NATIONAL TALENT SEARCH EXAMINATION (NTSE-2018) STAGE -1

STATE : DELHI PAPER : MAT

Date: 00/00/2017

Max. Marks: 50 **SOLUTIONS** **Time allowed: 45 mins**

1. The value of $\frac{1}{1+\sqrt{2}}+\frac{1}{\sqrt{2}+\sqrt{3}}+\frac{1}{\sqrt{3}+\sqrt{4}}+\frac{1}{\sqrt{4}+\sqrt{5}}+\frac{1}{\sqrt{5}+\sqrt{6}}+\frac{1}{\sqrt{6}+\sqrt{7}}+\frac{1}{\sqrt{7}+\sqrt{8}}+\frac{1}{\sqrt{8}+\sqrt{9}}$ is

(1) 4 (2) 2 (3) 0 (4) 1

Ans. (2)

Sol. By multiplying numerator and denominator

$$\frac{1}{\sqrt{2}+1}\times\frac{\sqrt{2}-1}{\sqrt{2}-1} \Rightarrow \frac{\sqrt{2}-1}{1}=\sqrt{2}-1$$

Similarly, $\frac{1}{\sqrt{3}+\sqrt{2}}\times\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}-\sqrt{2}} = \sqrt{3}-\sqrt{2}$ and so on

will get

$\Rightarrow \sqrt{2}-1+\sqrt{3}-\sqrt{2}+\sqrt{4}-\sqrt{3}+\sqrt{5}-\sqrt{4}+\sqrt{6}-\sqrt{5}+\sqrt{7}-\sqrt{6}+\sqrt{8}-\sqrt{7}+\sqrt{9}-\sqrt{8}$

$\Rightarrow \sqrt{9}-1 = 3-1=2$

2. If $5\tan\theta = 3$ then $\frac{5\tan\theta-3\cos\theta}{5\sin\theta+3\cos\theta}=$ _____

(1) 0 (2) $\frac{5}{3}$ (3) $\frac{3}{5}$ (4) $\frac{4}{5}$

Ans. 0

Sol. NA

3. A regular polygon is drawn with 35 diagonals its interior angle will be

(1) 154° (2) 164° (3) 144° (4) None of these

Ans. (3)

Sol. Total number of diagonals are : $\frac{n(n-3)}{2} = 35$

$= n^2 - 3n - 70 = 0$

$\Rightarrow n^2 - 10n + 7n - 70 = 0$

$\Rightarrow (n-10) + 7(n-10) = 0$

$n = 10$

Now, interior angle will be

$$\frac{(n-2)180}{n} \Rightarrow \frac{(10-2)180}{10} = \frac{8\times180}{10} = 144°$$

4. If x means –, + means ÷, – means × and ÷ means + then $15 - 2 \div 900 + 90 \times 100 = ?$

(1) 190 (2) 180 (3) 90 (4) –60

Ans. (4)

Sol. $15 \times 2 + 900 \div 90 - 100$

$\Rightarrow 30 + 10 - 100 = -60$

5. If one root of quadratic equation $(K + 1)x^2 - 5x + 2k = 0$ is recipeocal of other then value of K is

(1) 2 (2) 0 (3) –1 (4) 1

Ans. (4)

Sol. $a \times \frac{1}{a} = \frac{2K}{K+1}$

$\Rightarrow 2K = K + 1$

$\Rightarrow K = 1$

6. What will be the ratio of volume of cube is to volume of sphere inscribed in the cube

(1) 3 : π (2) 6 : π (3) 6 : 5 (4) 2 : π

Ans. (2)

Sol. $\frac{\text{Volume of cube}}{\text{Volume of sphere}} \Rightarrow \frac{a^3}{\frac{4}{3} \times \pi \left[\frac{a}{2}\right]^3} \Rightarrow \frac{a^3 \times 24}{4\pi a^3} = \frac{24}{4\pi} = \frac{6}{\pi}$

7. If α, β are the roots of the equation $2x^2 - 5x + 16 = 0$ then the value of $\left(\frac{\alpha^2}{\beta}\right)^{\frac{1}{3}} + \left(\frac{\beta^2}{\alpha}\right)^{\frac{1}{3}}$ is

(1) $\frac{1}{4}$ (2) $\frac{5}{4}$ (3) $\frac{1}{3}$ (4) $\frac{5}{12}$

Ans. (2)

Sol. $\alpha + \beta = \frac{5}{2}$, $\alpha\beta = 8$

$$\left[\frac{\alpha^2}{\beta}\right]^{\frac{1}{3}} + \left[\frac{\beta^2}{\alpha}\right]^{-\frac{1}{3}} \Rightarrow \frac{\alpha^{\frac{2}{3}}}{\beta\frac{1}{3}} + \frac{\beta^{\frac{2}{3}}}{\alpha^{\frac{1}{3}}} \Rightarrow \frac{\alpha+\beta}{(\alpha\beta)^{\frac{1}{3}}} \Rightarrow \frac{\frac{5}{2}}{(8)^{1/3}} = \frac{5}{2\times 2} = \frac{5}{4}$$

8. Divisor is 10 times of quotient and 10 times of remainder if quotent is 10 then what is divided.

(1) 1010 (2) 1100 (3) 1001 (4) 101

Ans. (1)

Sol. Divisor = 10 Q, Q = 10

Divisior = 10 R, R = 10

$\Rightarrow$ Dividend = $100 \times 10 + 10 = 1010$

9. Value of $[(0.111)^3 + (0.222)^3 - (0.333)^3 + (0.333)^2 (0.222)]^2$ will be

(1) 222 (2) 0 (3) 333 (4) 2

Ans. (2)

Sol. By approximation

10. If n is a natural number the $9^{2n} - 4^{2n}$ is always divisible by

(1) 13 (2) both 5 and 13 (3) 5 (4) None of the above

Ans. (2)

Sol. $9^{2n} - 4^{2n}$

$\Rightarrow 81^n - 16^n \Rightarrow a^n - b^n$ is always divisible by

So, (81 – 16) = 65, factors are 13 & 5

11. If sum of LCM and HCF of two number is 50 and their LCM is 20 more than their HCF, then the product of two numbers will be

(1) 525 (2) 425 (3) 625 (4) 325

Ans. (1)

Sol. Let the LCM be x and HCF be y

$\Rightarrow x + y = 50$

$\Rightarrow x = y + 20$

$\Rightarrow y + 20 + y = 50$

$\Rightarrow 2y = 30, y = 15$

$\Rightarrow x = 35, xy = 525$

12. A 320 m long train moving at an average speed of 120km/h crosses a platform in 24 seconds. A man crossed the same plateform in 4 minutes. The speed of the man in m/sec is :

(1) 2.0 (2) 2.4 (3) 1.6 (4) 1.5

Ans. (1)

Sol. Speed of train = $120 \times \frac{5}{18} = \frac{100}{3}$ m/s

$\Rightarrow \frac{320 + x}{\frac{100}{3}} = 24 \Rightarrow 320 + x = 24 \times \frac{100}{3} \Rightarrow x = 2480$ m

Speed of Man = $\frac{480}{240}$ = 2 m/s

13. If $\frac{a^{n+1} + b^{n+1}}{a^n + b^n}$ is the AM (arthmetic mean) between a and b, then, find the value of n

(1) 1 (2) 3 (3) 2 (4) 0

Ans. (4)

Sol. $\frac{a+b}{2} = \frac{a^{n+1} + b^{n+1}}{a^n + b^n}$

By observation n = 0

14. In a certain office, $\frac{1}{3}$ of the workers are women, $\frac{1}{2}$ of the same are married and $\frac{1}{3}$ of the married women have children. If $\frac{3}{4}$ of the men are married and $\frac{2}{3}$ of the married men have children, then what part of worker are withouit children ?

(1) $5/18$ (2) $4/9$ (3) $11/18$ (4) $17/36$

Ans. (3)

Sol. Let the total number of workers be x

$\Rightarrow$ women = $\frac{x}{3}$, man = $\frac{2x}{3}$

married women = $\frac{x}{3}\times\frac{1}{2}=\frac{x}{6}$

married men = $\frac{2x}{3}\times\frac{3}{4}=\frac{x}{2}$

maried women with children = $\frac{x}{6}\times\frac{1}{3}=\frac{x}{18}$

married men with children = $\frac{x}{2}\times\frac{2}{3}=\frac{2x}{6}=\frac{x}{3}$

Total without children = $x-\left[\frac{x}{18}+\frac{x}{3}\right]=\frac{11}{18}x$

15. If in a business, Alok gains 75% gains 75% more profit than Akash, then by what percentage profit of Akash is less than the profit of Alok.

(1) 25% (2) 12.63% (3) 30.8% (4) 42.85%

Ans. (4)

Sol. Profit of Akash = x

Profit of Alok = $x+\frac{75}{100}x \Rightarrow \frac{7x}{4}$

$\Rightarrow \left[\frac{\frac{7x}{4}-x}{\frac{7x}{4}}\times 100\right] = 42.85\%$

16. The height of three towers are in the ratio of 5 : 6 : 7. If a spider takes 15 minutes to climb the smallest tower, how much time it will take the climb the highest one

(1) 15 minutes (2) 18 minutes (3) 21 minutes (4) 54 minutes

Ans. (3)

Sol. 15 minutes to climb = 5x

$\therefore$ 21 minutes to climb = 7x

17. The two vertices of a Triangle are (4, –2) and (2, –6). If centerod of a triangle is (0, 1) then third vertex of triangle will be

(1) (–6, 11) (2) (11, –6)

(3) (6, –11) (4) (6, 11)

Ans. (1)

Sol. $x = \frac{x_1 + x_2 + x_3}{3}$, $y = \frac{y_1 + y_2 + y_3}{3}$

$\Rightarrow 0 = \frac{y_1 + y_2 + y_3}{3}$, $1 = \frac{-2 - 6 + y_3}{3}$

$\Rightarrow x_3 = -6$, $y_3 = 11$

18. If $\sin\alpha$, $\cos\alpha$, $\tan\alpha$ are in GP, GP means $\cos^2\alpha = \sin\alpha.\tan\alpha$ then $\cot^6\alpha - \cot^2\alpha =$

(1) 1 (2) 0 (3) 4 (4) 2

Ans. (1)

Sol. By elemination

19. Eight members of a group shake hand with one another once. How many hand shakes were done altogether.

(1) 64 (2) 16 (3) 28 (4) 18

Ans. (3)

Sol. 7 + 6 + 5 + 4 + 3 + 2 + 1 = 28

20. Three of the six vertices of a regular hexagon are chosen at random. The probability that triangle formed by these vertices is equilateral is

(1) $\frac{1}{20}$ (2) $\frac{1}{10}$ (3) $\frac{1}{5}$ (4) $\frac{1}{2}$

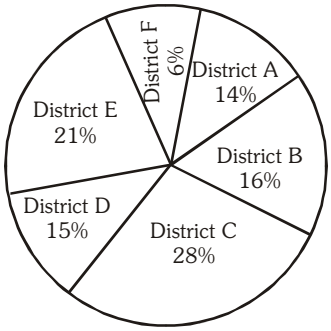
Ans. (2)

Sol. By elemination

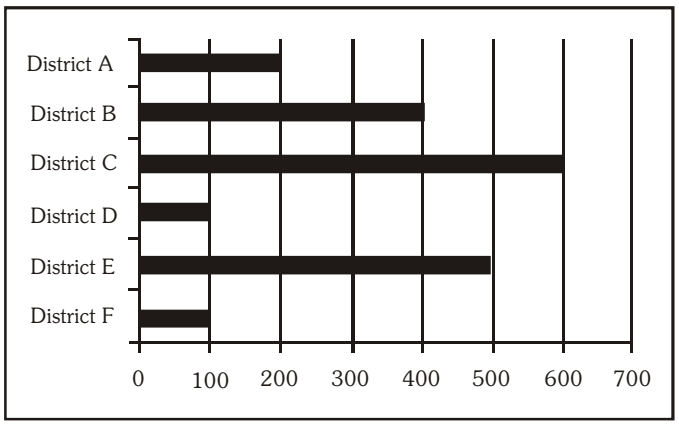
Direction: Question 21 to 25

Study the following pie-chart and bar graph and answer the following questions percentage distribution of teacher in six different districts. Total number of teachers = 4500

Percentage of teachers



Number of male of 4500



21. What is the total number of male teachers in District F, Female teachers in District C and Female teachers in District B together.

(1) 1180 (2) 1080 (3) 1020 (4) 1120

Ans. (2)

Sol. By Observation

22. The number of female teacher in district D is approximately what percent of the total number of teachers (both male and female) in District A

(1) 70 (2) 80 (3) 75 (4) 90

Ans. (4)

Sol. By Observation

23. In which district is the number of male teachers more than the number of female teachers ?

(1) B only (2) D only (3) Both B and E (4) Both E and F

Ans. (3)

Sol. By Observation

24. What is the difference between the number of female teachers in district F and total number of teachers (both male & female) in district E ?

(1) 625 (2) 775 (3) 675 (4) 725

Ans. (2)

Sol. By Observation

25. What is the ratio of the number of male teachers in district C to number of female teachers in district B ?

(1) 11:15 (2) 15:11 (3) 15:8 (4) 8:15

Ans. (3)

Sol. By Observation

26. Complete the given series

25, 255, 2545, 25455 .....

(1) 254545 (2) 25555 (3) 254555 (4) 255454

Ans. (1)

Sol. Pattern is $\times 10 + 5$, $\times 10 - 5$, $\times 10 + 5$ and so on.

27. Find the missing letter :

3	L	4
1	Q	17
5	?	4

(1) V (2) P (3) Q (4) T

Ans. (4)

Sol. $3 \times 4 = 12 - L$

$1 \times 17 = 17 - Q$

$5 \times 4 = 20 - T$

28. In the given arrangement of number after removing all even numbers which is the middle most number

18594712583659276452926412351428 3

(1) 5 (2) 7 (3) 6 (4) 9

Ans. (4)

Sol. 1 5 9 7 1 5 3 5 **9** 7 5 9 1 3 5 1 3

29. A clock is set right at 5 a.m. The clock loses 16 minutes in 24 hours. What will be the right time when the clock indicates 10 p.m. on the 4^{th} day ?

(1) 8 pm (2) 9 pm (3) 10 pm (4) 11 pm

Ans. (4)

Sol. In one hour clock loses – $\frac{16}{24}$. Total hrs. from 5 am (1^{st} day) to 11 pm (4^{th} day) = 90 hrs

So upto 11 pm (4^{th} day). It would have loses = $\frac{16}{24} \times 90$ = 60 min.

So if actual time is 11 pm. It will show 10 pm.

Direction (Q. No. 30 to 31) : Answer the questions based on the following information. Numbers are written on the Chess Board as given below.

	a	b	c	d	e	f	g	h
1	1	2	3	4	5	6	7	8
2	9	10	11	12	13	14	15	16
3	17	18	19	20	21	22	23	24
4	25	26	27	28	29	30	31	32
5	33	34	35	36	37	38	39	40
6	41	42	43	44	45	46	47	48
7	49	50	51	52	53	54	55	56
8	57	58	59	60	61	62	63	64

30. If $a_8 = a_1 + a_2 + a_3 + ...a_7$

$b_8 = b_1 + b_2 + b_3 + ...+ b_7$

. .

. .

. .

$h_8 = h1 + h2\ h3 + ...h_7$

What is $a_8 + b_8 + ... + h_8$ = _____

(1) 2080 (2) 1596 (3) 399 (4) 741

Ans. (2)

Sol. By Observation

31. The total number of odd numbers on white box are -

(1) 8 (2) 16 (3) 24 (4) 32

Ans. (2)

Sol. By Observation

Directions : Read the information given below carefully and answer the question.

x + y means x is the sister of y.

x – y means x is the son of y.

x – y means x is the mother of y.

x ≠ y means x is the father of y.

x ÷ Y y means x is brother of y.

x = y means x is daughter of y.

32. Which of the following alternative means 'F is father of J'

(1) F ÷ G ≠ H × l – J (2) J = I + H#G-F

(3) F + G – H × l – J (4)J + l – H ×G – F

Ans. (4)

Sol. By Observation

33. Five persons are standing in a line facing North. One of the two persons standing at the extreme ends is a teacher and the other is a businessman. A doctor is standing to the right of a student. A clerk is to left of the businessman. The student is standing between the teacher and the doctor. Counting from the left the doctor is at which place?

(1) I (2) III (3) II (4) IV

Ans. (2)

Sol. Teacher Student Doctor Clerk Business man

Directions (Q. No 34 to 36) : Read the information given below.

Ten friends ABCDEFGHIJ are sitting on the opposite sides of a rectangular table, five on each side of a pair of opposite sides of the table. J & F are sitting next to each other, B is sitting at middle position on one of the sides and C is sitting as far from B as B is sitting from A. A, B & C are sitting on the same side of the table. G & I are sitting opposite to each other, D is on one of the ends. E has an equal number of persons sitting on his either side. I is sitting to the immediate right of D.

34. Who is sitting opposite to G.

(1) H (2) I (3) J (4) A

Ans. (2)

Sol. By observation

35. In between of which two persons I is sitting ?

(1) D – E (2) J–E (3) B – C (4) D – B

Ans. (1)

Sol. By observation

36. In which of the following pairs, given person cannot be sitting opposite to each other ?

(1) D – C (2) F – C (3) E – B (4) G – H

Ans. (4)

Sol. By observation

37. A fruit seller does not use currency. Instead of he uses the following exchange rates :

10 strawberries = 2 Apples

1 Apple = 2 Bananas

4 Bananas =1 Mango

On the basis of the above exchange rates, how many strawberries are equal to one mango?

(1) 4 (2) 8 (3) 10 (4) 12

Ans. (3)

Sol. 1 mango = 4 bananas = 2 apples = 10 strawberries

38. if > stands for +

< stand for –

$\wedge$ stands for ×

$\vee$ stands for ÷

Then what is the value of $52 < 4 \wedge 5 > 8 \vee 2$

(1) 38 (2) 36 (3) 124 (4) 312

Ans. (2)

Sol. $52 - 4 \times 5 + 8 \div 2$

$\Rightarrow 52 - 20 + 4$

$\Rightarrow 36$

39. The time shown by the reflection of a clock in a mirror is 4 hours 35 minutes. What is the actual time in that clock ?

(1) 7 hrs 25 min. (2) 8 hrs 20 min. (3) 7 hrs 35 min. (4) 8 hrs 25 min.

Ans. (1)

Sol. 11:60 – 4:35 = 7:25

Directions (Q. No. 40 - 41) : Read the information carefully and answer the questions given below :

A cube is cut into two equal parts along a plane parallel to one of its faces. One piece is coloured orange on the two largest faces and yellow on the remaining. The other piece is coloured yellow on two smaller adjacent faces and orange on the remaining. Each is then cut into 32 cubes of the same size. These 64 cubes are mixed up. Then :-

40. How many cubes have no coloured face at all?

(1) 0 (2) 4 (3) 8 (4) 16

Ans. (1)

Sol. By observation

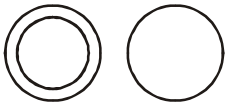
41. How many cubes have only one coloured face?

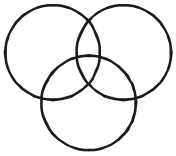
(1) 8 (2) 16 (3) 20 (4) 24

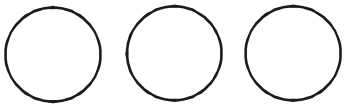
Ans. (2)

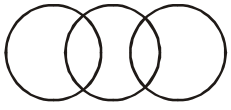
Sol. By observation

42. Choose the correct alternative that represents the relationship among illiterates, poor people and unemployed.

(1) 

(2) 

(3) 

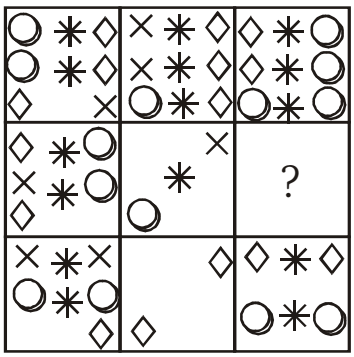
(4) 

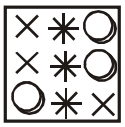
Ans. (2)

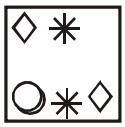
Sol. By observation

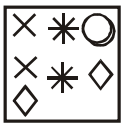
Directions (Q. No. 43 - 44) : In each of the following questions find out which of the answer figures complete the figure.

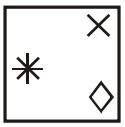
43. Question Figure



(1) 

(2) 

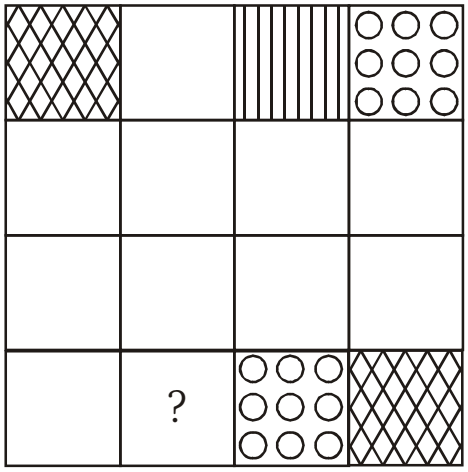
(3) 

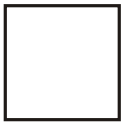
(4) 

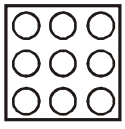
Ans. (2)

Sol. By observation

44. Question Figure



(1) 

(2) 

(3) 

(4) 

Ans. (4)

Sol. By observation

Directions (Q.45 - 46) : Select the correct alternative which will fit in the place of sign of interogation for a correct pattern.

45. 

(1) (2) (3) (4)

Ans. (3)

Sol. By observation

46. 

(1) (2) (3) (4)

Ans. (4)

Sol. By observation

47. If 'SKY WAS BLUE' is 123

'SEA IS BLUE' is 245

'PEOPLE SWIMMING IN SEA' is 4678

'PEOPLE LIKE SKY' is 801 and

'BIRDS IN SKY'' is 169. Then 'PEOPLE LIKE

BIRDS' will have the number.

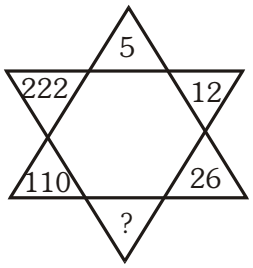
(1) 809 (2) 104 (3) 036 (4) 806

Ans. (1)

Sol. By elemminating common word

Direction (Q. No. 48 - 50) : Find the missing character in each of the following questions

48.

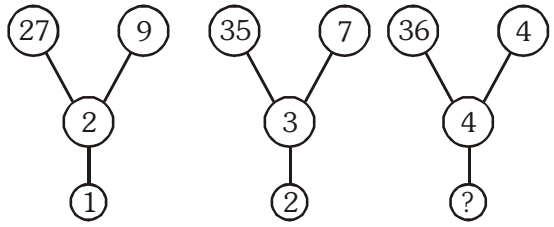


(1) 54 (2) 51 (3) 48 (4) 44

Ans. (1)

Sol. $5 \times 2 + 2 = 12$, $12 \times 2 + 2 = 26$ and so on

49.

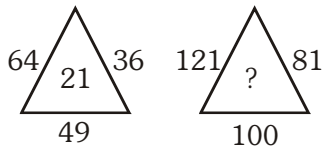


(1) 54 (2) 51 (3) 5 (4) 6

Ans. (3)

Sol. $27 \div 9 - 2 = 1$, $35 \div 7 - 3 = 2$ and so on

50.



(1) 40 (2) 30 (3) 20 (4) 10

Ans. (2)

Sol. $\sqrt{64} + \sqrt{36} + \sqrt{49} \Rightarrow 8 + 6 + 7 = 21$ and so on.