# NTSE STAGE – I (DELHI STATE)
# 05 – A (2019 – 20)
# (For Class – X)
# MENTAL ABILITY TEST (MAT)
## HINTS & SOLUTIONS

1. 2

1. Positive factors of 256 are
1, 2, 4, 8, 16, 32, 64, 128, 256

$\therefore$ $sq = \frac{a(r^n - 1)}{(r-1)} = \frac{1(2^9 - 1)}{(2-1)}$ [where a = 1, and r = 2, and n = 9]

$\therefore$ Sq = 511

2. 4

2. $\frac{X}{X+1} + \frac{X+1}{X} - \frac{1}{X(X+1)} = \frac{X^2 + (X+1)^2 - 1}{X(X+1)}$

$= \frac{X^2 + X^2 + 1 + 2X - 1}{X(X+1)} = \frac{2X^2 + 2X}{X(X+1)} = \frac{2X(X+1)}{X(X+1)}$

= 2

3. 1

3. 5 + 6 + 7 + … + 19
Here a = 5, d = 1 and n = 15

$\therefore$ $S_n = \frac{n}{2}[2a + (n-1)d]$

$S_{15} = \frac{15}{2}(10 + 14 \times 1) = \frac{15}{2} \times 24$

= 15 x 12 = 180

4. 1

4. $\frac{1}{2} : \frac{2}{3} : \frac{3}{4} = 6 : 8 : 9$

Let numbers be 6x, 8x and 9x

$\therefore$ 9x – 6x = 27

$\therefore$ x = 9

$\therefore$ Numbers are 54, 72, 81

5. 2 or 4

5. $3^{25} + 3^{26} + 3^{27} + 3^{28} = 3^{25}(3^0 + 3^1 + 3^2 + 3^3)$

$= 3^{25}(1 + 3 + 9 + 27)$

$= 3^{25} \times 40 = 3^{23} \times 9 \times 5 \times 8$

$= 3^{25} \times 40 = 3^{23} \times 8 \times 45$

6. 4

6. Rohan's final score = $\frac{90 \times 2 + 75 \times 1}{3}$

= 85

7. 1

7. Let Grand mother = G, mother = M and daughter = D
$\therefore$ Possible ways = GMD
GDM
MGD
MDG
DGM
DMG

8. 2

8. Let at time of marriage man's age = x years
And man's wife's age = y years
$\therefore$ x = y + 6 ….(1)
And $(x+12)=\frac{6}{5}(y+12)$
= 5x + 60 = 6y + 72
= 5x – 6y = 12 …(2)
Solving both equations we got x = 24 and y = 18

9. 3

9. P (number is even) = $\frac{1}{2}$

P (number is less than 4) = $\frac{1}{2}$

P (number is even and less than 4) = $\frac{1}{6}$

$\therefore P\left(\frac{\text{number is less than 4}}{\text{number is even}}\right)=\frac{P(\text{number is even and less than 4})}{P(\text{number is even})}=\frac{\frac{1}{6}}{\frac{1}{2}}=\frac{1}{3}$

10. 2

10. 10 balls $\rightarrow$ 5B and 5W
After removing 1 B balls, total balls left = 9 and
Total black balls left = 4
$\therefore$ P (B ball after removing 1$^{st}$ B ball) = $\frac{4}{9}$

11. 2

11. 10 – 3 = 12 $\rightarrow$ 10 – 3 + 5 = 12
12 – 4 = 13 $\rightarrow$ 12 – 4 + 5 = 13
14 – 5 = 14 $\rightarrow$ 14 – 5 + 5 = 14
16 – 6 = ? $\rightarrow$ 16 – 6 + 5 = 15

12. 2

12. If bus does not stops, then it will travel 9 km more with 54 kmph
$\therefore$ It will stop for $\frac{9}{54}\text{hr}=\frac{9}{54}\times 60\,\text{min}$
= 10 min

13. 4

13. $\frac{40\times1620}{100}+\frac{30\times960}{100}=\frac{x\times5200}{100}$

$\therefore\ x=\frac{40\times1620+30\times960}{5200}$

$\therefore\ x = 18$

14. 2

14. Between 1st and 25th tree there are 24 gap & let say each gap is of x m distance.

$\therefore\ 24\,x = 30$

$x=\frac{30}{24}$

Now between 3rd & 15th tree there are 12 gaps

$\therefore$ Distance between 3rd & 15th tree $=12\times\frac{30}{24}=15$ m

15. 4

15.

| Time | 8 | 8:30 | 9 | 9:30 | 10 | 10:30 | 11 | 11:30 | 12 | 12:30 | 1 | 1:30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bell | 3 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 3 |

$\therefore$ Bell rung 20 times.

16. 4

16. $\frac{80A}{100}=\frac{50B}{100}$

or $\frac{B}{A}=\frac{8}{5}$

Now $B=\frac{x\times A}{100}\Rightarrow x=\frac{B}{A}\times100$

$\therefore x=\frac{8}{5}\times100=160$

17. 3

17. Let numbers = (x – 2), (x – 1), (x + 1), (x + 2)

$\therefore\ \frac{(x-2)+(x-1)+x+(x+1)+(x+2)}{5}=7$

$\therefore\ \frac{5x}{5}=7$

$\therefore\ x = 7$

$\therefore$ highest number = 9

18. 2

18. $x^3+y^3+z^3-3xyz=(x+y+z)(x^2+y^2+z^2-xy-yz-zx)$

Now we know that, $(x+y+z)^2=x^2+y^2+z^2+2(xy+yz+zx)$

$\Rightarrow xy+yz+zx=\frac{15\times15-51}{2}=87$

$\therefore x^3+y^3+z^3-3xyz=15(51-87)$

$= 15 \times (-36)$

$= -540$

19. 4

19. Let sides = 3x, 4x & 5x cm

$\therefore S = \dfrac{3x + 4x + 5x}{2} = 6x$

$\therefore \text{Area} = \sqrt{S(S-a)(S-b)(S-c)}$

$384 = \sqrt{6x \times 3x \times 2x \times x}$

$384 = 6x^2$

$\therefore x = 8$

$\therefore P = 12x = 12 \times 8 = 96$ cm

20. 3

20. (1) $\dfrac{1}{3 + \dfrac{1}{\dfrac{17}{16}}} = \dfrac{1}{3 + \dfrac{16}{17}} = \dfrac{17}{66}$

(2) $\dfrac{1}{3 + \dfrac{1}{1 + \dfrac{1}{\dfrac{9}{8}}}} = \dfrac{1}{3 + \dfrac{1}{\dfrac{17}{9}}} = \dfrac{1}{\dfrac{60}{17}} = \dfrac{17}{60}$

(3) $\dfrac{1}{3 + \dfrac{1}{1 + \dfrac{1}{\dfrac{9}{4}}}} = \dfrac{1}{3 + \dfrac{1}{\dfrac{13}{9}}} = \dfrac{1}{\dfrac{48}{13}} = \dfrac{13}{48}$

(4) $\dfrac{1}{3 + \dfrac{1}{\dfrac{9}{8}}} = \dfrac{1}{\dfrac{35}{8}} = \dfrac{8}{35}$

21. 3

21. $a \$ b = a \times (a + b)$

$\therefore (2 \$ 0) \$ 1 = [2 \times (2 + 0)] \$ 1$

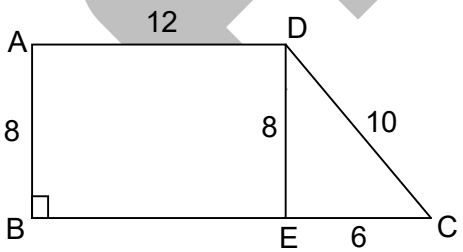
$= 4 \$ 1$

$= 4 \times (4 + 1)$

$= 20$

22. 2

22.




**Construction:** Draw DE $\perp$ BC

$\therefore$ Area of ABCD = Area of rec ABED + Area of $\Delta$DEC

$= \ell \times b + \dfrac{1}{2} \times b \times h$

$= 8 \times 12 + \dfrac{1}{2} \times 6 \times 8$

$= 96 + 24 = 120\ m^2$

23. 3

23. 4, 8, 28, 80, 244

× 3 – 4 × 3 + 4 × 3 – 4 × 3 + 4

24. 2

24. 4, 7, 12, 19, 28, 39, 52

+3 +5 +7 +9 +11 +13

25. 4

25. 10080, 1680, 336, 84, 28, 14

÷ 6 ÷ 5 ÷ 4 ÷ 3 ÷ 2

26. 2

26. $CI = P\left[\left(1+\frac{r}{100}\right)^n - 1\right]$

$4347 = 30000\left[\left(1+\frac{7}{100}\right)^n - 1\right]$

$= \frac{11490}{10000} = \left(\frac{107}{100}\right)^n$

$= \left(\frac{107}{100}\right)^2 = \left(\frac{107}{100}\right)^n$

$\therefore n = 2$

27. 2

27. $2^{\frac{1}{2}}, 9^{\frac{1}{3}}, 16^{\frac{1}{4}}, 32^{\frac{1}{5}}$

$= 2^{\frac{1}{2}}, 9^{\frac{1}{3}}, 2^1, 2^1$

$= 2^{\frac{6}{2}}, 9^{\frac{6}{3}}, 2^6, 2^6$

$= 2^3, 9^2, 2^6, 2^6$

28. 3

28. $x + \frac{1}{x} = 2$

$\Rightarrow x^2 + 1 - 2x = 0$

$\Rightarrow (x - 1)^2 = 0$

$\Rightarrow x = 1$

$\therefore x^{17} + \frac{1}{x^{19}} = 1^{17} + \frac{1}{1^{19}} = 2$

29. 3

29. Let runs required = x

$\therefore 15 \times 6 + x \times 5 = 7.2 \times 20$

$\therefore x = 54$

$\therefore$ required run rate = $\frac{54}{5} = 10.8$

30. 1

30. $P + Q = x + y$, $PQ = xy$

$(P + Q)^3 = P^3 + Q^3 = 3PQ\,(P + Q)$

$\Rightarrow P^3 + Q^3 = (x + y)^3 - 3xy\,(x + y) = x^3 + y^3$

31. 1

31. $\dfrac{x+5}{12} + \dfrac{x}{16} = 1$

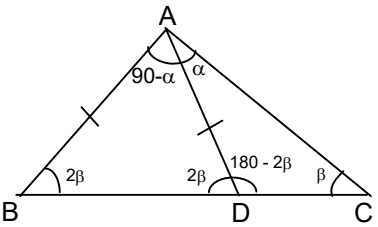
$= \dfrac{4x + 20 + 3x}{48} = 1$

$\Rightarrow x = \dfrac{48 - 20}{7} = \dfrac{28}{7} = 4$

$\therefore$ x = 4 min

32. 3

32.




In $\Delta ABD$, $90 - \alpha + 2\beta + 2\beta = 180^\circ$

$4\beta - \alpha = 90$ - - - (1)

In $\Delta ABC$ $3\beta + 90 = 180^\circ$

$\Rightarrow \beta = 30$ - - - (2)

$\therefore \alpha = 4\beta - 90 = 30^\circ$

33. 2

33. Since shaded region has $\dfrac{1}{6}$ of area of circle

$\therefore \angle$ in shaded region = $\dfrac{360}{6} = 60°$

$\therefore \angle$ in Arc AQB = 360 – 120 = 240

$\therefore$ length of arc AQB = $360 \times 2\pi r$

$= \dfrac{240}{360} \times 2\pi \times 10$

$= \dfrac{2}{3} \times 2\pi(10) = \dfrac{40}{3}\pi$

34. 4

34. Let original length = $\ell$cm & width = b cm

$\therefore$ Original Area = $\ell b cm^2$

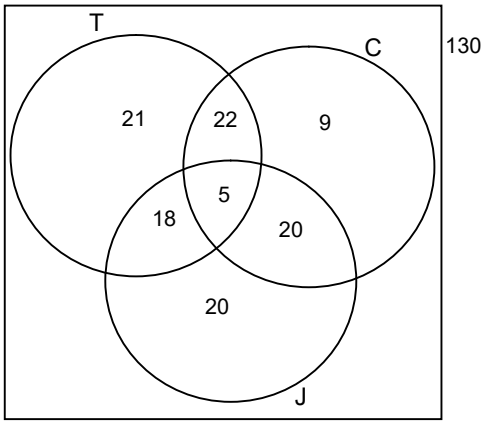
New area = $\dfrac{125}{100}\ell \times \dfrac{80}{100} b = \ell b cm^2$

Since original area = new area

$\therefore$ no change in area

35. 1

35.




36. 3 (Incomplete question in English language but according to hindi part it should be 3 (35))

36. Let 3 nos = x, y & z

$\therefore$ x + y = 55 - - - - (1)

y + z = 65 - - - - (2)

3x + z = 110 - - - - (3)

Form eq (1) & (2)

55 – x + z = 65

$\therefore$ z – x = 10 - - - - (4)

From eq (3) & (4)

3x + z + 3z – 3x = 110 + 30

$$z = \frac{140}{4} = 35$$

37. 4

37. For K ratio = $\frac{6000}{12000} = \frac{1}{2}$

For L ratio = $\frac{5400}{6000} = \frac{9}{10}$

For M ratio = $\frac{12000}{21000} = \frac{4}{7}$

For N ratio = $\frac{4200}{9000} = \frac{7}{15}$

For O ratio = $\frac{7500}{12000} = \frac{5}{8}$

Clearly N has the minimum ratio

38. 2

38. For K ratio = $\frac{2400}{27000} = 0.088$

For L ratio = $\frac{1200}{15000} = 0.08$

For M ratio = $\frac{4500}{45000} = 0.10$

For N ratio = $\frac{2400}{21000} = 0.114$

For O ratio = $\frac{3000}{30000} = 0.10$

Clearly N has maximum bonus in comparison to his total income.

39. 3

39. For K $= \frac{12000}{27000} \times 100 = 44.44\%$

For L $= \frac{6000}{15000} \times 100 = 40\%$

For M $= \frac{21000}{45000} \times 100 = 46.66\%$

For N $= \frac{9000}{21000} \times 100 = 42.85\%$

For O $= \frac{12000}{30000} \times 100 = 40\%$

Clearly M has maximum percentage

40. 1

40. $\frac{6000}{7500} \times 100 = 80\%$

41. 1

41. $\frac{M}{S} = \frac{4}{5}$

$\therefore$ M = 4n, S = 5n

$\frac{M-5}{S-5} = \frac{7}{9}$

$\Rightarrow \quad \frac{4n-5}{5n-5} = \frac{7}{9}$

$\Rightarrow$ 36n – 45 = 35n – 35

$\Rightarrow$ n = 10

$\therefore$ Present ayes are 40 and 50 years.

42. 4

42. Number of different combinations = $3_{C_1} \times 4_{C_1} \times 2_{C_1}$

$= \frac{3!}{1! \times 2!} \times \frac{4!}{1! \times 3!} \times \frac{2!}{1! \times 1!} = 4! = 24$

43. 4

43. Let original length = $\ell$

And original breadth = b

$\therefore$ Original area = $\ell$b

New area $= \frac{112.5\,\ell}{100} \times \frac{90\,b}{100}$

$= 1.0125\,\ell b$

$\therefore$ Charge in area $= \frac{(1.0125-1)}{1} \times 100 = 1.25\%$ increase

44. 1

44. x = Even number

P = Odd number

(1) Odd – Even – 1 = Even $\neq$ Odd

(2) Odd + Even + 1 = Even = Even

(3) Odd × Even + Odd = Odd = Odd

(4) $Odd^2 + Even^2 + 1$ = Even = Even

45. 1

45. Volume of liquid in cuboidal container
= Volume of liquid in cylindrical container
$\ell \times b \times h = \pi r^2 h$
$2 \times 10 \times 20 = \pi \times 5^2 \times h$
$\therefore \quad h = \frac{400}{25\pi} = \frac{16}{\pi}$

46. 1

46. $\tan\theta + \omega t\,\theta = 2$
$\tan\theta + \frac{1}{\tan\theta} = 2 \quad ; \quad \frac{\tan^2\theta + 1}{\tan\theta} = 2$
$\Rightarrow \tan^2\theta - 2\tan\theta + 1 = 0$
$\Rightarrow (\tan\theta - 1)^2 = 0$
$\Rightarrow \tan\theta = 1$
$\Rightarrow \cot\theta = 1.$
$\therefore \tan\theta^{100} + \cot\theta^{100}$
$1 + 1 = 2$

47. 2

47. $(a + b)^4 = \left[(a+b)^2\right]^2$
$= (a^2 + b^2 + 2ab)^2$
$= a^4 + b^4 + 4a^2b^2 + 4a^3b + 2a^2b^2 + 4ab^3$
$= a^4 + b^4 + 6a^2b^2 + 4a^3b + 4ab^3$
$\therefore$ Coefficient of $a^2b^2 = 6.$

48. 3

48. $\frac{\text{Girls}}{\text{Total class}} = \frac{x}{x+y}$

49. 4

49. $2^{6n} - 4^{2n}$
$64^n - 16^n$
We know that $a^n - b^n$ is always divisible by $(a - b)$
$\therefore \quad 64^n - 16^n$ is divisible by 48.

50. 3

50. $x = 2^1 - 2^{1/3} + 2^{2/3}$
$x - 2 = 2^{2/3} - 2^{1/3}$
Cubing both sides
$x^3 - 8 - 3(2x)(x - 2) = 2^2 - 2^1 - 3(2)(x - 2)$
$\Rightarrow x^3 - 8 - 6x^2 + 12x = 4 - 2 - 6x + 12$
$\Rightarrow x^3 - 6x^2 + 18x = 22$
$\Rightarrow x^3 - 6x^2 + 18x + 18 = 40$

51. 1

51. 1 figure $\Delta s = 6$
2 figure $\Delta s = 4$
3 figure $\Delta s = 2$
$\therefore$ Total number of $\Delta s = 12$

52. 3

52. Father (Ketan's

|

Ketan (Amit's father)

|

Amit

53. 4

53. si po re → book is thick …(1)
ti na re → bag is heavy …(2)
ka si → interesting book …(3)
de ti → that bag …(4)
From (2) & (4) code of 'bag' = ti, so code of 'that' = de
From (1) & (2) code of 'is' is re
From (1) & (3) code of 'book' = si, so code of 'interesting' = ka
∴ code of that bag is interesting' = de ti re ka

54. 1

54.

| P | R | I | N | C | I | P | A | L |
|---|---|---|---|---|---|---|---|---|
| M | B | O | Q | S | O | M | V | W |

| T | E | A | C | H | E | R |
|---|---|---|---|---|---|---|
| F | D | V | S | Z | D | B |

| | C | A | P | I | T | A | L |
|---|---|---|---|---|---|---|---|
| So, | S | V | M | O | F | V | W |

55. 1

55.

| R | O | P | E | | D | O | U | B | T | | L | I | V | E |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | , | | | | | | , | | | | | |
| % | 5 | 7 | $ | | 3 | 5 | # | 8 | * | | @ | 2 | 4 | $ |

∴

| T | R | O | U | B | L | E |
|---|---|---|---|---|---|---|
| * | % | 5 | # | 8 | @ | $ |

56. 3

56. $ ⟶ +
# ⟶ –
@ ⟶ ×

$* \longrightarrow \div$

$16 \$ 4 @ 5 \# 72 * 8 = 16 + 4 \times 5 - 72 \div 8$

$= 16 + 20 - 9$

$= 36 - 9$

$= 27$

57. 2

57. 5 3 2 1 6 4 | 8
1 2 3 4 5 6 | 8

58. 2

58. 8 S 9 P 9 K 6

59. 2

59. 12 R 3 M 5 P 20

$\therefore$ Total number of girls = 43

60. 3.

60. 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 | 1981
1 1 2 1 1 1 2 1 1 1 2

Same calendar repeats after 7 or multiple of 7 odd days, So 1981 will have same calendar as 1970.

61. 2

61. $(9-3)=6,(6-1)=5,(5-4)=1$

$(7-5)=2,(8-4)=4,(9-3)=6$

$\therefore (8-2)=6,(6-4)=2,(3-1)=2$

$\therefore$ 622

62. 2

62. $+ \longrightarrow \div$

$- \longrightarrow \times$

$\times \longrightarrow +$

$\div \longrightarrow -$

$\therefore\ 4+6\times 9\div 6-2\times 5$

$=4\div 6+9-6\times 2+5$

$=\frac{2}{3}+9-12+5=\frac{2}{3}+2$

$=\frac{8}{3}$

63. 1

63. As per observation

64. 4

64. As per observation

65. 1

65. As per observation

66. 3

66. As per observation

67. 1

67. $13^2 - 4^2 = 153$

$11^2 - 1^2 = 120$

Similarly $6^2 - 2^2 = 32$

68. 2

68. Total number of Biharis = 2 + 1 + 3 = 6

69. 1

69. Total number of Punjabis = 1 + 7 + 3 + 5 + 6 = 22

70. 4

70. Total number of Marathis = 3 + 6 + 4 + 8 = 21

71. 2

71. Only 2 Biharis are not Punjabis.

72. 4

72. Punjabis who are not Marathis = 5 + 1 + 7 = 13

73. 3

73.

| | |
|---|---|
| 1949 | $26^{th}$ Jan |
| 1600 + 300 + 12LY + 37NLY | 26 |
| 0 + 1 + 24 + 37 | 5 |
| 62 | |
| 6 | |

$\therefore$ Total number of odd days = 11

= 4

$\therefore$ $26^{th}$ Jan 1950 was Thursday

74. 1

74. $|12 \times 30 - 48 \times 5.5| = 96$

$\therefore$ Larger angle = 360 – 96

= 264

75. 2

75. $23\frac{40}{60}$ hrs of faulty clock = 24 hrs of actual clock

or $\frac{71}{3}$ hrs of faulty clock = 24 hrs of actual clock

$\therefore$ 71 hrs of faulty clock = $\frac{24 \times 71}{71} \times 3$

= 72 hrs of actual clock

$\therefore$ Correct time = 4 am

76. 3

76. Clearly 2 & 5 are opposite

1 & 6 are opposite

4 & 3 are opposite

77. 3

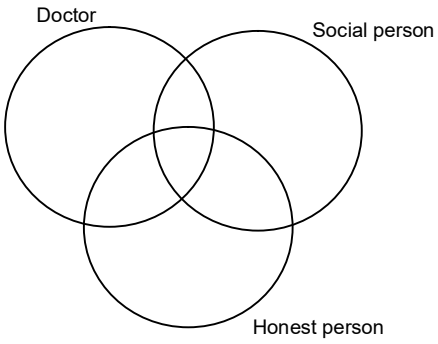
77. Here, $\Lambda = 4$

Clearly corner (8) cubes are 3 face coloured.

78. 4
78. $12(n-2) = 24$

79. 2
79. $6(n-2)^2 = 24$

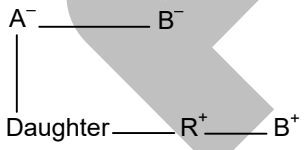
80. 3
80. $4 \times 7 = 28$
$3 \times 15 = 45$
Similarly $2 \times 5 = 10$
Logic of letter $\rightarrow$ In every row A, B & C are present.

81. 2
81. 


82. 2
82. (1) Difference between B & Q = 15.
(2) Difference between D & Y = 21.
(3) Difference between U & F = 15
(4) Difference between V & E = 17

83. 3
83. In given sequence PO & in alphabetical order it is OP.

84. 4
84. In given series letters between Y & L are 12 which is same as original alphabetical order & letters between L and F are 5 which is same as original alphabetical order.

85. 1
85. 

Clearly B is the aunt of S.

86. No option correct
86. Sohan and Neeraj have no mentioned correlation with Abhay, Neena & Sunita.

87. 3
87. $18 - 10 = 8$
$18 - 4 = 14$
$10 - 4 = 6$
Similarly $15 - 5 = 10$

88. 2
88. As per observation.

89. 1

89. As per observation.

90. 3
90. Horizontal lines = 3
Vertical lines = 5
Other lines = 8
Total number of lines required = 16

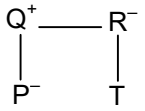
91. 3
91. Here, n = 4.
$\therefore$ Cubes with no surface coloured = $(n-2)^3 = 8$

92. 3
92. At least 2 face coloured = 2 face coloured + 3 face coloured
$= 12(n-2)^2 + 8 = 24 + 8 = 32$

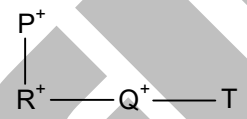
93. 1
93. 2 surface painted red = $12(n-2) = 24$

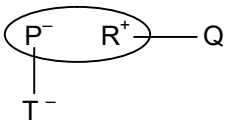
94. No option correct
94. 3 surface painted with red = corner cubes which are 8 in number.

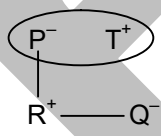
95. 3
95. Number of cubes obtained along each axis = 3
$\therefore$ Total number of cubes = $3 \times 3 \times 3 = 27$

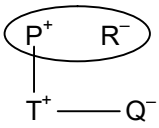
96. 4
96. 

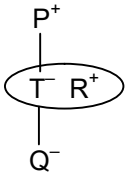
X → Father
+ → Daughter
÷ → Mother
– → Brother
Clearly T is the cousin of P.

97. 4
97. (i) 

(ii) 

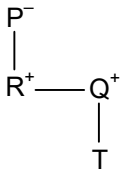
(iii) 

(iv) 


98. 3
98. Clearly R is the son in law of P.


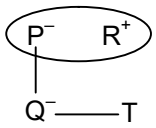

99. 1

99. Clearly P is the grand mother of T.




100. 2

100. Clearly Q is the sister of T.



# NTSE STAGE – I (DELHI STATE)
# 05 – A (2019 – 20)
# (For Class – X)
# SCHOLASTIC APTITUDE TEST

## HINTS & SOLUTIONS

101. 2

101. $P_i = 0$

$P_f = 18 \times 6 + 12$ V

$P_i = P_f$

$V = -9$ m/s

$$K.E. = \frac{1}{2} \times 12 \times (9)^2 \Rightarrow 6 \times 81 \Rightarrow 486\,J$$

102. 4

102. Slope of v – t graph gives acceleration and acceleration is constant from time t = 0 to t = T. After t = T, velocity is constant.

103. 1

103. $u = -\infty$ $v = -40$ cm

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{-40} = \frac{1}{f}$$

$P = -(2)5$ D

104. 2

104. Convection is caused by gravity pulling heavier elements in a gas or liquid down.

105. 3

105. $V_o = 4$ m/s

$V_I = -4$ m/s

$V_{Io} = V_I - V_o$

$= -4 - 4 = -8$ m/s

106. 1

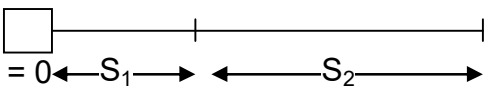
106. $$I = \frac{V}{R_{eq}}$$

$$2 = \frac{6}{2 + R}$$

$R = 1\ \Omega$

107. 4

107. t = 0 t = 10 t = 20




$$S_1 = \frac{1}{2}a(10)^2 \Rightarrow S_1 = 50a$$

$$S_1 + S_2 = \frac{1}{2}a(20)^2 \Rightarrow S_2 = 150a$$

$$S_2 = 3S_1$$

108. 1

108. $g = \frac{4}{3} G\pi dR$

$\frac{g_1}{g_2} = \frac{r_1}{r_2}$

109. 2

109. $f = -15$ cm $\qquad m = -\frac{v}{u} = 2$

$v = -2u$

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$\frac{1}{-2u} + \frac{1}{u} = \frac{1}{-15}$

$u = -7.5$ cm

110. 1

110. $\frac{\ell}{4} = \frac{1}{2}(g\sin\theta)(2)^2$ …(i)

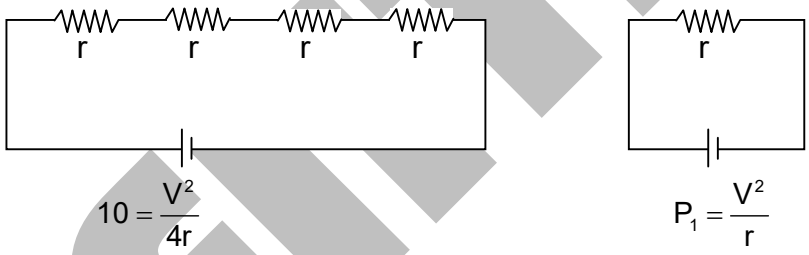
$\ell = \frac{1}{2}(g\sin\theta)t^2$ …(ii)

$\frac{t^2}{4} = 4$

$t = 4$ sec.

111. 1

111. $P = \frac{V^2}{R}$




$10 = \frac{V^2}{4r}$ $\qquad P_1 = \frac{V^2}{r}$

$P_1 = 40$ W

112. 4

112. $F = qVB\sin\theta$

If V is parallel to B $\quad \theta = 0°$

$F = 0$

113. 2

113. $I = \frac{5}{50} \Rightarrow \frac{1}{10}$ A

$5 = I\left(\frac{100R}{100+R}\right)$

$R = 100\ \Omega$

114 1, 2 & 4

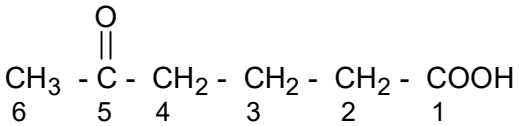
114. Epsom salt ($MgSO_4.7H_2O$)
Green vitriol ($FeSO_4.7H_2O$)
White vitriol ($ZnSO_4.7H_2O$)

115. 1
115. Element Zn & Sn are used for galvanization.

116. 3
116. $\underset{A}{Zn} + \underset{M}{CuSO_4} \longrightarrow \underset{N}{ZnSO_4} + Cu$

117. 4
117. Hydrogen has highest calorific value.

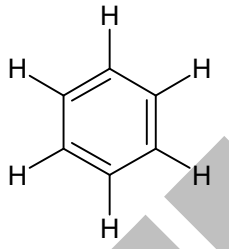
118. 1
118. pH of acid rain is less than 5.6

119. 2
119. 

5-Keto hexanoic acid

120. 4
120. $2NaCl(aq) + 2H_2O(l) \longrightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

121 1
121. $2KMnO_4 + 3H_2SO_4 \longrightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5[O]$

122 2
122. 
15 Covalent bond

123 4
123. No. of moles = $\frac{1000\ g}{56\ g} = 17.8$ moles
1 mole contains $N_A$ atom of Fe
So, 17.8 mole contain
$17.8 \times 6.022 \times 10^{23} = 1.075 \times 10^{25}$ atoms

124 1
124. Alkali metal oxide are basic in nature.

125. 1
125. The pH value of solution will be 7 to 9.

126. 1
126. No. of valence electron will remain same for any group element.

127. 3
127. Oxidation-reduction reactions takes place during break down of molecules in the respiration in our body. Oxidation of glucose and reduction of oxygen.

128. 4
128. Lactic acid is produced when pyruvate is broken down in absence of oxygen in muscle cell.

129. 1
129. Separation of oxygenated deoxygenated blood allows a highly efficient supply of oxygen to the body, also useful in animals that have high energy needs such as birds and mammals which constantly use energy to maintain their body temperature.

130. 2
130. Root pressure is effective way transporting water in xylem during night.

131 4
131. A Growth hormone
B Growth hormone releasing factor
C Insulin
D Thyroxine

132 1
132. Wrinkled seed = rr
Heterozygous tall plant = Tt

rrTt X rrTt

| | rT | rt |
|---|---|---|
| rT | rTrT | rTrt |
| rt | rTrt | rtrt |

rTrT – Homozygous wrinkled seed Homozygous tall
rTrt – Homozygous wrinkled heterozygous tall
rtrt – Homozygous wrinkled homozygous dwarf
100% Homozygous wrinkled
75% plants will be Tall and have wrinkled seed and 25% will be dwarf with wrinkled seed.

133 1
133. Two similar pea plants are growing in two different islands separated by vast ocean. The phenomenon of geographical isolation will not be seen as the plants get self pollinated.

134 3
134. DDT is non-biodegradable when it enters in food chain it gets accumulated in each trophic level. This phenomenon is called Biomagnification.

135. 2
135. Presence of coliform bacteria is an indicator of pollution level in water

136. 2
136. Leaves of tendu are the source of income of large number of people of India. These leaves are used to make bidis.

137. 4
137. Maximum number of trophic levels supported in any ecosystem is four.

138. 4
138. Correct sequence of reflex arc is
Receptor → Sensory Neuron → Relay Neuron → Motor Neuron → Effector organ

139. 1

139. Tricuspid valve is present in right atrium and right ventricle

140. 2

140. BCG vaccine provide protection against TB.

141. 1

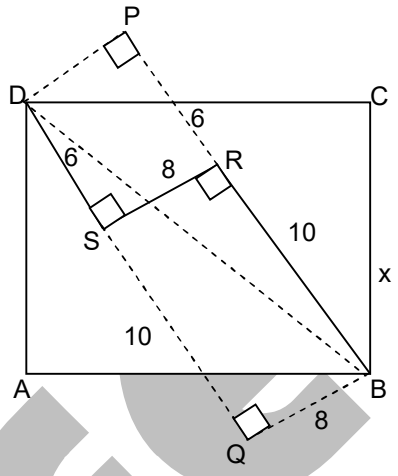
141. Extend BR and drawn $DP \perp BR$ on extended part.

Extend DS and draw $BQ \perp DS$ on extended part then DPBQ is rectangle having sides 8 m and 16 m

Diagonal of rectangle $= 8\sqrt{5}$

If x is side of square then

$2x^2 = 320 \Rightarrow x^2 = 160\,m^2$




142. 4

142. $\left(2^x-4\right)^3+\left(4^x-2\right)^3=\left(4^x+2^x-6\right)^3$

$\Rightarrow \left(2^x-4\right)^3+\left(4^x-2\right)^3+\left(6-4^x-2^x\right)^3=0$

Now $\left(2^x-4\right)+\left(4^x-2\right)+\left(6-4^x-2^x\right)=0$

$\Rightarrow \left(2^x-4\right)^3+\left(4^x-2\right)^3+\left(6-4^x-2^x\right)^3$

$=3\left(2^x-4\right)\left(4^x-2\right)\left(6-4^x-2^x\right)=0$

Now $2^x-4=0 \Rightarrow x=2$

$4^x-2=0 \Rightarrow x=\frac{1}{2}$

$6-4^x-2^x=0 \Rightarrow \left(2^x+3\right)\left(2^x-2\right)=0$

$\Rightarrow 2^x-2=0$ or $2^x+3=0$

$\Rightarrow 2^x=2$ or $2^x=-3$ (Not possible)

$\Rightarrow x=1$

So sum of all real values of

$x=2+\frac{1}{2}+1=\frac{7}{2}=3.5$

143. 4

143. Let $2019^x=y$ then given question reduces to $y+\frac{1}{y}=3$

$\Rightarrow y^3+\frac{1}{y^3}=18$ and $y^2+\frac{1}{y^2}=7$

Now $\sqrt{\frac{2019^{6x}-2019^{-6x}}{2019^x-2019^{-x}}}=\sqrt{\frac{y^6-\frac{1}{y^6}}{y-\frac{1}{y}}}$

$$= \sqrt{\frac{\left(y-\frac{1}{y}\right)\left(y^2+1+\frac{1}{y^2}\right)\left(y^3+\frac{1}{y^3}\right)}{\left(y-\frac{1}{y}\right)}} = \sqrt{144} = 12$$

144. 1

144. Since p is root of $x^2 - 5x + 7 = 0$

$\Rightarrow p^2 - 5p + 7 = 0$

$\Rightarrow p^2 - 5p = -7$

Now radius of circle

$r = \sqrt{(p-1)^2 + (p-4)^2}$

$= \sqrt{2(p^2 - 5p) + 17} = \sqrt{3}$ units

Area of circle $= 3\pi$ sq.units

145. 4

145. $\frac{1}{x+y} = \frac{1}{x} + \frac{1}{y} \Rightarrow x^2 + y^2 + xy = 0$

Dividing both sides by $y^2$ we get

$\left(\frac{x}{y}\right)^2 + \left(\frac{x}{y}\right) + 1 = 0$

Let $\frac{x}{y} = k$ then $k^2 + k + 1 = 0$

Now $\left(\frac{x}{y}\right)^6 + \left(\frac{x}{y}\right)^3 = k^6 + k^3$

Since $k^6 + k^3 = (k^2 + k + 1)(k^4 - k^3 + 2k - 2) + 2$

$\Rightarrow k^6 + k^3 = 2$ (since $k^2 + k + 1 = 0$)

146. 2

146. $x^3 - 597x - 5236 = 0$

Sum of roots = a + b + c = 0

Also, abc = 5236

Since a + b + c = 0

$\Rightarrow a^3 + b^3 + c^3 = 3abc$

= 15708

147. 3

147. $\cos ec\, x + \cot x = a$

$\Rightarrow \cos ec\, x - \cot x = \frac{1}{a}$

On adding both equations

$\cos ec\, x = \frac{a^2+1}{2a} \Rightarrow \cos x = \frac{a^2-1}{a^2+1}$

148. 2

148. Mean $= \frac{a_{15} + a_{16} + a_{136} + a_{137}}{4}$

$$= \frac{(a+14d)+(a+15d)+(a+135d)+(a+136d)}{4}$$

$= a + 75d$

$= 2 + 75 \times 3 = 227$

149. 3

149. Using AM $\geq$ GM

$$\Rightarrow \frac{\tan^2 x + \cot^2 x}{2} \geq \sqrt{\tan^2 x \cot^2 x}$$

$\Rightarrow \tan^2 x + \cot^2 x \geq 2$

So minimum value is 2.

150. **No option is correct**

150. $f(x) = x^4 + ax^3 + bx^2 + cx + d$

$f(1) = 5,\ f(2) = 10,\ f(3) = 15,\ f(4) = 20$

On the basis of given information

Let $f(x) = (x-1)(x-2)(x-3)(x-4) + 5x$

$f(12) = 7980,\ f(-8) = 11840$

Now $\frac{f(12) + f(-8)}{100} = 198.2$

151. 3

151. Let numbers are 12x and 12y, HCF (x, y) = 1

then $(12x)(12y) = 2160$

$\Rightarrow xy = 15 = 5 \times 3$

$\Rightarrow x = 5,\ y = 3$

So, numbers are 60 and 36

Sum = 96

152. 4

152. Let angles are $x-2d, x-d, x, x+d, x+2d$ then $5x = 540^\circ$

$\Rightarrow x = 108^\circ$

Sum of largest and smallest angle $= 2x = 216^\circ$

153. 1

153. $\sqrt{p} - \sqrt{q} = 20$

$\Rightarrow p = \left(20 + \sqrt{q}\right)^2 = 400 + q + 40\sqrt{q}$

$p - 5q = 400 + q + 40\sqrt{q} - 5q = 400 + 40\sqrt{q} - 4q$

$= 400 - 4\left(q - 10\sqrt{q}\right)$

$= 400 - 4\left(q - 10\sqrt{q} + 25 - 25\right)$

$= 400 + 100 - 4\left(\sqrt{q} - 5\right)^2 = 500 - 4\left(\sqrt{q} - 5\right)^2$

$(p - 5q)_{max} = 500$

$$\left(\frac{p-5q}{100}\right)_{max} = \frac{500}{100} = 5$$

154. 1

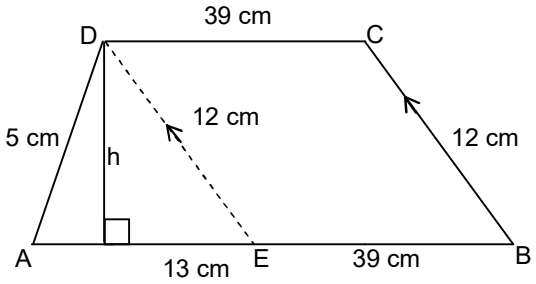
154. Draw $DE \parallel CB$

$\square BCDE$ is a parallelogram

$ar(\Delta ADE) = 30\ cm^2$

$\frac{1}{2} \times 13 \times h = 30 \Rightarrow h = \frac{60}{13}\ cm$

$ar(ABCD) = \frac{1}{2} \times (52 + 39) \times \frac{60}{13} = 210\ cm^2$




155. 4

155. Among all triangles inscribed in a circle of given radius equilateral triangle has maximum area

Let side of $\Delta ABC = x$

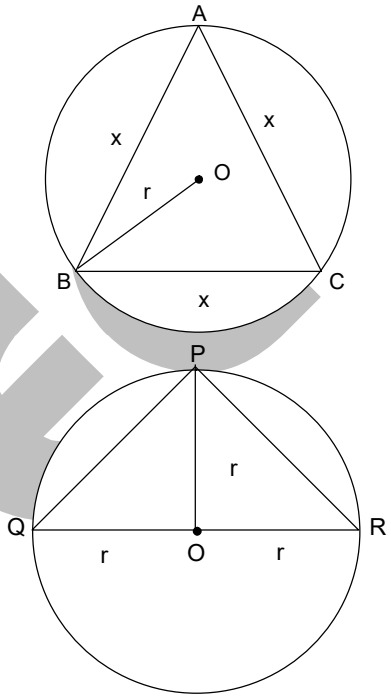
then $r = \frac{x^3}{4 \times \frac{\sqrt{3}}{4} x^2}$

$\Rightarrow x = \sqrt{3}r$

Area of $\Delta ABC = \frac{\sqrt{3}}{4} \times x^2 = \frac{3\sqrt{3}}{4} r^2$

When largest triangle is inscribed in a semicircle of radius r then base of $\Delta = 2r$, height of $\Delta = r$

Area of $\Delta PQR = r^2$




Difference $= \left(\frac{3\sqrt{3}}{4} - 1\right) r^2 = \left(\frac{3\sqrt{3} - 4}{4}\right) r^2$

156. 1

156. Either of p or r is 2.

Let p = 2

q + r = 70

r + s = 72

q + 2r + s = 142

r = 142 – 89 = 53

if r = 2,

p + q = 70

p + s = 72

q + s = 87

2p + q + s = 142

2p = 142 – 87 = 55

$p = \frac{55}{2}$, not possible

157. 1

157. CE = 10 units.

$\Delta CFE \sim \Delta CED$

$\Rightarrow \frac{CF}{CE} = \frac{CE}{CD}$

$$\frac{m}{10}=\frac{10}{15+m}\Rightarrow m=5$$

158. 2

158. Let $y=x^2-10x-69$

$$\frac{1}{y+24}+\frac{1}{y+40}=\frac{2}{y}$$

$$y(2y+64)=2(y^2+64y+960)$$

$$32y=-960$$

$$y=-30$$

$$x^2-10x-69=-30$$

$$(x-13)(x+3)=0 \quad x=13,-3$$

Sum = 13 – 3 = 10

159. 4

159. $$N=\frac{(2^{2/3}+2^{1/3}+1)\times(2^{1/3}-1)}{(2^{1/3}-1)}=\frac{2-1}{2^{1/3}-1}$$

$$2^{1/3}-1=\frac{1}{N}\Rightarrow 2^{1/3}=\frac{1}{N}+1$$

$$(2^{1/3})^3=\left(\frac{1}{N}+1\right)^3=\frac{1}{N^3}+1+\frac{3}{N^2}+\frac{3}{N}$$

$$2=\frac{1}{N^3}+1+\frac{3}{N^2}+\frac{3}{N}$$

$$\frac{1}{N^3}+\frac{3}{N^2}+\frac{3}{N}=1$$

160. 4

160. $x_1+x_2+.....+x_n=pn$ .....(i)

$x_1+x_2+.....+x_{10}=10q$ .....(ii)

$x_{11}+x_{12}+.....+x_n=(n-10)\times r$ .....(iii)

$$pn=10q+r(n-10)$$

$$n=\frac{10(q-r)}{p-r}$$