DU BTech IT N Mathematical Innovations

Topic:- IT M BTECH

1) By examining the chest X-ray, the probability that TB is detected when a person is suffering is 0.99. The probability of an healthy person diagnosed to have TB is 0.001. In a certain city, 1 in 1000 people suffers from TB, a person is selected at random and is diagnosed to have TB. Then, the probability that the person actually has TB is[Question ID = 2222]

1. 110/221 [Option ID = 8885]
2. 2/223 [Option ID = 8886]
3. 110/223 [Option ID = 8887]
4. 1/221 [Option ID = 8888]

2) A natural number x is chosen at random from the first 100 natural numbers. Then the probability, for the equation $x+\frac{100}{x}>50$ is

[Question ID = 2223]

1. 1/20

   [Option ID = 8889]
2. 11/20

   [Option ID = 8890]
3. 1/3

   [Option ID = 8891]
4. 3/20

   [Option ID = 8892]

3) There are 7 seats in a row. Three persons take seats in a row. Three persons take seats at random. The probability that the middle seat is always occupied and no two person are consecutive, is[Question ID = 2224]

1. 9/70 [Option ID = 8893]
2. 9/35 [Option ID = 8894]
3. 4/35 [Option ID = 8895]
4. 4/70 [Option ID = 8896]

4) In a precision bombing attack, there is a 50% chance that any one bomb will strike the target. Two direct hits are required to destroy the target completely. The number of bombs which should be dropped to give a 99% chance or better of completely destroying the target, can be[Question ID = 2225]

1. 9 [Option ID = 8897]
2. 11 [Option ID = 8898]
3. 10 [Option ID = 8899]
4. 8 [Option ID = 8900]

5) There are three bags B_1, B_2 and B_3. The bag B_1 contains 5 red and 5 green balls, B_2 contains 3 red and 5 green balls and B_3 contains 5 red and 3 green balls. Bags B_1, B_2 and B_3 have probabilities 3/10, 3/10 and 4/10 respectively of being chosen. A bag is selected at random and a ball is chosen at random from the bag. Then which of the following option is correct?

[Question ID = 2226]

1. Probability that the selected bag is B_3 and the chosen ball is green equals 3/10

   [Option ID = 8901]
2. Probability that the chosen ball is green, given that the selected bag is B_3, equals 3/8

   [Option ID = 8902]
3. Probability that the selected bag is B_3 given that the chosen ball is green, equals 5/13

   [Option ID = 8903]
4. Probability that the chosen ball is green equals 37/80

   [Option ID = 8904]

6) For $i=1, 2, 3, 4$ let T_i denote the event that the students S_i and S_{i+1} do not sit adjacent to each other on the day of the examination. Then, the probability of the event $T_1 \cap T_2 \cap T_3 \cap T_4$ is

[Question ID = 2227]

1. 1/15

   [Option ID = 8905]
2. 1/10

   [Option ID = 8906]
3. 7/60

   [Option ID = 8907]
4. 1/5

   [Option ID = 8908]

7) Pal's gardener is not dependable, the probability that he will forget to water the rose bush is 2/3. The rose bush is in questionable condition. Anyhow if watered, the probability of its withering is ½, if not watered, the probability of its withering is ¾. Pal went out to station and upon returning, he finds that the rose bush has withered. Then, the chance that the gardener did not water the rose bush, is[Question ID = 2228]

1. 2/5 [Option ID = 8909]
2. 1/2 [Option ID = 8910]
3. 1/3 [Option ID = 8911]
4. 3/4 [Option ID = 8912]

8) One mapping is selected at random from all mappings of the set $S=\{1, 2, 3, \ldots, n\}$ into itself. The probability that it is one-one is $\frac{3}{32}$.

Then the value of n is

[Question ID = 2229]

1. 3

   [Option ID = 8913]
2. 5

   [Option ID = 8914]
3. 4

   [Option ID = 8915]
4. 6

   [Option ID = 8916]

9) In a study of two groups, the following results are obtained :

	Group A	Group B
Sample Size	20	25
Sample Mean	22	23
Sample standard deviation	10	12

Which of the following statement is correct?

[Question ID = 2230]

1. Group A is less variable than group B because group A's standard deviation is smaller.

   [Option ID = 8917]
2. Group A is less variable than group B because group A's sample size is smaller.

   [Option ID = 8918]
3. Group A is less variable than group B because group A's sample mean is smaller.

   [Option ID = 8919]
4. Group A is less variable than group B because group A's coefficient of variation is smaller.

   [Option ID = 8920]

10) Consider any set of observations $x_1 < x_2 < x_3 < \ldots < x_{100} < x_{101}$; then the mean deviation of this set of observations about an arbitrary point k is minimum when k equals

[Question ID = 2231]

1. X_1

   [Option ID = 8921]
2. X_{51}

   [Option ID = 8922]
3. $\frac{x_1 + x_2 + \ldots + x_{101}}{101}$

   [Option ID = 8923]
4. X_{50}

   [Option ID = 8924]

11) The mean and standard deviation of 63 children on an arithmetic test are respectively 27.6 and 7.1. To them are added a new group of 26 who had less training and whose mean is 19.2 and standard deviation is 6.2. The value of the combined group differ from the original as mean and standard deviation is[Question ID = 2232]

1. 25.1, 7.8 [Option ID = 8925]
2. 2.3, 0.8 [Option ID = 8926]
3. 1.5, 0.9 [Option ID = 8927]
4. 2.5, 0.78 [Option ID = 8928]

12) If mean and variance of 7 variates are 8 and 16 respectively and five of them are 2, 4, 10, 12, 14, then find the product of remaining two variates[Question ID = 2233]

1. 49 [Option ID = 8929]
2. 48 [Option ID = 8930]
3. 45 [Option ID = 8931]
4. 40 [Option ID = 8932]

13) In a set of 2n distinct observations, each of the observations below the median of all the observations is increased by 5 and each of the remaining observations is decreased by 3. Then the mean of the new set of observations:[Question ID = 2234]

1. Increase by 1 [Option ID = 8933]
2. Decrease by 1 [Option ID = 8934]
3. Decrease by 2 [Option ID = 8935]
4. Increase by 2 [Option ID = 8936]

14) Let x_1, x_2, x_3 be uncorrelated variables each having the same standard deviation. The coefficient of correlation between $(x_1 + x_2)$ and $(x_2 + x_3)$ is

[Question ID = 2235]

1. 1/4

   [Option ID = 8937]
2. 1/3

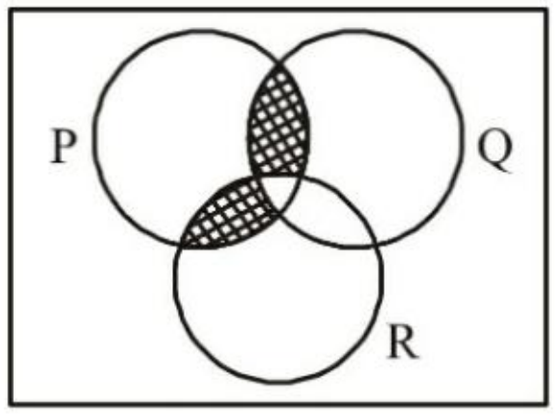
   [Option ID = 8938]
3. 1/2

   [Option ID = 8939]

4. 1

[Option ID = 8940]

15) What does the shaded portion of the Venn diagram given below represent?



[Question ID = 2236]

1. $(P \cap Q) \cap (P \cap R)$

   [Option ID = 8941]
2. $((P \cap Q) - R) \cup ((P \cap R) - Q)$

   [Option ID = 8942]
3. $((P \cup Q) - R) \cap ((P \cap R) - Q)$

   [Option ID = 8943]
4. $((P \cap Q) \cup R) \cap ((P \cup Q) - R)$

   [Option ID = 8944]

16) In a class of 80 students numbered 1 to 80, all odd numbered students opt for cricket, students whose numbers are divisible by 5 opt for football and those whose numbers are divisible by 7 opt for hockey. The number of students who do not opt any of the three games, is[Question ID = 2237]

1. 13 [Option ID = 8945]
2. 24 [Option ID = 8946]
3. 28 [Option ID = 8947]
4. 52 [Option ID = 8948]

17) A relation on the set $A = \{x : |x| < 3, x \in Z\}$, where Z is the set of integers is defined by $R = \{(x, y) : y = |x|, x \neq -1\}$. Then the number of elements in the power set of R is:

[Question ID = 2238]

1. 32

   [Option ID = 8949]
2. 16

   [Option ID = 8950]
3. 8

   [Option ID = 8951]
4. 64

   [Option ID = 8952]

18) If $f(x) = 2x + |x|$, $g(x) = \frac{1}{3}(2x - |x|)$ and $h(x) = f(g(x))$, then domain of $\underbrace{\sin^{-1}(h(h(h(h \ldots h(x) \ldots))))}_{n \text{ times}}$ is

[Question ID = 2239]

1. [-1, 1] [Option ID = 8953]
2. $\left[-1, -\frac{1}{2}\right] \cup \left[\frac{1}{2}, 1\right]$

   [Option ID = 8954]
3. $\left[-1, -\frac{1}{2}\right]$

   [Option ID = 8955]
4. $\left[\frac{1}{2}, 1\right]$

   [Option ID = 8956]

19) Let $f : [4, \infty) \to [4, \infty)$ be a function defined by, $f(x) = 5^{x(x-4)}$, then $f^{-1}(x)$ is

[Question ID = 2240]

1. $2 - \sqrt{4 + \log_5 x}$

   [Option ID = 8957]
2. $2 + \sqrt{4 + \log_5 x}$

   [Option ID = 8958]
3. $\left(\frac{1}{5}\right)^{x(x-4)}$

   [Option ID = 8959]
4. $\left(\frac{1}{5}\right)^{x(x+4)}$

[Option ID = 8960]

20) A function whose graph is symmetrical about the origin is given by[Question ID = 2241]

1. $f(x)=(3^x+3^{-x})$

[Option ID = 8961]

2. $f(x)=\cos[\log(x+\sqrt{1+x^2})]$

[Option ID = 8962]

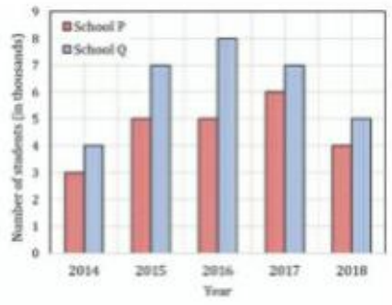
3. $f(x+y)=f(x)+f(y)\ \forall x,y\in R$

[Option ID = 8963]

4. $f(x)=\cos[\log(x-\sqrt{1+x^2})]$

[Option ID = 8964]

21) The following figure shows the data of students enrolled in 5 years (2014-2018) for two schools P and Q. During this period, the ratio of the average number of students enrolled in school P to the averageof the difference of the number of students enrolled in school P and Q is



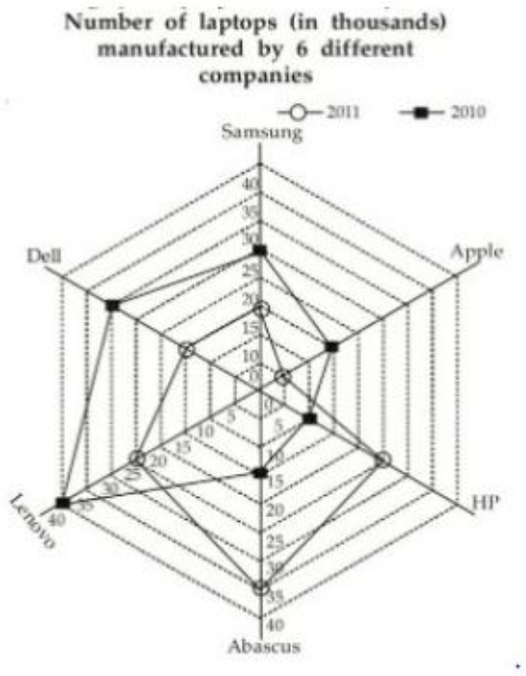
[Question ID = 2242]

1. 8:23 [Option ID = 8965]
2. 23:8 [Option ID = 8966]
3. 23:31 [Option ID = 8967]
4. 31:23 [Option ID = 8968]

22) Direction: A series is given, with one term missing. Choose a correct alternative from the given options that will complete the series. 56, 90, 132, 184, 248, ?[Question ID = 2243]

1. 368 [Option ID = 8969]
2. 316 [Option ID = 8970]
3. 362 [Option ID = 8971]
4. 326 [Option ID = 8972]

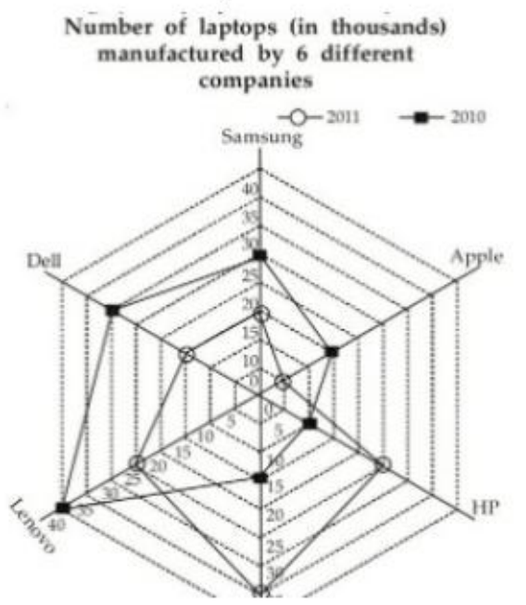
23) In the following graph the number of laptops manufactured by six different companies in the years 2010 and 2011 has been given. Please answer the below questions based on this graph.



What is the percentage increase in production of laptops by HP in 2011 in comparison to that in 2010?[Question ID = 2244]

1. 125 [Option ID = 8973]
2. 100 [Option ID = 8974]
3. 150 [Option ID = 8975]
4. 250 [Option ID = 8976]

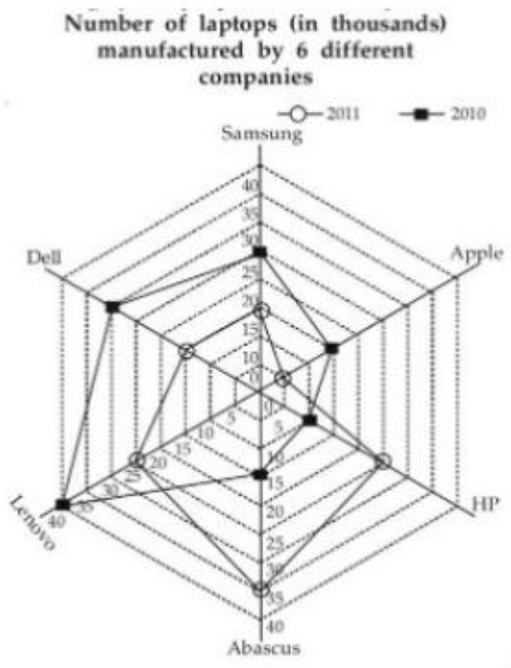
24) In the following graph the number of laptops manufactured by six different companies in the years 2010 and 2011 has been given. Please answer the below questions based on this graph.



The difference between the number of laptops manufactured by Apple, Lenovo and Samsung in 2010 and that by Dell, HP and Abascus in 2011[Question ID = 2245]

1. 5500 [Option ID = 8977]
2. 4550 [Option ID = 8978]
3. 3550 [Option ID = 8979]
4. 5000 [Option ID = 8980]

25) In the following graph the number of laptops manufactured by six different companies in the years 2010 and 2011 has been given. Please answer the below questions based on this graph.



What is the average number of laptops (in thousands) manufactured by all companies taken together in 2010?[Question ID = 2246]

1. 22 [Option ID = 8981]
2. 22.5 [Option ID = 8982]
3. 32.5 [Option ID = 8983]
4. 23.5 [Option ID = 8984]

26) If $I_n = \int \frac{dx}{(x^2+a^2)^n}$, then $I_{n+1} + \frac{1-2n}{2na^2} I_n =$

[Question ID = 2247]

1. $\frac{1}{2na^2} \frac{x}{(x^2+a^2)^n}$

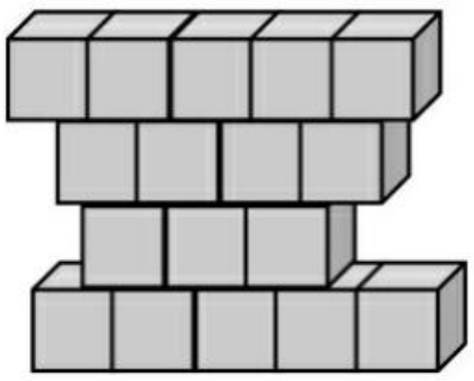
   [Option ID = 8985]
2. $\frac{x}{(x^2+a^2)^n}$

   [Option ID = 8986]
3. $\frac{1}{2na^2} \frac{x}{(x^2+a^2)^{n-1}}$

   [Option ID = 8987]
4. $\frac{x}{(x^2+a^2)^{n-1}}$

   [Option ID = 8988]

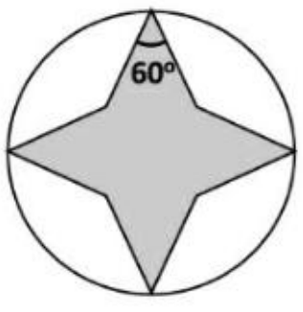
27) Seventeen unit cubes are glued together to form the solid shown in the figure. The surface area of the solid figure is



[Question ID = 2248]

1. 56 [Option ID = 8989]
2. 51 [Option ID = 8990]
3. cannot be determined with the given data [Option ID = 8991]
4. 53 [Option ID = 8992]

28) A regular four pointed star is inscribed in a circle of radius 8 cm. The area of the shaded region is



[Question ID = 2249]

1. $128(\sqrt{3}-1)$ sq. cms

   [Option ID = 8993]
2. $64(\sqrt{3}+1)$ sq. cms

   [Option ID = 8994]
3. $8(\sqrt{3}-1)$ sq. cms

   [Option ID = 8995]
4. $8(\sqrt{3}+1)$ sq. cms

   [Option ID = 8996]

29) A circle is inscribed in an equilateral triangle of side a and a square is inscribed in this circle. The area of the square is

[Question ID = 2250]

1. $\frac{a^2}{6}$ sq. units

   [Option ID = 8997]
2. $\frac{\pi a^2}{6}$ sq. units

   [Option ID = 8998]
3. $\frac{\pi a^2}{3}$ sq. units

   [Option ID = 8999]
4. $\frac{a^2}{3}$ sq. units

   [Option ID = 9000]

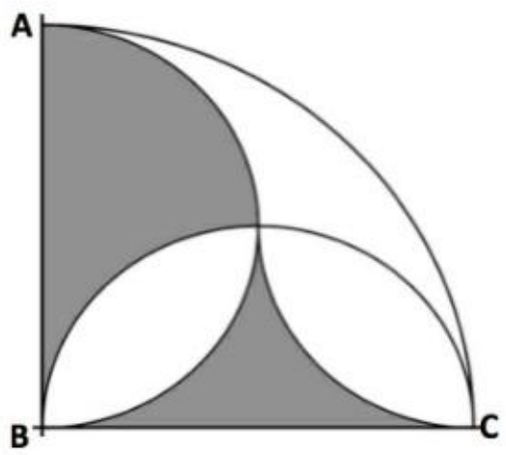
30) ABCD is a trapezium with AB parallel to BC, $\angle BAD = \angle ADC = 90^o$. The diagonals AC and BD intersect at E. If AB = 6 cms, CD = 18 cms and AD = 24 cms, then the area of the triangle BEC is (in sq. units)[Question ID = 2251]

1. 54 [Option ID = 9001]
2. 81 [Option ID = 9002]
3. 162 [Option ID = 9003]
4. 216 [Option ID = 9004]

31) ABCD is a parallelogram. Point P on AB divides it in the ratio AP : PB = 2:1. Point Q on DC divides it in the ration DQ : QC = 3:5. Diagonal AC intersect PQ at the point R. Then RC : AC is[Question ID = 2252]

1. 31 : 15 [Option ID = 9005]
2. 2 : 1 [Option ID = 9006]
3. 16 : 7 [Option ID = 9007]
4. 8 : 3 [Option ID = 9008]

32) Quadrant ABC is 1/4th of a circle of radius 10cms. Two semicircles are drawn on the side AB and BC. The area of the shaded region is (Take π = 3)



[Question ID = 2253]

1. 37.5 sq cms

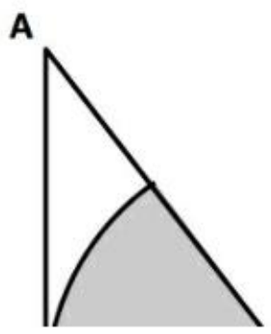
   [Option ID = 9009]
2. 75 sq cms

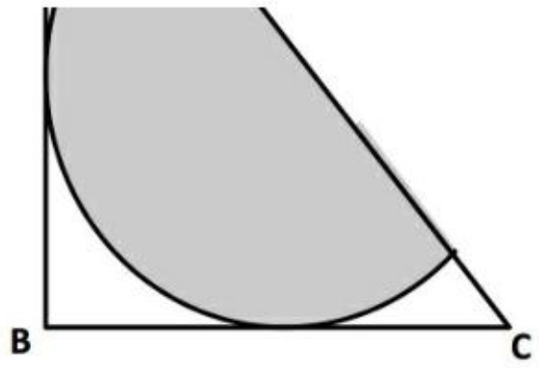
   [Option ID = 9010]
3. 12.5 sq cms

   [Option ID = 9011]
4. 25 sq cms

   [Option ID = 9012]

33) Passage for the next two questions: ABC is a right angled triangle with $\angle ABC = 90^o$ and side lengths AB = 36 units and BC = 27 units. A semicircle is inscribed in ABC, such that the diameter is on AC and it is tangent to AB and BC.





If the radius of the semicircle is an improper fraction of the form a/ b , where a and b are coprime positive integers. Then the value of a+b is

[Question ID = 2254]

1. 115

   [Option ID = 9013]
2. 109

   [Option ID = 9014]
3. 16

   [Option ID = 9015]
4. 17

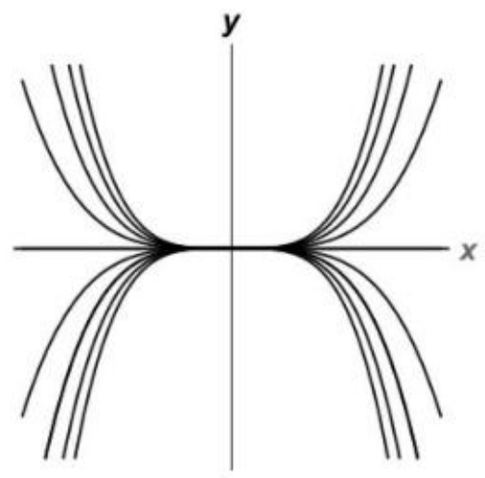
   [Option ID = 9016]

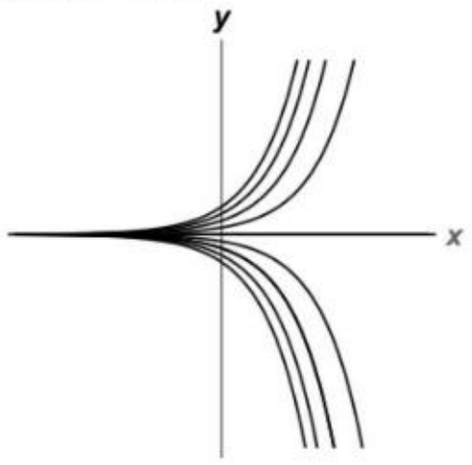
34) If the vertex B is the origin, and the two perpendicular sides are the coordinates axes, then the coordinates of the centre of the semi-circle is given by (m, n). The value of m - n is[Question ID = 2255]

1. 0 [Option ID = 9017]
2. 3.75 [Option ID = 9018]
3. - 3.75 [Option ID = 9019]
4. 9 [Option ID = 9020]

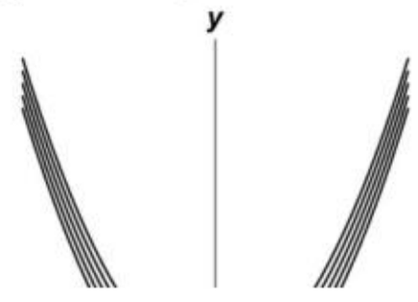
35) The solution curves of the the first order differential equation $x\frac{dy}{dx}=4y$ are

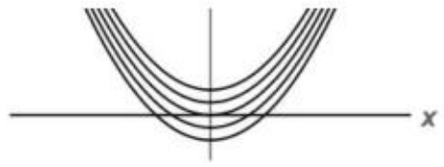
[Question ID = 2256]

1. 

   [Option ID = 9021]
2. 

   [Option ID = 9022]
3.

   [Option ID = 9023]
4. 



[Option ID = 9024]

36) $\int_{e}^{e^{512}} \frac{1}{x\ln x + x\ln x(\ln(\ln x))^2}\,dx =$

[Question ID = 2257]

1. $\tan^{-1}(\ln 512)$

   [Option ID = 9025]
2. ln 512 [Option ID = 9026]
3. tan (512) [Option ID = 9027]
4. $\tan^{-1}$ (256) [Option ID = 9028]

37) If $f(m)=\sum_{n=2}^{m}\int_{n}^{n^3}\frac{1}{x\ln x}dx$, then f (2021) =

[Question ID = 2258]

1. 2020 ln3

   [Option ID = 9029]
2. 1010 ln 3

   [Option ID = 9030]
3. 1010 ln 2

   [Option ID = 9031]
4. 2020 ln 2

   [Option ID = 9032]

38) $\int_{1}^{2}\frac{1}{x(x^n+1)}dx =$

[Question ID = 2259]

1. $\frac{1}{n}\ln\left(\frac{2^{n+1}}{1+2^n}\right)$

   [Option ID = 9033]
2. $\frac{n+1}{n}\ln\left(\frac{2}{2^n+1}\right)$

   [Option ID = 9034]
3. $\frac{1}{n+1}\ln\left(\frac{2}{2^n-1}\right)$

   [Option ID = 9035]
4. $\frac{1}{n}\ln\left(\frac{2}{2^n-1}\right)$

   [Option ID = 9036]

39) The value of the integral $\int_{3}^{6}\left(\sqrt{x+\sqrt{12x-36}}+\sqrt{x-\sqrt{12x-36}}\right)dx$ is

[Question ID = 2260]

1. $6\sqrt{3}$

   [Option ID = 9037]
2. $3\sqrt{6}$

   [Option ID = 9038]
3. 12

   [Option ID = 9039]
4. $3\sqrt{3}$

   [Option ID = 9040]

40) $\int_{\pi/6}^{\pi/3}\frac{\cot x\,\sec^2 x}{1+\cot x}dx =$

[Question ID = 2261]

1. $\frac{1}{2}\ln 3$

   [Option ID = 9041]
2. 2 ln 3 [Option ID = 9042]
3. $-\frac{1}{2}\ln 3$

   [Option ID = 9043]
4. - 2 ln 3 [Option ID = 9044]

41) Area of the region bounded by the curve $y = e^x$ and the line x = 0 and y = e is[Question ID = 2262]

1. 1 [Option ID = 9045]
2. e - 1 [Option ID = 9046]

3. e [Option ID = 9047]
4. e^e - 1 [Option ID = 9048]

42) If f (x) = x + sin x, then the value of $\int_0^{\pi} f^{-1}(x)dx$ is

[Question ID = 2263]

1. $\frac{\pi^2}{2}-2$

   [Option ID = 9049]
2. $\pi-2$

   [Option ID = 9050]
3. 1

   [Option ID = 9051]
4. $\frac{\pi}{4}-2$

   [Option ID = 9052]

43) Any curve which cuts every member of a given family of curve at right angle is called an orthogonal trajectory of the family. The procedure for finding the orthogonal trajectory for the curve $f(x, y) = c$ is

Step 1: Differentiate the equation of the curve to eliminate the arbitrary parameter c.

Step 2: As the two curves meet at right angles replace the tangent $\frac{dy}{dx}$ obtained in Step 1 by $-\frac{dx}{dy}$

Step 3: Solve the differentail equation obtained in Step 2

The orthogonal trajectory to the family of circles with centre as the origin are

[Question ID = 2264]

1. Lines passing through the origin

   [Option ID = 9053]
2. All lines that are tangent to the circles.

   [Option ID = 9054]
3. A regular n-gon subscribing the circle

   [Option ID = 9055]
4. Exponential curves of the form $y = Ce^x$

   [Option ID = 9056]

44) Any curve which cuts every member of a given family of curve at right angle is called an orthogonal trajectory of the family. The procedure for finding the orthogonal trajectory for the curve $f(x, y) = c$ is

Step 1: Differentiate the equation of the curve to eliminate the arbitrary parameter c.

Step 2: As the two curves meet at right angles replace the tangent $\frac{dy}{dx}$ obtained in Step 1 by $-\frac{dx}{dy}$

Step 3: Solve the differentail equation obtained in Step 2

The orthogonal trajectories to the family of parabolas $y^2 = 4ax$ are

[Question ID = 2265]

1. family of parabolas of the form $x^2 = Cy$

   [Option ID = 9057]
2. family of straight lines

   [Option ID = 9058]
3. family of ellipses

   [Option ID = 9059]
4. family of hyperbolas

   [Option ID = 9060]

45) Any curve which cuts every member of a given family of curve at right angle is called an orthogonal trajectory of the family. The procedure for finding the orthogonal trajectory for the curve $f(x, y) = c$ is

Step 1: Differentiate the equation of the curve to eliminate the arbitrary parameter c.

Step 2: As the two curves meet at right angles replace the tangent $\frac{dy}{dx}$ obtained in Step 1 by $-\frac{dx}{dy}$

Step 3: Solve the differentail equation obtained in Step 2

The orthogonal trajectories to the family of exponential curves $y = ke^{-x}$ are

[Question ID = 2266]

1. family of parabolas

   [Option ID = 9061]
2. family of circles

   [Option ID = 9062]
3. family of hyperbolas

   [Option ID = 9063]
4. family of exponential curves

[Option ID = 9064]

46)

	City A	City B	City C	City D	City E
City A		•	•	•	•
City B			•	•	•
City C				•	•
City D					•
City E					

Each in the mileage table above represents an entry indicating the distance between a pair of the five cities. If the table were extended to represent the distances between all pairs of 30 cities and each distance were to be represented by only one entry, how many entries would the table then have?

[Question ID = 2267]

1. 600

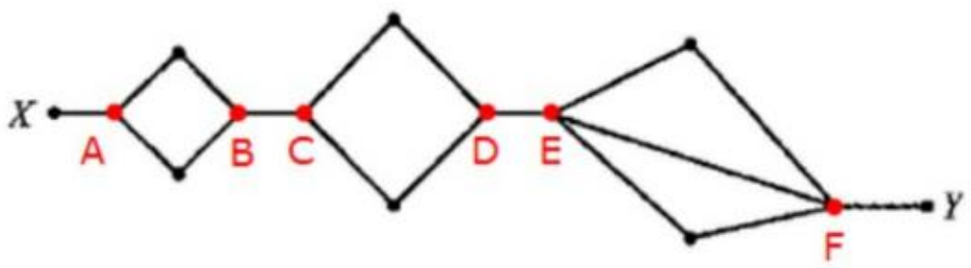
   [Option ID = 9065]
2. 435

   [Option ID = 9066]
3. 450

   [Option ID = 9067]
4. 900

   [Option ID = 9068]

47)



The diagram above shows the various paths along which a mouse can travel from point X, where it is released, to point Y, where it is rewarded with a food pellet. How many different paths from X to Y can the mouse take if it goes directly from X to Y without retracing any point along a path?

[Question ID = 2268]

1. 6

   [Option ID = 9069]
2. 7

   [Option ID = 9070]
3. 12

   [Option ID = 9071]
4. 14

   [Option ID = 9072]

48)

$$\square\triangle$$
$$\times\triangle\square$$
$$\_\_\_\_\_$$

The product of the two-digit numbers above is the three digit number $\square\bigcirc\square$, where $\square, \triangle$ and $\bigcirc$, are three different nonzero digits. If $\square \times \triangle < 10$, what is the two digit number $\square\triangle$?

[Question ID = 2269]

1. 11

   [Option ID = 9073]
2. 12

   [Option ID = 9074]
3. 21

   [Option ID = 9075]
4. 31

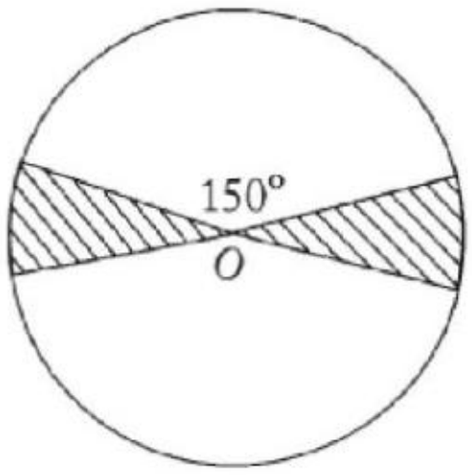
   [Option ID = 9076]

49) A set of numbers has the property that for any number t in the set, $t+2$ is also in the set. If (-1) is in the set, which of the following must also be in the set ?

A. -3 B. 1 C. 5 Choose the correct answer from the options given below:[Question ID = 2270]

1. A only [Option ID = 9077]
2. B only [Option ID = 9078]
3. A and B only [Option ID = 9079]
4. B and C only [Option ID = 9080]

50)



If O is the centre of the circle above, what fraction of the circular region is shaded?

[Question ID = 2271]

1. $\frac{1}{12}$

[Option ID = 9081]

2. $\frac{1}{9}$

[Option ID = 9082]

3. $\frac{1}{6}$

[Option ID = 9083]

4. $\frac{1}{4}$

[Option ID = 9084]

51) If $f(x)=(1+x)^n$, then $f(0)+f'(0)+\frac{1}{2}f''(0)+\ldots+\frac{1}{n!}f^n(0)$ *is*

[Question ID = 2272]

1. n

[Option ID = 9085]

2. 2^n

[Option ID = 9086]

3. $2^{(n-1)}$

[Option ID = 9087]

4. 1

[Option ID = 9088]

52) If $f(x)=(x+1)(x+2)(x+3)\ldots(x+100)$ and $g(x)=f(x)f''(x)-(f'(x))^2$ then $g(x)=0$ has

[Question ID = 2273]

1. no soulutions [Option ID = 9089]
2. one solution [Option ID = 9090]
3. two soultions [Option ID = 9091]
4. at least three solutions [Option ID = 9092]

53) $\lim\limits_{x\to\infty}\frac{\log_{10}(x+2)+[x+2]}{x+\sum\limits_{r=0}^{\infty}\left(\frac{1}{2}\right)^r}$ is, where [.] is an integral part function

[Question ID = 2274]

1. 0

[Option ID = 9093]

2. 1

[Option ID = 9094]

3. -1

[Option ID = 9095]

4. limit does not exist

[Option ID = 9096]

54) If $f(x)=\begin{cases}1+x, & 0\le x\le 2\\ 3-x, & 2\le x\le 3\end{cases}$, then at how many points is fof not differentiable

[Question ID = 2275]

1. 2 [Option ID = 9097]
2. 1 [Option ID = 9098]
3. 3 [Option ID = 9099]
4. 0 [Option ID = 9100]

55) $\lim\limits_{x\to\infty}\frac{\sum\limits_{r=1}^{2021}(r+x)^{2021}}{x^{2021}+2021^{2021}}$ *is*

[Question ID = 2276]

1. 1 [Option ID = 9101]
2. 0 [Option ID = 9102]
3. 2021 [Option ID = 9103]
4. limit does not exist [Option ID = 9104]

56) Let $f(x)=\begin{cases} x^n \sin\frac{1}{x}, & x\neq 0 \\ 0 \quad , & x=0 \end{cases}$, if f(x) is continuous at $x=0$ but not differentiable at $x=0$, then

[Question ID = 2277]

1. $n\in(0,1]$

   [Option ID = 9105]
2. $n\in[1,\infty)$

   [Option ID = 9106]
3. $n\in(-\infty,0)$

   [Option ID = 9107]
4. $n=0$

   [Option ID = 9108]

57) If the curve $x^2y=1$ and $x^3=a^5y$ intersect at right angles then a^6 is

[Question ID = 2278]

1. 2 [Option ID = 9109]
2. 3 [Option ID = 9110]
3. 4 [Option ID = 9111]
4. 6 [Option ID = 9112]

58) On the curve $y^2-x^2=1$, there is a point P whose x coordinate is n where $n\in N$. If d_n represents the distance from P to the line $y=x$, then $\lim\limits_{n\to\infty}(nd_n)$ is

[Question ID = 2279]

1. 1 [Option ID = 9113]
2. $2\sqrt{2}$

   [Option ID = 9114]
3. $\frac{1}{2\sqrt{2}}$

   [Option ID = 9115]
4. $\frac{1}{2}$

   [Option ID = 9116]

59) If $f(x)=\lim\limits_{n\to\infty}(\sqrt[n]{x}-1)n$, then $\frac{1}{f'(2012)}, \frac{1}{f'(2013)}, \frac{1}{f'(2014)}$ are in

[Question ID = 2280]

1. arithmetic progression [Option ID = 9117]
2. geometric progression [Option ID = 9118]
3. harmonic progression [Option ID = 9119]
4. none of these [Option ID = 9120]

60) Total number of parallel tangents of $f_1(x)=x^2-x+1$ and $f_2(x)=x^3-x^2-2x+1$ is equal to

[Question ID = 2281]

1. 2

   [Option ID = 9121]
2. 3

   [Option ID = 9122]
3. 4

   [Option ID = 9123]
4. none of these

   [Option ID = 9124]

61) If the rate of increase of a side of a triangle inscribed in a circle of radius R, is R times the rate of increase of the measure of opposite angle, then the measure of the angle is, [Question ID = 2282]

1. $\frac{\pi}{6}$

   [Option ID = 9125]
2. $\frac{\pi}{4}$

   [Option ID = 9126]
3. $\frac{\pi}{3}$

   [Option ID = 9127]
4. $\frac{\pi}{2}$

   [Option ID = 9128]

62) Let, $f(x)=x^2-bx+c$, where b, c are odd natural numbers and $f(x)=0$ has both the roots primes. If b+c=35, then the minimum value of $f(x)$ is,

[Question ID = 2283]

1. $-\frac{183}{4}$

[Option ID = 9129]

2. $\frac{173}{16}$

[Option ID = 9130]

3. $-\frac{81}{4}$

[Option ID = 9131]

4. $\frac{81}{4}$

[Option ID = 9132]

63) If $f(x)=\int_{x^2}^{x^2+1} e^{-t^2}dt$, then f(x) is an increasing function in

[Question ID = 2284]

1. the interval [-2, 2]

[Option ID = 9133]

2. the interval $[0, \infty]$

[Option ID = 9134]

3. the interval $(-\infty, 0)$

[Option ID = 9135]

4. for no value of x

[Option ID = 9136]

64) The intercepts made on X-axis by tangents to the curve $y=\int_0^x |t|dt$, and which are parallel to the line y=2x, are equal to

[Question ID = 2285]

1. ± 1

[Option ID = 9137]

2. ± 2

[Option ID = 9138]

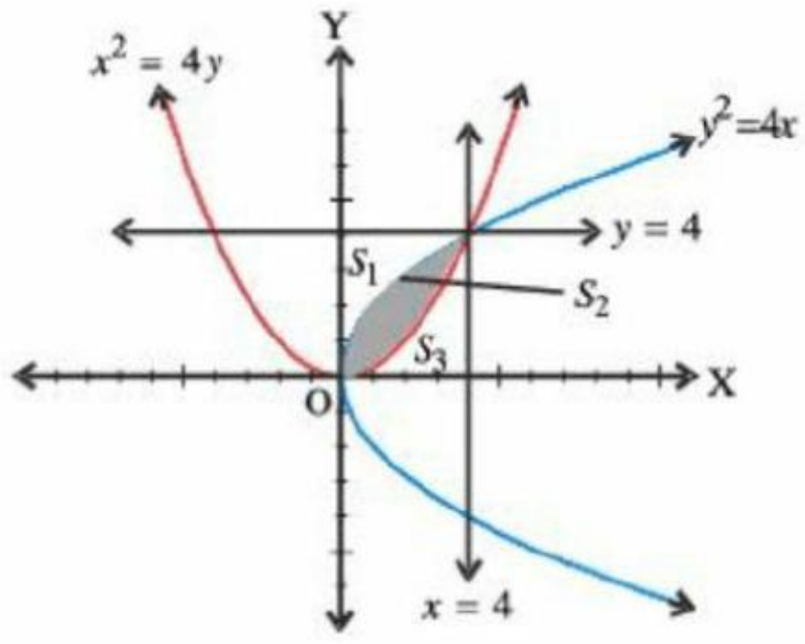
3. ± 3

[Option ID = 9139]

4. ± 4

[Option ID = 9140]

65) A square is formed by the lines x=4, y=4 and coordinte axis, parabola $y^2=4x$ and $x^2=4y$ divide this square into three parts S_1, S_2, S_3. Then S_1: S_2: S_3 is



[Question ID = 2286]

1. 1:2:3

[Option ID = 9141]

2. 1:2:1

[Option ID = 9142]

3. 1:1:1

[Option ID = 9143]

4. 2:1:2

[Option ID = 9144]

66) The adjacent sides of a parallelogram ABCD are represented by vectors $\vec{AB}=2\hat{i}+10\hat{i}+11\hat{k}$ and $\vec{AD}=-\hat{i}+2\hat{i}+2\hat{k}$. Side[illegible]me

parallelogram ABCD rotates in the plane of ABCD through an angle with measure α and it becomes $\overrightarrow{AD'}$. If $\overrightarrow{AD'}$ makes right angle with $\overrightarrow{AB}$, then $\cos\alpha = \ldots$

[Question ID = 2287]

1. $\frac{8}{9}$

   [Option ID = 9145]

2. $\frac{\sqrt{17}}{9}$

   [Option ID = 9146]

3. $\frac{1}{9}$

   [Option ID = 9147]

4. $\frac{4\sqrt{5}}{9}$

   [Option ID = 9148]

67) For the volume of the parallelopiped with edges $\hat{i}+x\hat{j}, 4\hat{i}-\hat{j}+x\hat{k}$, and $-x\hat{i}+\hat{j}-\hat{k}$ to be maximum, the value of x should be ... where $x \in [0, \sqrt{3}]$

[Question ID = 2288]

1. -3

   [Option ID = 9149]

2. 1

   [Option ID = 9150]

3. -1

   [Option ID = 9151]

4. 3

   [Option ID = 9152]

68) A square of side 'α' lies in the upper half plane of X-axis and one of its vertices is at the origin. If the line containing a side passing through the origin makes an angle of measure α with positive X-axis, then the equation of the diagonal not passing through the origin is,....$\left(0 < \alpha < \frac{\pi}{4}\right)$

[Question ID = 2289]

1. $y(\cos\alpha+\sin\alpha)+x(\sin\alpha-\cos\alpha)=a$

   [Option ID = 9153]

2. $y(\cos\alpha+\sin\alpha)+x(\sin\alpha+\cos\alpha)=a$

   [Option ID = 9154]

3. $y(\cos\alpha+\sin\alpha)+x(\cos\alpha-\sin\alpha)=a$

   [Option ID = 9155]

4. $y(\cos\alpha-\sin\alpha)-x(\sin\alpha-\cos\alpha)=a$

   [Option ID = 9156]

69) A triangle is formed in the first quadrant by a tangent to the curve $f(x)=x^2+bx-b$ at (1, 1) and coordinate axes. If the area of the triangle is 2, then b=...

[Question ID = 2290]

1. -1

   [Option ID = 9157]

2. 3

   [Option ID = 9158]

3. -3

   [Option ID = 9159]

4. 1

   [Option ID = 9160]

70) $S_1, S_2, \ldots$ are squares such that for every n>1, the length of the side of S_n is equal to the length of diagonal of S_{n+1}. If the length of the side of S_1 is 10, then for what value of n, area of S_n is less than 1,[Question ID = 2291]

1. 7 [Option ID = 9161]
2. 6 [Option ID = 9162]
3. 8 [Option ID = 9163]
4. 11 [Option ID = 9164]

71) Let α_1, α_2 and β_1, β_2 be the roots of $ax^2+bx+c=0$ and $px^2+qx+r=0$, respectively. If the system of equations $\alpha_1 y+\alpha_2 z=0$ and $\beta_1 y+\beta_2 z=0$ has a non-trivial solution, then

[Question ID = 2292]

1. $\frac{b^2}{q^2}=\frac{ac}{pr}$

   [Option ID = 9165]

2. $\frac{c^2}{r^2}=\frac{ab}{pq}$

   [Option ID = 9166]

3. $\frac{a}{p^2}=\frac{bc}{qr}$

[Option ID = 9167]

4. $\frac{b^2}{p^2}=\frac{bc}{qr}$

[Option ID = 9168]

72) If a, b and c are positive real numbers. The following system of equations

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=1$$
$$\frac{x^2}{a^2}-\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$$
$$-\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$$

in x, y and z has

[Question ID = 2293]

1. infinite solutions

[Option ID = 9169]

2. unique solution

[Option ID = 9170]

3. no solution

[Option ID = 9171]

4. finite number of solutions

[Option ID = 9172]

73) If $ax^6+bx^5+cx^4+dx^3+ex^2+fx+g=\begin{vmatrix} x+1 & x^2+2 & x^2+x \\ x^2+x & x^2+1 & x^2+2 \\ x^2+2 & x^2+x & x+1 \end{vmatrix}$, then

[Question ID = 2294]

1. $f=4, g=-5$

[Option ID = 9173]

2. $f=-3, g=-5$

[Option ID = 9174]

3. $f=-3, g=9$

[Option ID = 9175]

4. $f=-4, g=9$

[Option ID = 9176]

74) If the system of linear equations

$$x+2ay+az=0$$
$$x+3by+bz=0$$
$$x+4cy+cz=0$$

has a non-zero solution, then a, b, c

[Question ID = 2295]

1. are in AP

[Option ID = 9177]

2. are in GP

[Option ID = 9178]

3. are in HP

[Option ID = 9179]

4. satisfy $a+2b+3c=0$

[Option ID = 9180]

75) If a, b and c are real, then the interval in which $f(x)=\begin{vmatrix} x+a^2 & ab & ac \\ ab & x+b^2 & bc \\ ac & bc & x+c^2 \end{vmatrix}$ is decreasing, is

[Question ID = 2296]

1. $(0, \infty)$

[Option ID = 9181]

2. $\left(0, \frac{2}{3}(a^2+b^2+c^2)\right)$

[Option ID = 9182]

3. $(-\infty, 0)$

[Option ID = 9183]

4. $\left(-\frac{2}{3}(a^2+b^2+c^2), 0\right)$

[Option ID = 9184]

76) The number of functions f from the set $A=\{0, 1, 2\}$ into the set B={0, 1, 2, 3, 4, 5, 6, 7} such that $f(i) \le f(j)$ for $i<j$ and $i, j \in A$ is

[Question ID = 2297]

1. ${}^8C_3$

[Option ID = 9185]

2. ${}^8C_3+2({}^8C_2)$

[Option ID = 9186]

3. ${}^{10}C_3$

[Option ID = 9187]

4. ${}^8C_2$

[Option ID = 9188]

77) Let n be a positive integer with $f(n)=1!+2!+3!+\ldots+n!$ and $P(x)$, $Q(x)$ be polynomials in x such that $f(n+2)=P(n)f(n+1)+Q(n)f(n)$ for all $n \ge 1$. Then,

[Question ID = 2298]

1. $P(x)=x+3$ and $Q(x)=-x-2$

[Option ID = 9189]

2. $P(x)=-x+3$ and $Q(x)=x-2$

[Option ID = 9190]

3. $P(x)=-x-3$ and $Q(x)=-x-2$

[Option ID = 9191]

4. $P(x)=x+3$ and $Q(x)=x+2$

[Option ID = 9192]

78) The value of ${}^mC_{(r+1)}+\sum_{k=m}^{n}{}^kC_r$ is equal to

[Question ID = 2299]

1. ${}^nC_{(r+1)}$

[Option ID = 9193]

2. ${}^{(n+1)}C_{(r+1)}$

[Option ID = 9194]

3. ${}^nC_r$

[Option ID = 9195]

4. ${}^nC_{2r}$

[Option ID = 9196]

79) The value of ${}^{47}C_4+\sum_{j=0}^{3}{}^{(50-j)}C_3+\sum_{k=0}^{5}{}^{(56-k)}C_{(53-k)}$ is equal to

[Question ID = 2300]

1. ${}^{57}C_4$

[Option ID = 9197]

2. ${}^{57}C_3$

[Option ID = 9198]

3. ${}^{57}C_5$

[Option ID = 9199]

4. ${}^{57}C_6$

[Option ID = 9200]

80) If $(1-x+x^2)^n=a_0+a_1x+a_2x^2+\ldots+a_{2n}x^{2n}$, where $a_0, a_1, a_2,\ldots,a_{2n}$ are in AP, then a_n is equal to

[Question ID = 2301]

1. $\frac{1}{2n+1}$

[Option ID = 9201]

2. $\frac{1}{2n-1}$

[Option ID = 9202]

3. $\frac{2}{2n-1}$

[Option ID = 9203]

4. $\frac{1}{n+1}$

[Option ID = 9204]

81) If $C_0, C_1, C_2, \ldots, C_n$ denote the binomial coefficients in the expansion of $(1+x)^n$, then $\sum_{r=0}^{n}(-1)^r.{}^nC_r.\frac{1+r\log_e 10}{(1+\log_e 10^n)^r}$ is equal to

[Question ID = 2302]

1. 0 [Option ID = 9205]
2. 1 [Option ID = 9206]
3. 2 [Option ID = 9207]
4. 3 [Option ID = 9208]

82) If α and β are the roots of the equation

$ax^2+bx+c=0$ and $S_n=\alpha^n+\beta^n$, then $a\,S_{n-1}+b\,S_n+c\,S_{n-1}$ is equal to

[Question ID = 2303]

1. 0

   [Option ID = 9209]
2. abc

   [Option ID = 9210]
3. $a+b+c$

   [Option ID = 9211]
4. a

   [Option ID = 9212]

83) Let a, b and c be real numbers, $a\neq 0$. If α is a root of $a^2x^2+bx+c=0$, β is a root of $a^2x^2-bx-c=0$ and $0<\alpha<\beta$. Then, the equation $a^2x^2+2bx+2c=0$ has a root γ that always satisfies

[Question ID = 2304]

1. $\gamma=\alpha$

   [Option ID = 9213]
2. $\alpha<\beta<\gamma$

   [Option ID = 9214]
3. $\alpha<\gamma<\beta$

   [Option ID = 9215]
4. $\gamma=\beta$

   [Option ID = 9216]

84) Let a_n be the n^{th} term of an AP. If $\sum_{r=1}^{10^{99}} a_{2r}=10^{100}$ and $\sum_{r=1}^{10^{99}} a_{2r-1}=10^{99}$, then common difference of an AP is

[Question ID = 2305]

1. 1 [Option ID = 9217]
2. 9 [Option ID = 9218]
3. 10 [Option ID = 9219]
4. 10^{99} [Option ID = 9220]

85) The sum of infinite terms of a decreasing GP is equal to the greatest value of the function $f(x)=x^3+3x-9$ in the interval [-2, 3] and the difference between the first two terms is $f'(0)$. Then, the common ratio of a GP is

[Question ID = 2306]

1. -2/3 [Option ID = 9221]
2. 4/3 [Option ID = 9222]
3. 2/3 [Option ID = 9223]
4. -4/3 [Option ID = 9224]

86) The range of real number α for which the equation $z+\alpha|z-1|+2i=0$ has a solution, is

[Question ID = 2307]

1. $\left[-\frac{\sqrt{5}}{2},\frac{\sqrt{5}}{2}\right]$

   [Option ID = 9225]
2. $\left(\frac{\sqrt{5}}{2},\infty\right)$

   [Option ID = 9226]
3. $\left(-\infty,-\frac{\sqrt{5}}{2}\right)$

   [Option ID = 9227]
4. $\left(-\infty,-\frac{\sqrt{5}}{2}\right)\cup\left(\frac{\sqrt{5}}{2},\infty\right)$

   [Option ID = 9228]

87) If the equation $a_nX^n+a_{n-1}+\ldots+a_1X=0$, $a_1\neq 0$, $n\geq$ has a positive root $X=\alpha$, then the equation $na_nX^{n-1}+(n-1)a_{n-1}X^{n-2}+\ldots+a_1=0$ has a positive root, which

[Question ID = 2308]

1. is equal to α

[Option ID = 9229]

2. is greater than or equal to α

[Option ID = 9230]

3. belongs to $(0, \alpha)$

[Option ID = 9231]

4. is greater than α

[Option ID = 9232]

88) If for the complex numbers z_1 *and* z_2, $|1-\overline{z_1}z_2|^2-|z_1-z_2|^2=k(1+|z_1|^2)(1+|z_2|^2)$, then k is equal to

[Question ID = 2309]

1. 1 [Option ID = 9233]
2. -1 [Option ID = 9234]
3. 2 [Option ID = 9235]
4. 4 [Option ID = 9236]

89) If $z_1z_2 \in C$, $z_1^2+z_2^2 \in R$, $z_1(z_1^2-3z_2^2)=2$ and $z_2(3z_1^2-z_2^2)=11$, then the value of $z_1^2+z_2^2$ is

[Question ID = 2310]

1. 5 [Option ID = 9237]
2. 6 [Option ID = 9238]
3. 10 [Option ID = 9239]
4. 12 [Option ID = 9240]

90) The sum of n terms of the series $\frac{4}{1.2.3}+\frac{5}{2.3.4}+\frac{6}{3.4.5}+\ldots$ is

[Question ID = 2311]

1. $\frac{n+3}{n(n+1)(n+2)}$

[Option ID = 9241]

2. $\frac{n(n+1)}{n(n+1)(n+2)}$

[Option ID = 9242]

3. $\frac{5}{4}-\frac{2n+5}{2(n+1)(n+2)}$

[Option ID = 9243]

4. $\frac{3}{4}-\frac{2n+5}{2(n+1)(n+2)}$

[Option ID = 9244]

91) From a certain point, Aditi walks 70 m towards the south. Then, she turns to her right & starts walking straight for another 70 m. Then, again turning to her left he walks for 60 m. She then turns to her left & walks for 70 m. How far is she from the starting point?[Question ID = 2312]

1. 120 m [Option ID = 9245]
2. 135 m [Option ID = 9246]
3. 140 m [Option ID = 9247]
4. 130 m [Option ID = 9248]

92) The school result is increasing year after year. Forecast the result of 2012 from the following information.

Year	2006	2007	2008	2009	2010	2011	2012
Result	34.25%	36.75%	39.75%	43.25%	47.25%	51.75%	?

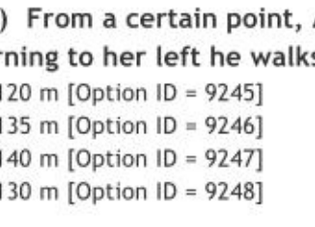
[Question ID = 2313]

1. 51.75% [Option ID = 9249]
2. 56.75% [Option ID = 9250]
3. 48.00% [Option ID = 9251]
4. 57.25% [Option ID = 9252]

93) A clock gains five minutes every hour. What will be the angle traversed by the second hand in one minute?[Question ID = 2314]

1. 360^0 [Option ID = 9253]
2. 360.5^0 [Option ID = 9254]
3. 390^0 [Option ID = 9255]
4. 380^0 [Option ID = 9256]

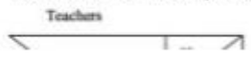
94) How many straight lines in the figure?

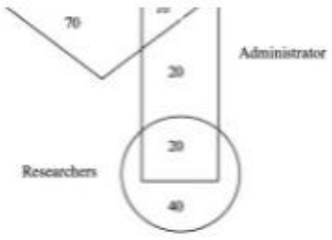


[Question ID = 2315]

1. 16 [Option ID = 9257]
2. 19 [Option ID = 9258]
3. 17 [Option ID = 9259]
4. 18 [Option ID = 9260]

95) In the given diagram, teachers are represented in the triangle, researchers in the circle and administrators in the rectangle. Out of the total number of the people, the percentage of administrators shall be in the range of





[Question ID = 2316]

1. 16 to 30 [Option ID = 9261]
2. 0 to 15 [Option ID = 9262]
3. 31 to 45 [Option ID = 9263]
4. 46 to 60 [Option ID = 9264]

96) Three of the five students allocated to a hostel put in special requests to the warden.

Given the floor plan of the vacant rooms, select the allocation plan that will accommodate all their requests.

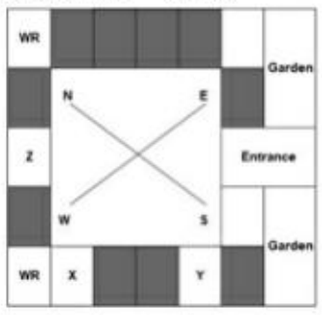
Request by X: Due to pollen allergy, I want to avoid a wing next to the garden.

Request by Y: I want to live as far from the washrooms as possible, since I am very sensitive to smell.

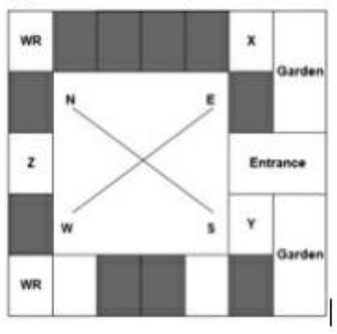
Request by Z: I believe in Vaastu and so want to stay in the South-west wing.

The shaded rooms are already occupied. WR is washroom.

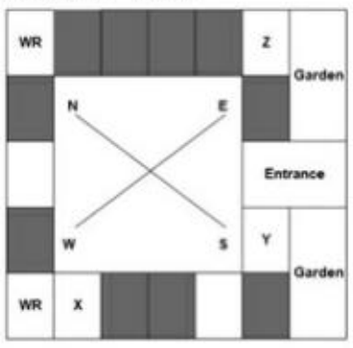
[Question ID = 2317]

1. 

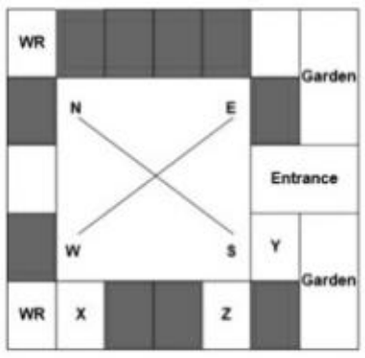
[Option ID = 9265]

2. 

[Option ID = 9266]

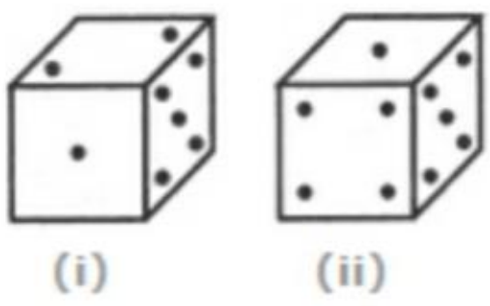
3. 

[Option ID = 9267]

4. 

[Option ID = 9268]

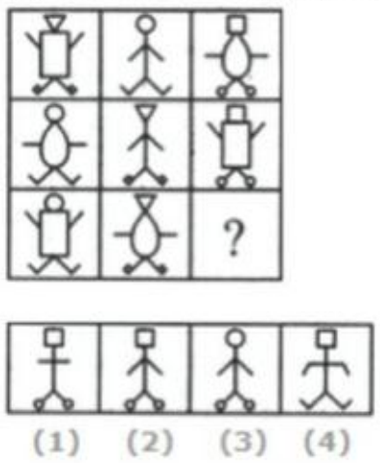
97) Observe the dots on a dice (one to six dots) in the following figures. How many dots are contained on the face opposite to that containing four dots?



[Question ID = 2318]

1. 2 [Option ID = 9269]
2. 3 [Option ID = 9270]
3. 6 [Option ID = 9271]
4. cannot be determined. [Option ID = 9272]

98) Select a suitable figure from the four alternatives that would complete the figure matrix.



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

[Question ID = 2319]

1. 1 [Option ID = 9273]
2. 2 [Option ID = 9274]
3. 3 [Option ID = 9275]
4. 4 [Option ID = 9276]

99) The value of the expression $\frac{1}{1+\log_u vw}+\frac{1}{1+\log_v wu}+\frac{1}{1+\log_w uv}$ is

[Question ID = 2320]

1. -1

   [Option ID = 9277]
2. 0

   [Option ID = 9278]
3. 1

   [Option ID = 9279]
4. 3

   [Option ID = 9280]

100) The nomenclature of Hindustani music has changed over the centuries. Since the medieval period dhrupad styles were identified as baanis. Terms like gayaki and baaj were used to refer to vocal and instrumental styles, respectively. With the institutionalization of music education the term gharana became acceptable. Gharana originally referred to hereditary musicians from a particular lineage, including disciples and grand disciples.

Which one of the following pairings is NOT correct?

[Question ID = 2321]

1. dhrupad, baani

   [Option ID = 9281]
2. gayaki, vocal

   [Option ID = 9282]
3. baaj, institution

   [Option ID = 9283]
4. gharana, lineage

   [Option ID = 9284]