ASSOCIATION OF MATHEMATICS TEACHERS OF INDIA

Screening Test – Kaprekar Contest

(NMTC SUB-JUNIOR LEVEL—VII and VIII Grades)

2024-2025

Instructions:

1. Fill in the Response sheet with your Name, Class and the Institution through which you appear, in the specified places.
2. Diagrams are only Visual guides; they are not drawn to scale.
3. You may use separate sheets to do rough work.
4. Use of Electronic gadgets such as Calculator, Mobile Phone or Computer is not permitted.
5. Duration of Test: 10 am to 12 Noon (Two hours)
6. For each correct response you get 1 mark;
   for each incorrect response, you lose ½ mark.

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1. There is a 6-digit number in which the first and the fourth digit from the first are the same, the second and the fifth digit from the first are the same and the third and the sixth digit from the first are the same. Then the number is always

a) A square number **b)** Divisible by 5

c) Divisible by 11 **d)** An odd number.

2. Starting from the number 1, Ritu generates a series of numbers as

1, 3, 6, 11, 18, 29, 42, ...

such that the differences of the consecutive numbers from the beginning give consecutive primes. In this series she came across a perfect square for the first time. The Square root of this perfect square is

a) 14 **b)** 19 **c)** 23 **d)** 21

3. The expression $\dfrac{x\left(\dfrac{\sqrt{x}+\sqrt{y}}{2y\sqrt{x}}\right)^{-1}+y\left(\dfrac{\sqrt{x}+\sqrt{y}}{2x\sqrt{y}}\right)^{-1}}{\left(\dfrac{x+\sqrt{xy}}{2xy}\right)^{-1}+\left(\dfrac{y+\sqrt{xy}}{2xy}\right)^{-1}}$ reduces to

a) $\sqrt{xy}$ **b)** $\dfrac{\sqrt{x}+\sqrt{y}}{2}$ **c)** $\dfrac{2}{\sqrt{x}+\sqrt{y}}$ **d)** $\dfrac{\sqrt{xy}}{\sqrt{x}+\sqrt{y}}$

4. The sum of the digits of a two-digit number is multiplied by 8 and the result is found to be 13 more than the number. Then the two digit number is

a) A prime number

b) An even number

c) Such that the difference of its digits is 2.

d) Such that the sum of its digits is a composite number.

5. A water tank is fitted with four different taps as outlets. If the tank is full,

it takes 1 hour to empty the tank when the first tap alone is opened;

it takes 2 hours to empty the tank when the second tap alone is opened;

it takes 3 hours to empty the tank when the third tap alone is opened;

it takes 4 hours to empty the tank when the fourth tap alone is opened.

When all the taps are opened *simultaneously*, the full tank will be emptied in

a) More than 29 minutes **b)** Between 28 and 29 minutes

c) Between 29 and 30 minutes **d)** Less than 28 minutes.

6. Two primes p, q are such that $p + q$ is odd and $q - 10p = 23$. Then $q - 20p$ equals to

a) 1 **b)** 3 **c)** 5 **d)** 7

7. Which one of the following is a false statement?

a) Diagonals of a square bisect each other at right angles.

b) Diagonals of a rectangle bisect each other.

c) Diagonals of a rhombus bisect each other at right angles.

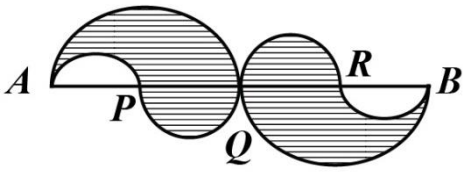
d) If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a rectangle.

8. Soham has his 23rd birthday on 1st January 2024 and he noticed that 2024 is divisible by 23. If he lives till 100 years of age, how many times other than the above, his age would be a divisor of the then year?

a) 2 **b)** 3 **c)** 4 **d)** 5

9. Consider the two figures shown here.

AB = 16 cm in both the figures.



Points P, Q, R divide AB in equal lengths in fig.1

fig.1

Similarly P,Q,R,S,T,L,M divide AB in equal length in fig 2

All the curves are semi-circles.

fig 2

If [a] and [b] are the areas of the shaded figures respectively in fig 1 and fig 2, then

a) [a] – [b] is a non-zero number. **b)** $[a] = \frac{5}{4}[b]$

c) $[a] = \frac{4}{5}[b]$ **d)** [a] = [b]

10. The sum of 11 consecutive natural numbers is 121. The sum of the next three numbers is

a) 54 **b)** 55 **c)** 53 **d)** 57

11. A big ship wrecked and 1000 people landed in a remote island. The food material was available for them for 60 days. After 16 days another small ship, which had no food stock, wrecked and 100 people landed in the same island. The number of days the food material for all of them available is

a) 42 **b)** 35 **c)** 40 **d)** 41

12. Two numbers are respectively 28% and 70% of a third number. The percentage of the first number to the second is

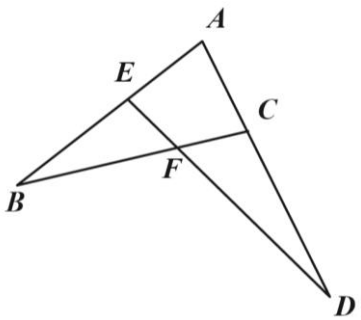
a) 40 **b)** 36 **c)** 45 **d)** 50

13. The sum of two natural numbers is 150. Their HCF is 15. The number of pairs of such numbers is

a) 1 **b)** 2 **c)** 3 **d)** 4

14. ABC and ADE are isosceles triangles.

If $\angle BFD = 156^o$, then $\angle A$ =



a) 68^o **b)** 70^o

c) 66^o **d)** 70^o

15. Some students are made to stand in rows of equal number, one behind the other. Saket is in the 3rd row from the front and 5th row from the back. He is 4th from the left and 6th from right. The total number of students is

a) 45 **b)** 72 **c)** 63 **d)** 81

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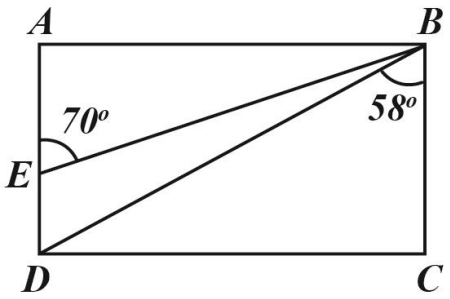
16. In the adjoining figure, ABCD is a rectangle. Then,

∠EBD = _____ degrees.



17. An infinite sequence of positive numbers $x_1, x_2, x_3, \ldots, x_n, x_{n+1}, \ldots$ satisfies $x_n^2 = (3n+7)+(n-3)x_{n+1}$, where x_n is the n^{th} term of the sequence. Then the numerical value of x_1 is _____

18. For $n \geq 2$ and $n \in Z$, the smallest positive integer n for which <u>none</u> of the fractions $\frac{17}{n+17}, \frac{18}{n+18}, \frac{19}{n+19}, \ldots\ldots\ldots, \frac{100}{n+100}$ can be simplified is _____.

19. In triangle ABC, AB = 15 cm, BC = 20 cm and CA = 25 cm. Then the length of the shortest altitude of the triangle (in cm) is _____.

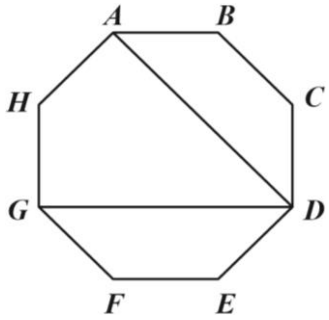
20. The units digit of $19^{2025} + 999^{2023}$ is _____.

21. N is a 2-digit number. When 6 is added to the tens digit and 2 is subtracted from the units digit, we get a two digit number which is equal to $3N$. Then N is _____.

22. ABCD is a quadrilateral. AB is parallel to CD and AB > CD. If AD = AB = BC and ∠ADC = 140°, then the measure of ∠CAB is _____degrees.

23. The product of two positive numbers x and y is 4 times their Sum and the same product is 8 times their difference. If $x \geq y$, then x = _____.

24. In the adjoining figure, ABCDEFGH is a regular Octagon. The measure of ∠ADG (in degrees) is _____.

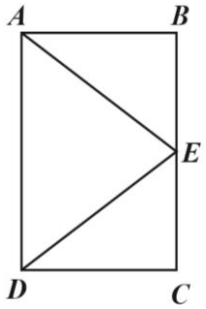


25. If $2^{3a+2} = 4^{b+7}$ and $3^{a+10} = 27^{2b+10}$ then the value of $a^2 + b^2$ is _____.

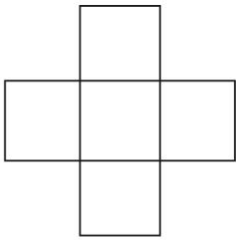
26. ABCD is a rectangle. AB = 6 and AD = 10.

E is a point on BC such that AE = 10.

Then area of ΔADE (in square units) is _____.



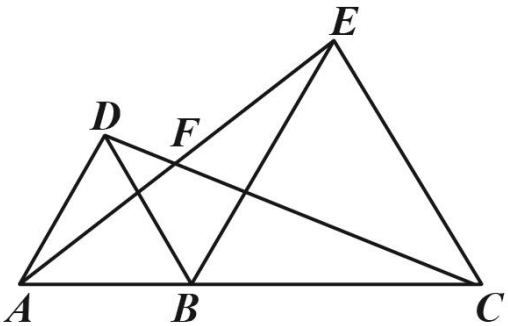
27. The numbers 1, 4, 7, 10 and 13 are placed in each box of the figure, such that the sum of the numbers in the horizontal or vertical boxes are the same. The largest possible value of the horizontal or vertical sum is _____.



28. The number of integer pairs (m , n) such that $m(n^2+1) = 48$ is _____.

29. In the adjoining figure, ΔABD and ΔBCE are equilateral triangles.

The measure of ∠AFC = _____ degrees.



30. The value of $\dfrac{\sqrt[4]{27.\sqrt[3]{9}}}{\sqrt[6]{9.3^3.\sqrt{3}}}$ is _____.

End of Question Paper