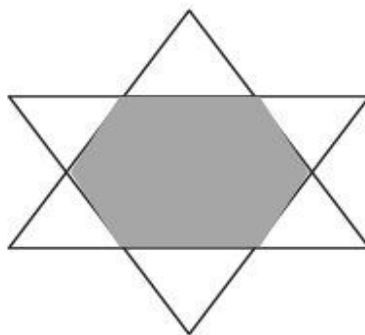


Fig. 2

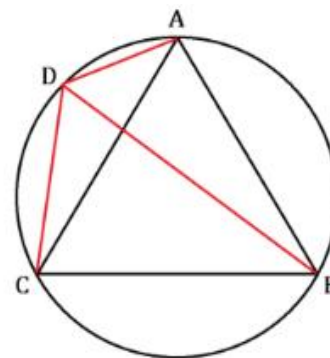


Fig. 3

32. If j and k are integers and $j-k$ is even, which of the following must be even?
 a. jk b. $j+2k$ c. $jk+j$ d. $jk-2j$
33. Given, ABCD is a rectangle. Points P, Q, R, S and T cut side AB of the rectangle such that $AD=9$, $AB=15$, $AP=3$, $PQ=QR=RS=ST=1$. E is a point on AD such that $AE=3$. Which of the following segments is parallel to the diagonal BD of the rectangle?
 a. EQ b. ER c. ES d. ET
34. A 2-foot by 2-foot by 2-foot solid cube is cut into 2-inch by 2-inch by 4-inch rectangular solids, what is the ratio of the total surface area of all the resulting smaller rectangular solids to the surface area of the original cube? (1foot=12 inches)
 a. 10:1 b. 15:1 c. 8:1 d. 5:1
35. Let X be a data set such that standard deviation of X=5. Then, the standard deviation of $\frac{3X+6}{3}$ is
 a. 7 b. 5 c. 0 d. 15
36. If P is perimeter of a triangle with one side of 7 and another side of 9, what is the range of possible values for P?
 a. $2 < P < 16$ b. $17 < P < 32$ c. $17 < P < 33$ d. $16 < P < 32$
37. When x is divided by 3, the remainder is 1, when x is divided by 7, the remainder is 2. How many positive integers less than 100 could be value of x ?
 a. 5 b. 6 c. 7 d. 4
38. If the length of a rectangle is decreased by 10% and the breadth is increased by 10%, by what percentage will the area increased or decreased?
 a. Remains constant b. Increases by 1% c. Decreases by 1% d. Increases by 2%
39. A man is standing at a distance of 60m from one tree and 54m from another tree on a playground. If the area of the triangle formed by the man and two trees is $810m^2$, at what angular position is the man standing with these two trees?
 a. 45° b. 60° c. 30° d. 15°
40. In the adjoining figure (Fig.4), what is the value of x ?
 a. $15\sqrt{2}$ b. $12\sqrt{5}$ c. $10\sqrt{6}$ d. $9\sqrt{5}$
41. How many triangles are there in the figure (Fig. 5)?
 a. 19 b. 24 c. 22 d. 20
42. A piece of paper in the shape of an equilateral triangle (Fig.6) having one corner folded over is shown alongside. What is the value of x in degrees?
 a. 60° b. 80° c. 100° d. 40°

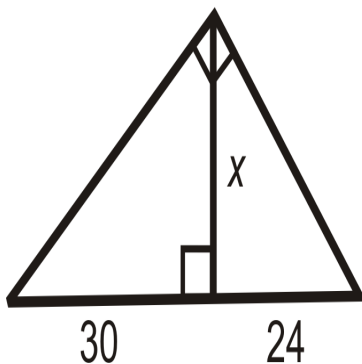


Fig. 4



Fig. 5

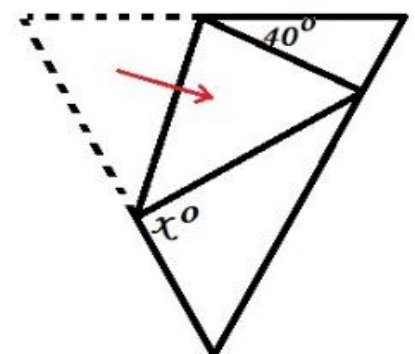


Fig. 6

43. Which of the followings is the reflection of the line $2x + 3y = 6$ on the x - axis ?
 a. $2x - 3y = 6$ b. $3x - 2y = 6$ c. $2x + 3y = 6$ d. $3x + 2y = 6$
44. A bag contains an equal number of 5 rupee, 1 rupee, 50 paise & 25 paise coins respectively. If the total value is 135, how many coin of each type of there?
 a. 22 b. 19 c. 21 d. 20
45. Auto lot has a 2:1 ratio of blue cars to red cars and a 6:1 ratio of red cars to orange cars on the lot. What could be the total number numbers of blue, red and orange cars on the lot?
 a. 37 b. 38 c. 39 d. 40
46. The traffic lights at three different road crossing changes after 48sec, 72sec & 108sec. If they all changes simultaneously at 8:20:00 hours, at what time will they again changes simultaneously?
 a. 8:30:12 hrs. b. 8:29:12 hrs. c. 8:28:12 hrs. d. 8:27:12 hrs.
47. If an ant climbing a pole completes climbing in 5 days. Ant climbs 4 meters in a day and slips down 3 meters in a night. What is the height of pole?
 a. 9m b. 8m c. 7m d. 5m
48. How many positive integers t will make the expression $\frac{19}{t} + \frac{5}{t}$ have an integer value?
 a. 6 b. 8 c. 4 d. 12
49. From figure below (**Fig. 7**), what is the ratio of the volume of the cone to the volume of the cylinder ?
 a. $1/6$ b. $1/3$ c. $2/3$ d. $1/4$
50. In the figure below (**Fig. 8**), the largest circle has a radius of six meters. Five congruent smaller circles are placed as shown and are lined up in east-to-west and north-to-south orientations. What is the radius in meters of one of the five smaller circles?
 a. 3 b. 1.5 c. 2.5 d. 2

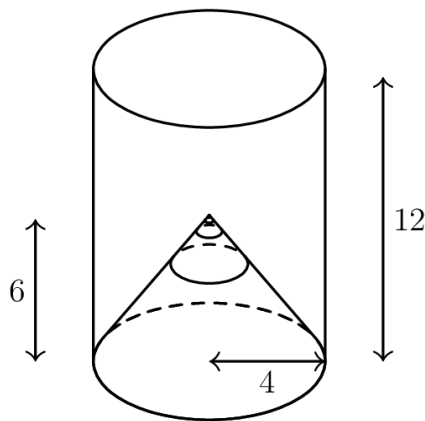


Fig.7

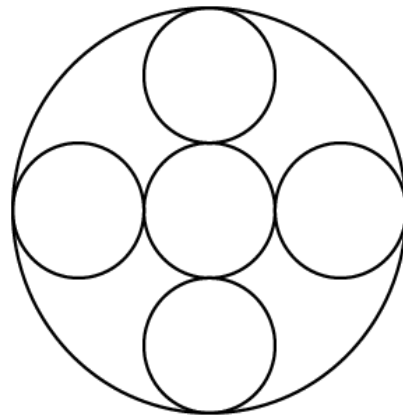


Fig. 8