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 HYDERABAD :: Ph. 9985072333

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### IIT Ramaiah SAT Model Question Paper - 2019

Time : 3 Hrs.

Marks: 360

Each Question has 4 choices (a), (b), (c) and (d)- out of which ONE or MORE THAN ONE CORRECT.

For correct answer +4 marks awarded. No negative marks.

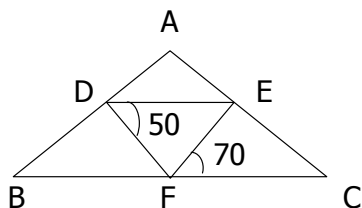
1. The number of primes from the series  $(2019!+2)$   $(2019!+3)$   $(2019!+4)$ ...  $(2019!+2019)$  are

a) 2018      b) 0      c) 1      d) 2020

2. The highest power of 11 contained in  $2019!$  is

a) 292      b) 294      c) 296      d) None

- 3.



In  $\triangle ABC$ , D, E, F are mid points of AB, AC, BC then  $\angle A =$  \_\_\_\_\_

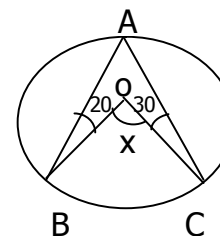
a)  $30^\circ$       b)  $50^\circ$       c)  $60^\circ$       d)  $80^\circ$

4. If  $a_1 a_2 a_3 \dots a_{2019}$  be positive real number then

$$(a_1 + a_2 + \dots + a_{2019}) \left( \frac{1}{a_1} + \frac{1}{a_2} + \dots + \frac{1}{a_{2019}} \right) \geq$$

a) 2019      b)  $(2019)^2$       c)  $(2019)^3$       d) 1

- 5.



If 'O' Center then  $x =$  \_\_\_\_\_

a)  $50^\circ$       b)  $60^\circ$       c)  $80^\circ$       d)  $100^\circ$

- 6.



If ABCD is a parallelogram then  $y - x =$  \_\_\_\_\_

a)  $45^\circ$       b)  $90^\circ$       c)  $135^\circ$       d)  $180^\circ$

- 7.

$7^{2019} - 1$  is divisible by

a) 2019      b)  $(7^{2018} - 1)$   
 c)  $(7^{2018} + 1)$       d) both 'b' and 'c'

- 8.

A cubic polynomial  $P(x)$  when divided by  $x+3$  and  $x-3$  leaves remainders 4 and 12 respectively, then the remainder obtained when  $P(x)$  is divided by  $x^2 - 9$  is

a)  $\frac{3}{2}x + 6$       b)  $\frac{2}{3}x + 6$       c)  $\frac{-3}{2}x + 6$       d) none

- 9.

The last digit in the expansion of  $7^{2019}$  is

a) 1      b) 3      c) 7      d) 9

10. The sum of first 24 terms of the A.P.  $a_1, a_2, a_3, \dots$ . If it is known that  $a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 225$  is  
 a) 865    b) 900    c) 930    d) None of these
11. The minimum value of  $9 \sec^2 \theta + 16 \cos^2 \theta$  is  
 a) 98    b) 24    c) 49    d) 48
12. The vertices of a  $\Delta ABC$  are  $A(5,2), B(6,5), C(2,3)$ .  
 The equation of bisectors  $\angle BAC$  of  $\Delta ABC$  is  
 a)  $2x+y+12=0$     b)  $x+2y-12=0$   
 c)  $x+y+12=0$     d)  $2x+y-12=0$
13. Two sets A and B have 'm' and 'n' elements respectively. If 3 elements of A are same as that of B and the remaining are distinct, then the number of subsets of  $A \cup B$  is 1024 where  $m + n =$   
 a) 10    b) 11    c) 12    d) 13
14. The number of real values of 'k' for which the lines  $(k+1)x+3y+4=0$  and  $6x+(k-2)y+13=0$  intersect is  
 a) 0    b) 1    c) c    d) infinite
15. If  $x+1$  is a factor of  $x^4+(p-3)x^2-(3p-5)x^2+(2p-q)x+6$ , then the value of p is  
 a) 2    b) 4    c) -4    d) 0
16.  $\log_{2019} \left( \frac{1}{2} \right) + \log_{2019} \left( \frac{1}{3} \right) + \log_{2019} \left( \frac{1}{4} \right) + \dots + \log_{2019} \left( \frac{1}{2019} \right)$   
 a) -1    b) 0    c) 1    d) 2

17. If A is the set of the divisors of the number 15, B is the set of prime numbers smaller than 10 and C is the set of even numbers smaller than 9, then  $(A \cup C) \cap B$  is the set  
 a)  $\{1,3,5\}$     b)  $\{1,2,3\}$     c)  $\{2,3,5\}$     d)  $\{2,5\}$
18. A quadratic equation has two roots  $\alpha$  and  $\beta$  where  $\alpha^3 + \beta^3 = 152, \alpha\beta = 15$  then the quadratic equation is  
 a)  $x^2+8x+15=0$     b)  $x^2-6x=15=0$   
 c)  $x^2-8x+15=0$     d)  $2x^2+5x+30=0$
19.  $1^{2019} + 2^{2019} + 3^{2019} + \dots + 2020^{2019}$  is divisible by  
 a) 2018    b) 2019    c) 2020    d) 2021
20. If  $f(x)$  is divided by  $(x-1), (x+1)$  and  $(2x-1)$ , then the remainders are 2, 3 and -1 respectively. Then the remainder when  $f(x)$  is divided by  $(2x^3-x^2-2x+1)$  is  
 a)  $\frac{26x^2-3x-11}{6}$     b)  $\frac{26x^2-3x-11}{3}$   
 c)  $\frac{26x^2-3x-11}{2}$     d)  $\frac{26x^2+3x-11}{6}$
21. Two cars A and B are travelling with speed 60 Km/h and 72 Km/h respectively. Initially they are at two towns P and Q. They are travelling in opposite direction. If they can meet each other in 5 hrs then the distance between the towns P and Q (in Km) is  
 a) 60    b) 600    c) 660    d) 720
22.  $\frac{\sin \theta + \cos \theta}{\sin \theta - \cos \theta} + \frac{\sin \theta - \cos \theta}{\sin \theta + \cos \theta} + \frac{2}{2 \cos^2 \theta - 1} =$   
 a) 1    b) -1    c) 0    d) 2
23. Let  $f(x) = \sum_{r=0}^6 a_r x^r$ , where  $a_0 = 1$  and  $f(x) = k$  for

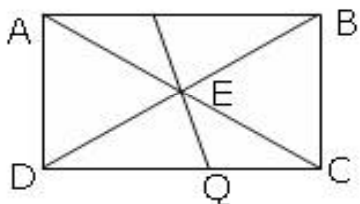
$k = 1, 2, 3, \dots, 6$  that  $f(7) =$

- a) 7!            b) 6!            c) 7            d) 8

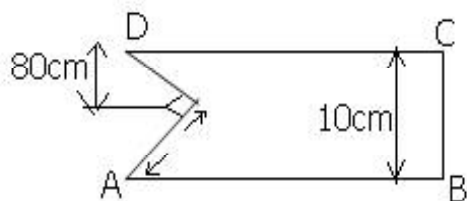
24. A steel wire having 0.25cm as the radius of its circular section is one meter long. It is melted and spherical balls of radius 0.25cm are made. The number of the balls that can be made is  
 (a) 250    (b) 300    (c) 350    (d) 2400
25. X's salary is half that of Y's. If X got a 50% rise in his salary and Y got 25% rise in his salary then the percentage increase in combined salaries of both is  
 a) 30            b)  $33\frac{1}{2}$             c)  $37\frac{1}{2}$             d) 75
26. If  $|4x + 3| > 7$  for  $x \in \mathbb{R}$ , then the solution set is given by  
 (a)  $\{x \in \mathbb{R} : 1 < x < -5/2\}$   
 (b)  $\{x \in \mathbb{R} : -1 < x < 5/2\}$   
 (c)  $\{x \in \mathbb{R} : x < 1\} \cup \{x \in \mathbb{R} : x < -5/2\}$   
 (d)  $\{x \in \mathbb{R} : x < 1\} \cup \{x \in \mathbb{R} : x < -5/2\}$
27. The vertices of a triangle PQR have coordinates as follows: P(0,a), Q(b,0), R(c,d) where a, b, c and d are positive. The origin and point A lie on opposite sides of PQ. The area of triangle PQR may be found from the expression  
 (a)  $\frac{ab + ac + bc + cd}{2}$             (b)  $\frac{ab + ad - ab}{2}$   
 (c)  $\frac{ab - ac - bd}{2}$             (d)  $\frac{ac + bd + ab}{2}$
28. If the radius vector OP makes angle  $q$  with the positive direction of the x-axis, where P is the point (-5, 12), then  
 (a)  $\sin q = 12/13$ ,  $\cos q = 5/13$ ,  $\tan q = -12/5$   
 (b)  $\sin q = 5/13$ ,  $\cos q = 12/13$ ,  $\tan q = 12/5$   
 (c)  $\sin q = 12/13$ ,  $\cos q = -5/13$ ,  $\tan q = 5/12$   
 (d)  $\sin q = 12/13$ ,  $\cos q = 5/13$ ,  $\tan q = 12/5$

29. The system of linear inequations  $x + y \leq 0$ ,  $x \geq 0$  and  $y \geq 0$  has :  
 a) 3 solutions    b) exactly 1 solution  
 c) no solution    d) an infinite number of solution
30.  $\sqrt{x-a} + \sqrt{x-5} = 0$ , then a is a solution of  
 a)  $x^2 - 6x + 5 = 0$             b)  $x^2 - 7x + 10 = 0$   
 c)  $x^2 - x + 1 > 0$             d)  $x^2 + x + 1 > 0$
31.  $ax^2 + bx + c = 0$  is a quadratic equation, a, b, c are rational numbers.  $\Delta = b^2 - 4ac$ .  
 a) Roots of the equation are always real  
 b) If  $\Delta = k^2$ , k is rational, then roots are rational  
 c) If  $\Delta \neq k^2$ , k is rational, then the roots are rational conjugates  
 d) Roots of the equation are always rational
32. If  $A = (\cos x + \sin x)^2 + (\cos x - \sin x)^2$ ,  
 $B = 2(\cos^6 x + \sin^6 x) - 3(\cos^4 x + \sin^4 x) + 1$  then  
 a)  $A = B$             b)  $A^2 + B = 4$   
 c)  $A^2 - B^2 = 4$             d)  $(1 + 2A - 5A^2 + 6A^3)(B^2 - 3B) = 0$
33. For the function  $f(x) = \sqrt{x^2 - 3x + 2} + \sqrt{3x - x^2 - 2}$   
 a) domain is [1,2]            b) domain is {1, 2}  
 c) range is {0}            d) Range is
34. If  $p = \frac{s}{(1+k)^n}$  then 'n' equals:  
 (a)  $\frac{\log(s/p)}{\log(1+k)}$             (b)  $\log \frac{s}{(1+k)}$   
 (c)  $\log \frac{s-p}{(1+k)}$             (d)  $\log \frac{s}{p} + \log(1+k)$

35. The value of  $\frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \dots + \frac{1}{4070306} =$   
 a)  $\frac{2017}{2018}$     b)  $\frac{2018}{2019}$     c)  $\frac{2016}{2017}$     d)  $\frac{2018}{2017}$
36. If 200% of a number is x, what will be 1/2 % of it  
 (a) x/2    (b) x/100    (c) x/200    (d) x/400
37. Area of quadrilateral formed by the vertices (-1, 6), (-3, -9) (5, -8) and (3, 9) is  
 a) 81 sq units                      b) 18 sq units  
 c) 50 sq units                      d) 25 sq units
38. Quadrilateral ABCD is parallelogram. E is the midpoint of the diagonal DB. DE = 10 cm, DB = 16 cm. The length PQ is:

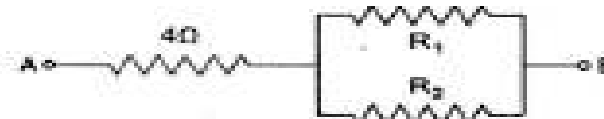


- a) 13 cm    b) 16 cm    c) 8 cm    d) 12 cm
39. The area of given figure is:



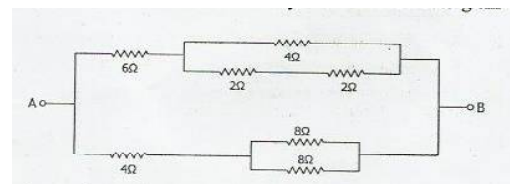
- a) 126 cm<sup>2</sup>    b) 72.7 cm<sup>2</sup>    c) 115.3 cm<sup>2</sup>    d) 157 cm<sup>2</sup>

40. If a, b and c are distinct positive real numbers and  $a^2 + b^2 + c^2 = 1$ , then  $ab + bc + ca$  is  
 (a) less than 1                      (b) equal to 1  
 (c) greater than 1                      (d) any real number
41. A uniform wire of resistance 6W is bent to form a regular hexagon. The least and largest resistances possible between any two corners of the hexagon are respectively.  
 (a)  $8.3\Omega$  &  $1.5\Omega$                       (b)  $0.83\Omega$  &  $2.5\Omega$   
 (c)  $0.83\Omega$  &  $1.5\Omega$                       (d)  $1.3\Omega$  &  $1.5\Omega$
42. Resistances  $R_1$  and  $R_2$  are in the ratio 1:2. Equivalent resistance between A and B is 8 W. Find  $R_1$  and  $R_2$ . If  $R_1$  is now doubled and a potential difference of 20 V is applied between A and B find the current flowing from A to B.



- (a) 3A    (b) 2A    (c) 5A    (d) 6A

43. Potential difference between A and B is 16 V. Find the currents in the 6 Ω and 8 Ω Resistances



- (a) 1A    (b) 2A    (c) 5A    (d) 0.5A

44. Electric supply of a house is through 10 A fuse, at 220V through the heater and bulbs. A 1000 W heater is used in this

house. The number 40W bulbs that can be used simultaneously is:

- a) 10            b)20            c)30            d)40

45. The length of a resistance is increased by 5% and area cross section is increased 10%, then the resistance is changed by

- a) 5% increase                      b) 5% decrease  
c) 10% decrease                      d) none of these

46. Two capacitors connected in parallel having the capacities  $C_1$  and  $C_2$  are given a charge of  $q$  which is distributed among them. The ratio of the charges on  $C_1$  and  $C_2$  will be

- a)  $1/ C_1 C_2$     b)  $C_1 / C_2$     c)  $C_2 / C_1$     d)  $C_1 / C_2$

47. Equal volumes of two miscible liquids of relative densities 6 and 2 are mixed to form a homogenous mixture. A cube floats on this liquid mixture with half its volume submerged. If instead equal masses of these liquids were mixed, find the fraction of the volume of the cube that would submerge in the mixture.

- (a)  $4/3$             (b)  $1/3$             (c)  $2/3$             (d)  $5/3$

48. An upward force experienced by a body when partly or wholly immersed in a fluid is called:

- (a) Vertical force                      (b) up thrust  
(c) buoyant force                      (d) both (b) and (c)

49. A piece of metal weighs 45N in air and 28.3N when fully submerged in water. The specific gravity of the metal is

- a) 2.69            b) 3.19            c) 4.2            d) 11.22

50. The ratio of electric force between two electrons to two protons separated by the same distance in air is

- a)  $10^0$     b)  $10^6$     c)  $10^4$     d) none of the above

51. Two charges of  $50 \mu C$  and  $100 \mu C$  are separated by a distance of 0.6m. What is the intensity of electric field at point midway between them?

- a)  $5 \times 10^6 N/C$  towards  $50 \mu C$   
b)  $5 \times 10^3 N/C$  towards  $50 \mu C$   
c)  $5 \times 10^6 N/C$  towards  $100 \mu C$   
d)  $5 \times 10^3 N/C$  towards  $50 \mu C$

52. A steel wire of length 'I' has a magnetic moment, M. It is then bent into a semicircular arc. The new magnetic moment is

- a) M            b)  $2M/p$             c)  $M/p$             d)  $pM$

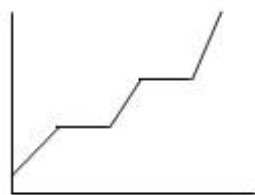
53. A straight conductor carries a current vertically upward. A charged particle moving horizontally towards the wire is at an instant located to the east of the wire. The direction of the magnetic field at the position of the charged particle and the direction of the force on it.

- a) Field is towards north and force downward  
b) Field is towards north and force upward  
c) Field is towards south and force downward  
d) Field is towards south and force upward

54. When 400 gm of water at  $30^\circ C$  is mixed with 150 gm of water at  $25^\circ C$  contained in a calorimeter, the final temperature is found to be  $27^\circ C$ . The water equivalent of the calorimeter in the same units is

- a) 350            b) 450            c) 550            d) 250

55. Calculate the amount of heat required to convert 1 g ice and  $0^\circ C$  into steam at  $100^\circ C$ .



- a) 200 cal   b) 716 cal   c) 100 cal   d) 500 cal

56. A block A of mass  $m$  moving with a constant velocity  $v$  along a smooth horizontal floor collides with another block B of mass  $7m$  and rebounds with a velocity  $2v/5$ , the velocity of block B after collision is

- a)  $v/3$    b)  $v/5$    c)  $2v/5$    d)  $3v/5$

57. A particle is moving along a straight line with constant acceleration. If the distance travelled by the body between  $n^{\text{th}}$  and  $(n+1)^{\text{th}}$  seconds is  $100\text{m}$ , then its velocity at the end of the  $n^{\text{th}}$  second is

- a)  $20\text{m/s}$    b)  $50\text{m/s}$    c)  $30\text{m/s}$    d)  $70\text{m/s}$

58. A car travels from A to B covering half the distance at  $v_1$  and the remaining half of the distance at  $v_2$ . This car then returns from B to A at  $v_3$ . If the time taken for the return journey from B to A is half of the time taken to go from A to B, the relation between  $v_1$ ,  $v_2$  and  $v_3$  is

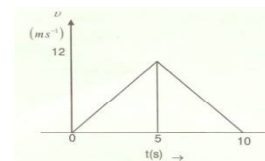
a)  $\frac{1}{v_1} - \frac{1}{v_2} = \frac{4}{v_3}$    b)  $\frac{1}{v_1} + \frac{1}{v_2} = \frac{4}{v_3}$

c)  $\frac{1}{v_1} + \frac{4}{v_2} = \frac{1}{v_3}$    d)  $\frac{1}{v_1} + \frac{1}{v_2} = \frac{1}{v_3}$

59. A body moves with a uniform velocity of  $5\text{ ms}^{-1}$  from a point. From the same point at the same time another body starts from rest and moves with uniform acceleration of  $2\text{ ms}^{-2}$  in the same direction. When and where do they meet each other?

- a) 5 s, 20 m   b) 5 s, 10 m  
c) 10 s, 25 m   d) 5 s, 25 m

60. The speed time graph of a particle moving in a fixed direction is as shown in the figure. The distance traversed by the particle between  $t = 0$  to  $t = 5\text{ s}$  is



- a) 24 m   b) 30 m   c) 36 m   d) 40 m

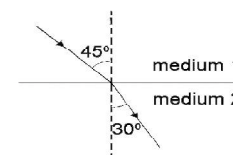
61. When a body is in equilibrium under the action of two or more forces, the algebraic sum of the moments about the turning point is:

- (a) Positive integer   (b) Negative integer  
(c) zero   (d) None of the above

62. The mass lost in 1 hour in the previous situation.

- (a)  $32 \times 10^{-3}\text{ gm}$    (b)  $16 \times 10^{-2}\text{ gm}$   
(c)  $16 \times 10^{-3}\text{ gm}$    (d)  $16 \times 10^{-4}\text{ gm}$

63. A ray of light incident at the boundary of two media travels along the path shown. Find the angle in the denser medium if the angle in the rarer medium is doubled.



- (a)  $20^\circ$    (b)  $10^\circ$    (c)  $45^\circ$    (d)  $30^\circ$

64. Nucleus of an atoms whose atomic mass is 24 consists of :
- 11 electrons , 11 protons and 13 neutrons
  - 11 electrons , 13 protons, and 11 neutrons
  - 11 protons and 13 neutrons
  - 11 protons and 11 electrons
65. A nucleus  ${}_nX^m$  emits one  $\alpha$  and two  $\beta$  particles, the resulting nucleus is :
- ${}_nX^{m-4}$
  - ${}_nZ^{m-4}$
  - ${}_{n-2}Y^{m-4}$
  - ${}_{z-4}Z^{m-4}$
66. For which of the following cases does the reaction go to nearly completion
- $K=1$
  - $K=10^{-10}$
  - $K=10^{10}$
  - none of these
67. For the reaction, the equilibrium constant values are given  $A \rightleftharpoons B, K_1=2; B \rightleftharpoons C, K_2=4; C \rightleftharpoons D, K_3=3$ . The equilibrium constant for the reaction  $A \rightleftharpoons D$  is
- 48
  - 24
  - 6
  - 12
68. 80% of a first order chemical reaction completed in 100 sec., what time it will take for the completion of 99.2%
- 200 sec
  - 400 sec
  - 300 sec
  - 150 sec
69. Which pair of species has same percentage of carbon
- $CH_3COOH$  and  $C_6H_{12}O_6$
  - $CH_3COOH$  and  $C_2H_5OH$
  - $HCOOCH_3$  and  $C_{12}H_{22}O_{11}$
  - $C_6H_{12}O_6$  and  $C_{12}H_{22}O_{11}$

70. One of the Phosphorus compound is popularly used as rat poison. The oxidation number of the Phosphorus in this compound is
- Zero
  - 2
  - 3
  - +2
71. Which of the following pairs carry same no. of electrons, but electronic configuration is not same
- $Cr^+, Mn^{+2}$
  - $Fe^{+3}, Mn^{+2}$
  - $Co^{+3}, Ni^{+4}$
  - $Cu^{+1}, Ni$
72. Ground state electronic configuration of chromium is against to
- Hund's rule
  - Pauli's rule
  - Aufbau's rule
  - All
73. The periodic table consists of 18 groups. An isotope of copper on bombardment with protons undergoes a nuclear reaction yielding element 'x' as shown below. To which group, the element X-belongs in the period table  ${}_{29}^{63}Cu + {}_1^1H \rightarrow 6{}_0^1n + \alpha + 2{}_1^1H + X$
- 10<sup>th</sup> group
  - 18<sup>th</sup> group
  - 8<sup>th</sup> group
  - 11<sup>th</sup> group
74. The first I.P values of three elements are 1314, 1680, 2080  $\text{kJ mol}^{-1}$ . The correct sequence of elements is
- F, O and Ne
  - F, Ne and O
  - F, Ne and O
  - O, F and Ne
75. First four ionization energy values of an element are 191, 578, 872 and 5972 k.cals. The number of valency electrons in the element is
- 4
  - 3
  - 1
  - 2
76. If an element with atomic number 119 is discovered. What is the position of the element in the modern periodic table
- 2<sup>nd</sup> vertical column
  - 13<sup>th</sup> vertical column
  - 9<sup>th</sup> vertical column
  - 1<sup>st</sup> vertical column

