

MATHEMATICS - ALGEBRA

1. What is the sum

$$1 - 2 + 3 - 4 + \dots + 98 - 100$$

- A) -50
- B) 50
- C) 0
- D) 100

2. Note that $a = x^x$, $b = x^2$, $c = x$ and $0 < x < 1$. Which one of the following correct?

- A) $a > b > c$
- B) $a > c > b$
- C) $b > a > c$
- D) $b > c > a$

3. For how many values of x does the equality

$$|x| + |x - 1| = 1 \text{ hold?}$$

- A) 0
- B) 1
- C) 2
- D) 3

4. For real numbers a , b and c , three equalities: $xy = a^2$, $yz = b^2$ and $zx = c^2$ are satisfied. x is :

- A) $\frac{ab}{b}$
- B) $\frac{ac}{b}$
- C) $\frac{bc}{a}$
- D) $\frac{c}{b}$

5. Hassan multiplied a 2-digit number by 4 and then added 3. He got reversed number (the digits of the number interchanged). What is that number?

- A) 80
- B) 71
- C) 23
- D) 17

7. Which of the following expressions is $\frac{x-1}{1-x^2} + 1$ equal to?

- A) $\frac{1}{1-x}$
- B) $\frac{x}{1-x}$
- C) $\frac{x}{1+x}$
- D) $\frac{-1}{1+x}$

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6. Given that $\frac{a+b}{b+c} + \frac{b+c}{c+a} + \frac{c+a}{a+b} = 4$
 $\frac{a-c}{b+c} + \frac{b-a}{c+a} + \frac{c-b}{a+b}$ is :

- A) 0
- B) 1
- C) 2
- D) 3

8. You are given the two numbers x and y satisfy $4x \leq 3y + 2016 \leq 2x + 2016$. What is the largest value of y ?

- A) 0
- B) 1
- C) -672
- D) 672

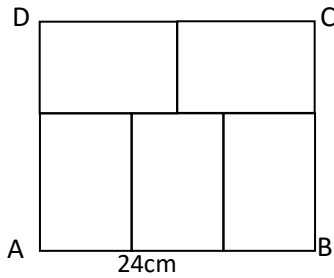
9. Given that $x + y = 3$, $y + z = 5$, and $z + x = 6$. What is z ?

- A) 2
- B) 3
- C) 4
- D) 5

10. Two buses started travelling from Arusha to Dar es Salaam and Dar es Salaam to Arusha with different constant speeds. They met at a certain place after three hours. The bus from Arusha to Dar arrived in Dar after one hour from the meeting place. Find how long the bus Dar to Arusha took to arrive in Arusha totally.

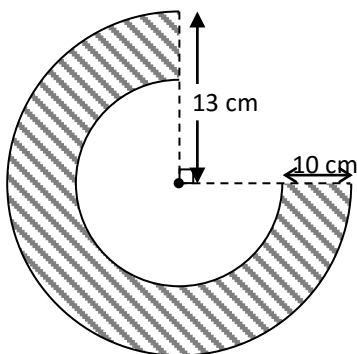
GEOMETRY

11. Rectangle ABCD is formed by five identical rectangles. If AB = 24 cm then the perimeter of the rectangle ABCD is:



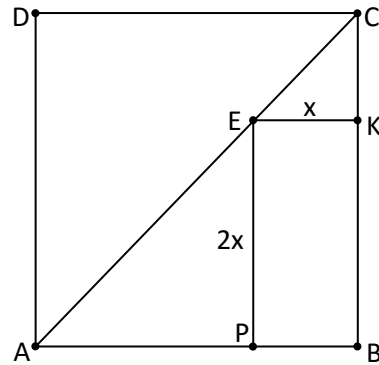
- A) 88
- B) 44
- C) 96
- D) 72

12. Find the area of the shaded region from the following figure. ($\pi = 3$)



- A) 144
- B) 208
- C) 360
- D) 160

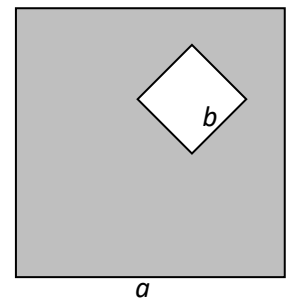
13. ABCD is a square, DC = 6cm, EK = x, EP = 2x and AC is the diagonal of the square. What is the area of the rectangle PBKE.



- A) 9
- B) 8
- C) 6
- D) 4

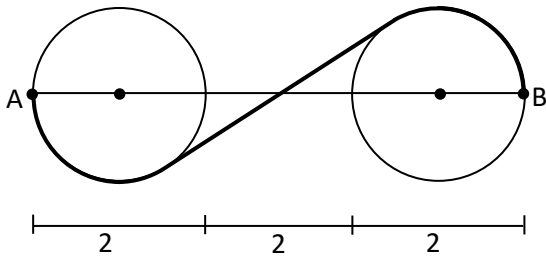
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14. In the figure, two squares are given with their sides a and b . If the sum of their perimeters is 80cm and the area of the shaded part is 100cm^2 then $a - b = ?$



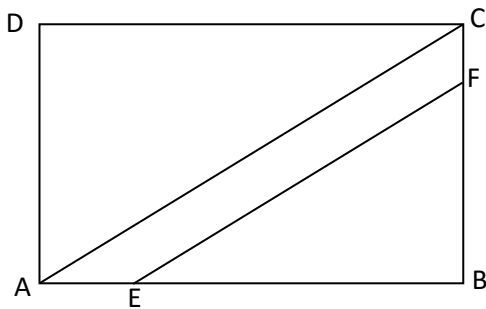
- A) 5
- B) 20
- C) 25
- D) 50

15. A rope is pulled tight around two circles as shown in the figure. The rope connects the first circle at point A and the second circle at point B. The circles have radius 1 and a mutual distance of 2. The points A, B and the centers of the circles are on the same straight line. What is the size of angle between the rope and line AB?



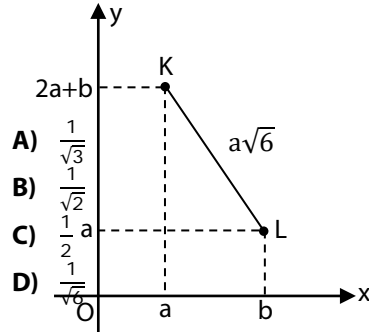
- A) 15°
- B) 30°
- C) 45°
- D) 60°

16. ABCD is a rectangle $\frac{AE}{AB} = \frac{1}{4}$, $\frac{CF}{FB} = \frac{1}{2}$, the area of AEFC is 45 cm^2 . The area of ABCD:



- A) 60
- B) 90
- C) 180
- D) 225

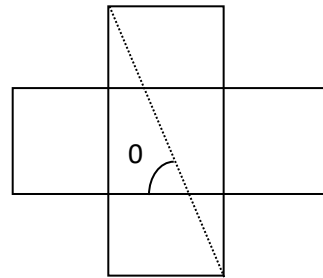
17. In a Cartesian coordinate plane, $K(a, 2a + b)$, $L(b, a)$ and $KL = a\sqrt{6}$ what is the ratio a/b ?



- A) $\frac{1}{\sqrt{3}}$
- B) $\frac{1}{\sqrt{2}}$
- C) $\frac{1}{2}$
- D) $\frac{1}{\sqrt{6}}$

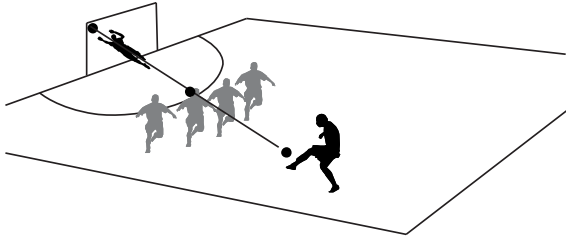
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18. The geometrical shape is formed by five identical squares shown in the figure below. What is $\sin \theta + \cos \theta$?



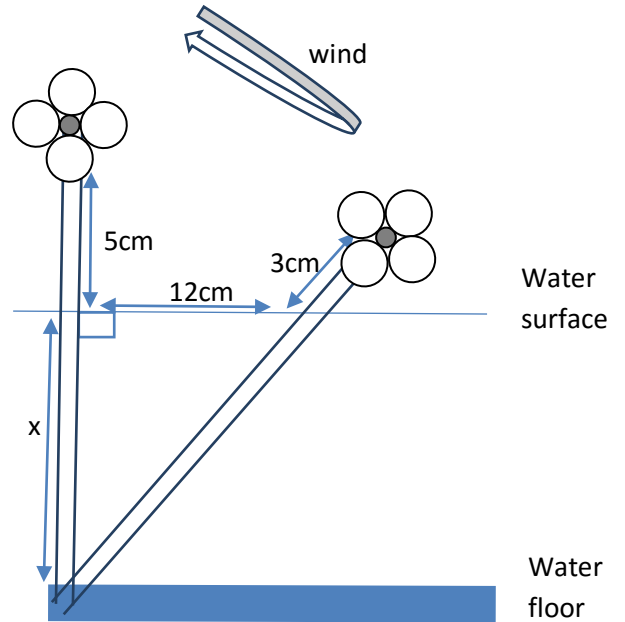
- A) $\frac{1}{\sqrt{10}}$
- B) $\frac{2}{\sqrt{10}}$
- C) $\frac{4}{\sqrt{10}}$
- D) $\frac{10}{\sqrt{10}}$

19. A football player kicked the ball towards the goalpost. The ball touched head of defender and then hit the upper part of the goalpost as shown. If the post is 2.8m tall, the distance between the striker and the defender is 9m and the defender 3m away from goalpost, how tall is the defender?



- A) 1.4
- B) 2.1
- C) 2.8
- D) 3

20. In the figure above, a flower is in a pond when the wind blows, the flower goes to its upright position. What is the value of x ?



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COMBINATORICS

21. 5 points are marked on a circle. How many segments is it possible to draw joining any two of the points without any of them intersecting? Sharing a common end point does not count as intersecting.

- A) 7
- B) 8
- C) 9
- D) 10

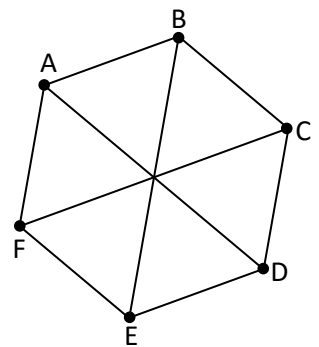
22. How many positive integers are there less than 100 and have at least two distinct digits?

- A) 18
- B) 81
- C) 90
- D) 99

23. We painted on each face of two identical solid cubes with red, blue and green such a way that opposite faces are same color. We make a block placing one cube on top of the other. In how many possible ways can we make a block?

- A) 12
- B) 16
- C) 18
- D) 32

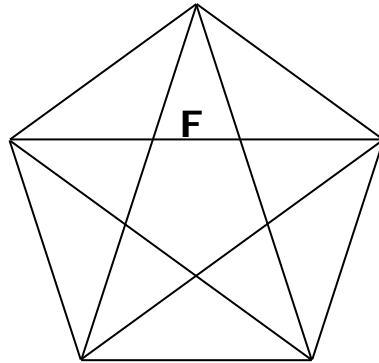
24. A regular hexagon ABCDEF with side 2 units in the figure is divided into six identical equilateral triangles by the diagonals. How many parallelograms are there?



- A) 10
- B) 9
- C) 8
- D) 6

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25. How many triangles of regular pentagon in the figure contain letter F?



- A) 6
- B) 7
- C) 8
- D) 9

27. Julian started reading a book two pages from the beginning and one page from the end in turn. If the last page she read 41st from the beginning, then what is the number of pages?

- A) 40
- B) 41
- C) 61
- D) 64

26. Emmanuel has six identical square cards: one red, three yellow and two blue. He makes cube out of the squares by gluing them together. How many different cubes can Emmanuel make? Two cubes are considered to be different if they cannot be transformed into one another by a rotation.

- A) 3
- B) 4
- C) 5
- D) 6

28. How many triangles can be formed by 5 points of which 3 are collinear?

- A) 7
- B) 8
- C) 9
- D) 10

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29. There are two distinct letters and three mailboxes. In how many ways can the letters be put into the mailboxes?

- A) 9
- B) 8
- C) 6
- D) 4

30. Fifteen subsets of a set A are arranged in such a way that no consecutive sets have common element and their union is not set A . In other words, $X_1, X_2, \dots, X_{15} \subset A$, $X_i \cap X_{i+1} = \emptyset$ and $X_i \cup X_{i+1} \neq A$. What is the number of elements of A ?

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NUMBER THEORY

31. Note that $1001 : 7 = 143$. When 100110011001100110011001 is divided by 7 what is the remainder?

- A) 3
- B) 2
- C) 1
- D) 0

32. $5p + 6 = q^2$ where p and q are two-digit prime numbers. What is the minimum value of q ?

- A) 2
- B) 11
- C) 19
- D) 23

33. Four symbols \square , Δ , \otimes and ∇ represent distinct digits. Suppose that $\square \times \square = \Delta \square$ and $\otimes + \otimes = \nabla \square$. Which digit is \square ?

- A) 5
- B) 6
- C) 7
- D) 8

34. How many prime number triples satisfy $p + q = r$ where p , q and r are prime numbers?

- A) 0
- B) 1
- C) 2
- D) Infinite

35. A student divide a 3-digit prime number by 3 and 5 he gets remainder 2 in each time. (All digits of that prime number are distinct) What is the smallest possible number?

- A) 137
- B) 107
- C) 97
- D) 89

37. Kate invited her friends to the party. If she distributes apples to 2 thirds or 5 eighths of her friends, then everyone will get exactly one. What is the minimum number of her friends?

- A) 10
- B) 12
- C) 21
- D) 24

36. Which of the following value of n makes $6n - 21$ is multiple of 15?

- A) 6
- B) 17
- C) 8
- D) 9

38. Is there any integer such that one more of its square is divisible by 3?

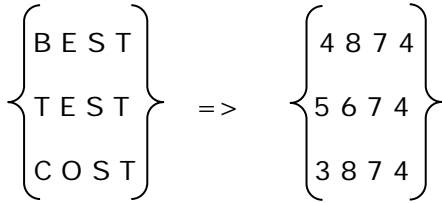
- A) only one
- B) no
- C) two
- D) infinite

39. The numbers a , b , and c are positive integers below 1000, and they satisfy $4a = 5b = 7c$.
What is the minimum value of a ?
- A) 20
 - B) 28
 - C) 35
 - D) 36

40. Solve the equation $3^m + 1 = n^2$ in integers.

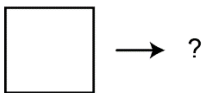
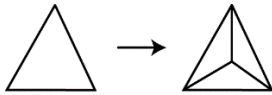
IQ QUESTIONS

41. Each word in the left column corresponds to only one number in the right column. What number corresponds to **BOOT**?







- A) 4774
- B) 5674
- C) 3664
- D) 3884

42.



Which of the following comes in place of?

- A) 
- B) 
- C) 
- D) 

43. LEAD → DEAL
 ▲↕↖▶ →

Which of the following best matches?

- A) ▲↕↖▶
- B) ▶↕↖▲
- C) ▶↖↕▲
- D) ▶↕↗▲

44. An army has formed 3 different passwords in the following.

- i. Cara shimbu zax serpent : Secret attack on Wednesday
- ii. Gradnor zax barom : Secret plans
- iii. Serpent barom gradnor cara shimbu : Attack plan on Wednesday

According to given information what does `serpent` means?

- A) Wednesday
- B) Secret
- C) Attack
- D) Plan

Genius Cup September 17, 2016

45. Collins was sent to a market to buy 18 boxes of drink. Collins can carry only 4 boxes in each turn. How many times should Collins go to the market?

- A) 4
- B) $4\frac{1}{2}$
- C) 5
- D) $5\frac{1}{2}$

47. Which of the following is odd?

- A) DODOMA
- B) TABORA
- C) TANGA
- D) MWANZA

46. Which of the following is different of others?

- A) TRIANGLE
- B) QUADRILATERAL
- C) PENTAGON
- D) CIRCLE

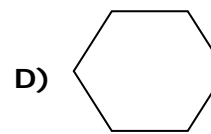
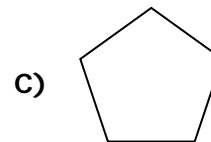
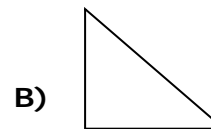
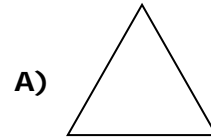
48. Which of the following letter is out of order?

- A D F I K M P
- A) D
 - B) F
 - C) K
 - D) M

49. Which one is different from others?

- A) TO EAT
- B) TO SMELL
- C) TO HEAR
- D) TO TOUCH

50. Which of the following is different?



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