1. The plane $ax + by + cz = 0$ cuts the cone $yz + zx + xy = 0$ in perpendicular lines if

(A) $ab + bc - ca = 0$

(B) $a + b + c = 0$

(C) $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 0$

(D) $\frac{1}{a} - \frac{1}{b} + \frac{1}{c} = 0$

2. The equation of the cone reciprocol to the cone $ax^2 + by^2 + cz^2 = 0$ is

(A) $\frac{x^2}{a} + \frac{y^2}{b} + \frac{z^2}{c} = 0$

(B) $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 0$

(C) $(x - a)^2 + (y - b)^2 + (z - c)^2 = 0$

(D) $x^2 + y^2 + z^2 = a^2 + b^2 + c^2$.

3. If a right curcular cone has three mutually parpendicular tangent planes, then the semi-vertical angle of the cone is

(A) $\cot^{-1}\sqrt{2}$

(B) $\tan^{-1}\sqrt{2}$

(C) $\sin^{-1}\sqrt{2}$

(D) $\cos^{-1}\sqrt{2}$

4. For $z \in \mathbb{C}$, the roots of the equation $(z + 1)^{2n} + (z - 1)^{2n} = 0$ are

(A) integers

(B) pure imaginary numbers

(C) rational numbers

(D) irrational numbers

5. The area of the parallelogram having diagonals $3\hat{i} + \hat{j} - 2\hat{k}$ *and* $\hat{i} - 3\hat{j} + 4\hat{k}$ is

(A) $5+\sqrt{3}$

(B) $5/\sqrt{3}$

(C) $5\sqrt{3}$

(D) $5-\sqrt{3}$

6. The system of equations $\lambda x + y + z = 1$, $x + \lambda y + z = \lambda$ and $x + y + \lambda z = \lambda^2$ has unique solution if

(A) $\lambda = 1$

(B) $\lambda = -2$

(C) $\lambda = 3$

(D) $\lambda \neq -1, \lambda \neq -2$

7. If in a group G, $a^5 = e$, $aba^{-1} = b^2$ for $a, b \in G$, then order of the element b is

(A) 30

(B) 31

(C) 32

(D) 33

8. Which one of the following group is not cyclic?

(A) the group of n^{th} roots of unity.

(B) a subgroup of cyclic group

(C) the group $(\mathbb{Z}, +)$

(D) the group $(\mathbb{Q}, +)$.

9. The number of conjugate classes of a non-abelian group of order 125 is

(A) 28

(B) 29

(C) 30

(D) 31

10. Which one of the following statement about linear programming problem (LLP) is correct?

(A) Every LPP admits an optimal solution.

(B) Every LPP admits a unique optimal solution.

(C) If an LPP admits two optimal solution, then it has an infinite number of optimal solutions

(D) The set of all feastible solutions to LPP is not a convex set.

11. The equation whose roots are the reciprocal of the roots of the equation $x^4 - 3x^3 + 7x^2 - 8x + 2 = 0$ is

(A) $2y^4 - 8y^3 + 7y^2 - 3y + 1 = 0$

(B) $2y^4 + 8y^3 + 7y^2 - 3y + 1 = 0$

(C) $2y^4 - 8y^3 - 7y^2 - 3y + 1 = 0$

(D) $2y^4 - 8y^3 + 7y^2 - 3y - 1 = 0$.

12. A bag contains 3 coins, one of them is fair and rest two are biased with probability of getting a head (H) on them as 0.6 and 0.1 respectively. A coin is randomly picked from this bag and flipped three times. Suppose the sequence (in order) observed in these flips is (*HTT*), *T* being the tail. Then the probability that the coin picked form the bag is a fair coin is

(A) $\frac{151}{1500}$

(B) $\frac{125}{302}$

(C) $\frac{177}{302}$

(D) $\frac{349}{1000}$

13. Let the volume of a soft-drink bottle follows a normal distribution $N(\mu, 100)$, with mean μ. A random sample of n bottles is chosen form this population to construct a 95% confidence interval for μ. Using $z_{0.025} = 1.96$, if the width of this interval is 2.00 units then $\lfloor n \rfloor$ (where $\lfloor . \rfloor$ is the floor function) is equal to

(A) 96

(B) 192

(C) 392

(D) 384

14. Let the real sequence $\langle a_n \rangle$ be such that $a_{n+1} = |a_n - 2^{1-n}|$, $\forall$ n $\in \mathbb{N}$. Then the sequence $\langle a_n \rangle$.

(A) does not coverage when $a_1 < 0$.

(B) coverages to a_1 if $a_1 < 0$

(C) coverages to 0 if $a_1 < 0$

(D) coverages to 0 when $a_1 \in (0, 2)$.

15. If a line passing through the point $P(2,-1,1)$ and parallel to the line joining the points, whose position vectors are $-\hat{i}+4\hat{j}+\hat{k}$ and $\hat{i}+2\hat{j}+2\hat{k}$, inersects the plane $2x + y + 2z = 9$ at a point Q, then the length PQ is equal to

(A) 3

(B) $\sqrt{14}$

(C) $2\sqrt{5}$

(D) $\sqrt{21}$

16. If a sphere is inscribed in a tetrahedron whose faces are $x = 0$, $y = 0$, $z = 0$ and $x + 2y + 2z = 4$, then the radius of the sphere is

(A) $\frac{1}{4}$

(B) 2

(C) $\frac{1}{2}$

(D) 4

17. The equation of the cone having vertex (0, 1, 0) and base as an ellipse $4x^2 + z^2 = 1$, $y = 4$, is

(A) $36x^2 + 9z^2 - (y - 1)^2 = 0$

(B) $64x^2 + 16z^2 - (y - 1)^2 = 0$

(C) $64x^2 + 16z^2 + (y - 1)^2 = 0$

(D) $36x^2 + 9z^2 + (y - 1)^2 = 0$

18. Let R = $\{(x, y) : 1 < x^2 + y^2 < 4, y > 0\}$. Then the integral $\iint_R y\sqrt{x^2 + y^2}\,dx\,dy$ is equal to

(A) $\frac{15}{4}$

(B) 0

(C) $\frac{23}{4}$

(D) $\frac{15}{2}$

19. If the minimum distance between any point P on the sphere $(x - 2)^2 + (y - 1)^2 + (z - 3)^2 = 1$ and any point Q on the sphere $(x + 3)^2 + (y - 2)^2 + (z - 4)^2 = k^2$ is $3\left(\sqrt{3} - 2\right)$ then k is equal to

(A) 5

(B) 4

(C) 2

(D) 1

20. If the solution curve of the differential equation $(3xy + 2y^2 + 4y)dx + (x^2 + 2xy + 2x)dy = 0$ passes through the point (1, 1) then this solution curve also passes through the point

(A) (1, 4)

(B) (2, 1)

(C) (−2, −1)

(D) (2, −2)

21. Every connected subset of $\mathbb{R}$ must be

(A) an interval

(B) a set of rationals

(C) a set of irrationals

(D) a set of integers.

22. The function $f(x) = x^5 - 5x^4 + 5x^3 - 1$ for all $x \in \mathbb{R}$ has a local

(A) maximum at $x = 3$

(B) minimum at $x = 1$

(C) maximum at $x = 3$ and minimum at $x = 1$

(D) maximum at $x = 1$ and minimum at $x = 3$

23. Which one of the following set is countable?

(A) the set [0, 1]

(B) the set of plynomials with integer coefficient

(C) the set of rational numbers

(D) the set of real numbers

24. Let $F_n = [1/n, 2]$ for each $n \in \mathbb{N}$. Then $\bigcup_{n=1}^{\infty} F_n$ is

(A) open but not closed

(B) closed but not open

(C) both open and closed

(D) neigher open nor closed

25. Every monotone sequence has

(A) a monotone subsequece

(B) a convergent subsequence

(C) a bounded subsequence

(D) a Cauchy subsequence.

26. The value of the $\lim_{n\to\infty}\left(\frac{n^n}{n!}\right)^{1/n}$ is

(A) e

(B) $1/e$

(C) $\sqrt{e}$

(D) 0.

27. Which one of the following statement is true?

(A) Every bounded sequence is convergent

(B) Every convergent sequence is bounded

(C) Every monotone sequence is convergent

(D) Every Cauchy sequence is unbounded.

28. The number of limit points of the set $\left\{\cos\frac{n\pi}{3} : n \in \mathbb{N}\right\}$ is

(A) 1

(B) 2

(C) 3

(D) 4

29. A continous function $f : [a, b] \rightarrow \mathbb{R}$ is

(A) unbounded

(B) bounded and does not attain maximum value.

(C) bounded and does not attain minimum value.

(D) bounded and attains both maximum and minimum value.

30. If $\langle a_n \rangle$ is non-increasing sequence of real numbers and if $\sum a_n$ converages, then

(A) $\lim_{n\to\infty} na_n = 2$

(B) $\lim_{n\to\infty} na_n = 1$

(C) $\lim_{n\to\infty} na_n = 0$

(D) $\lim_{n\to\infty} na_n = \infty$

31. The roots of the equation $z^6 + 1 = 0$ lies on

(A) the unit circle

(B) the parabola $y^2 = x$

(C) the hyperbola $3x^2 - 2y^2 = 6$

(D) the rectangle with vertices (0, 0), (1, 0), (0, 2) and (1, 2).

32. The value of the $\lim_{x\to 0} \dfrac{(1+x)^{1/x} - e + ex/2}{x^2}$ is

(A) $\dfrac{11}{24}$

(B) $\dfrac{11e}{24}$

(C) $\dfrac{11}{24e}$

(D) $\dfrac{11e^2}{24}$

33. The asymptotes of the curve $\frac{a^2}{x^2}+\frac{b^2}{y^2}=1$ are

(A) $x = 1 - a,\ y = 1 + b$

(B) $x = 1 + a,\ y = 1 - b$

(C) $x = 1 - a,\ y = 1 - b$

(D) $x = \pm a,\ y = \pm b$

34. The radius of curvature at the origin for the curve $x^3 + y^3 - 2x^2 + 6y = 0$ is

(A) 1/2

(B) 3/2

(C) 5/2

(D) 7/2

35. The curve $y = x^3 - 6x^2 + 11x - 6$ is

(A) convex in $(2, \infty)$ and concave in $(-\infty, 2)$

(B) convex in $(-\infty, 2)$ and concave in $(2, \infty)$

(C) convex in $[-2, 2]$

(D) concave in $(-\infty, \infty)$

36. The directrix and focus of the parabola $x^2 - 6x - 6y + 6 = 0$ are

(A) $y + 2 = 0$ and $(3, 1)$ respectively

(B) $y + 3 = 0$ and $(1, 1)$ respectively

(C) $y + 1 = 0$ and $(0, 1)$ respectively

(D) $y + 4 = 0$ and $(3, 1)$ respectively

37. The asmptotes of the rectangular hyperbola $x^2 - y^2 = a^2$ are

(A) $x = \pm a$

(B) $x = \pm b$

(C) $x = \pm a$ and $x = \pm b$

(D) $x = \pm x$

38. The conic $9x^2 + 24xy + 16y^2 - 2x + 14y + 1 = 0$ represents

(A) a circle

(B) an elipse

(C) a hyperbola

(D) a parabola

39. The equation of the sphere with centre at (2, 3, –4) and touching the plane $2x + 6y - 3z + 15 = 0$ is

(A) $x^2 + y^2 + z^2 + 4x + 6y + 8z - 20 = 0$

(B) $x^2 + y^2 + z^2 - 4x - 6y + 8z - 20 = 0$

(C) $x^2 + y^2 + z^2 + 4x + 6y + 8z + 20 = 0$

(D) $x^2 + y^2 + z^2 - 4x - 6y + 8z + 20 = 0$.

40. The equation of the cylinder whose generators are parallel to $x = y/2 = -z$ and passing through the curve $3x^2 + 2y^2 = 1$ and $z = 0$ is

(A) $3x^2 + 2y^2 + 11z^2 - 8yz + 6zx - 1 = 0$

(B) $3x^2 + 2y^2 + 11z^2 - 8yz - 6zx - 1 = 0$

(C) $3x^2 + 2y^2 + 11z^2 + 8yz + 6zx - 1 = 0$

(D) $3x^2 + 2y^2 + 11z^2 - 8yz - 6zx + 1 = 0$.

Read the following passage and answer the questions that follow:

All our industries are based on some form of natural resource, and several industries are based on resources found in the forests. Our paper pulp, rayon and plywood industries, for instance, are completly dependent on forest produce. In our country, paper is made from bamboo: and our large paper mills are using more bamboo than forest can replace. In Karnātaka, the government officially allows mills to cut 1,60,000 tons of bamboo every year,although it has been estimated that only 1,30,000 tons are replaced. This means that, if we are content to use 1,30,000 tons of bamboo for paper annually, our bamboo forests will remain in good shape, and we would be able to go on making paper indefinitely. But because we use 30,000 tons more than we should, we will soon find that we have killed off all the bamboos in the forest and we might have to stop making paper. There is another strange anomaly in the case of bamboos. While it is lincesed at Re 1 per ton to the paer mills, its actual value is,naturally, much higher. In fact, for the local villagers who use bamboo to make baskets, the cost works out to about Rs 1,000 per tonne. The situtation which we fear regarding paper-making and consequent depletion of bamboo forests has already come to pass in the case of tanning industry. The nut of one common terminallias is used in tanning leather. But because of overuse, ther are very few trees left of this once plentiful species, and the tanning industry has had to come to a stop. One can imagine the implication for all those who depend on the industry, whether a worker or consumer.

41. Industries depend upon

(A) Energy

(B) Wild life

(C) Natural resource

(D) Paper pulp

42. Paper industry can come to a stop because of

(A) use of computers

(B) overcutting of trees

(C) man's reluctance to write

(D) forest fires.

43. The price of bamboo

(A) shows partiality for paper industry

(B) is exhorbetant

(C) shows partiality for the basket making industry

(D) is fair for all users

44. The tanning industry has been harmed because

(A) only bamboo trees are grown

(B) of over cutting of trees which provide nuts for tanning

(C) of controls

(D) of high price of nuts used for tanning

45. Forest can be preserved by

(A) totally stopping the cutting of trees

(B) replacing the cut trees by growing new trees

(C) stopping the use of paper

(D) developing computer industry

46. The value of the expression (in *C*-language) $(j \,||\, m) + (x \,||\, ++n)$ where $j = 0,\ m = 1,\ n = -1,\ x = 1.0$ is

(A) 0

(B) –1

(C) 1

(D) 2

47. The range of values of 8 bit signed integer is

(A) -2^7 to $2^7 - 1$

(B) -2^8 to $2^7 - 1$

(C) 0 to $2^8 - 1$

(D) -2^7 to $2^8 - 1$

48. In C-language the value of $(30)_{10}$ & $(22)_{10}$ is

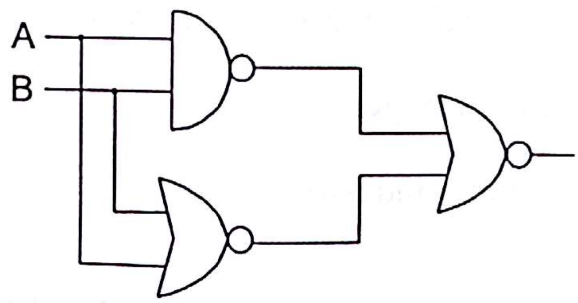
(A) $(10)_{16}$

(B) $(16)_{16}$

(C) $(16)_{10}$

(D) $(1E)_{16}$

49. The output of the following circuit is:



(A) $A + B$

(B) $\overline{A} + B$

(C) $A + \overline{B}$

(D) $\overline{A} + \overline{B}$

50. The octal representation of 1101 is

(A) 15

(B) 62

(C) 52

(D) 32

51. The mean and standard deviation of the marks of 200 students were found to be 40 and 15 respectively. Later, it was discovered that a score 40 was wrongly read as 50. The correct mean and standard deviation respectively are:

(A) 39.95, 22.45

(B) 39.95, 14.98

(C) 39.80, 22.45

(D) 39.80, 14.98

52. How many 3's are there in the following number series, which are preceded by an odd number but not followed by an even number?

34253152136731827853913452354 35

(A) One

(B) Two

(C) Three

(D) Four

53. How many numbers are there from 5 to 100, which are divisible by 3 and either unit or tenth digit or both include 3?

(A) 10

(B) 8

(C) 6

(D) Less than 6

54. If x means $-$, $-$ means x, $+$ means $\div$ and $\div$ means $+$ then —

$13 - 12 \div 400 + 20 \times 100 = ?$

(A) 186

(B) 176

(C) 76

(D) 1/1760

55. The ratio of incomes of two persons is 9 : 7 and the ratio of their expenditures is 4 : 3, If each of them saves Rs. 200 per month, then monthly income of first and second persons are

(A) Rs. 3600 and Rs. 2800 respectively

(B) Rs. 2700 and Rs. 2100 respectively

(C) Rs. 1800 and Rs. 1400 respectively

(D) Rs. 900 and Rs. 700 respectively

56. Students of a class are made ot stand in rows, Of one student is extra in a row, there would be 2 rows less. If one student is less in a row there would be 3 row more. The total number of students in the class is

(A) 6

(B) 12

(C) 36

(D) 60

57. Points A and B are 90 km apart from each other on a highway. A taxi starts from A and another from B at the same time. If they go in the same direction they meet in 9 hours and if they go in opposite directions they meet in 9/7 hours. The maximum speed of the taxi among the two taxies is

(A) 20 km/hr

(B) 30 km/hr

(C) 40 km/hr

(D) 50 km/hr

58. A boat covers 36 km downstream and 32 km upstream in 7 hours. Also it covers 40 km upstream and 48 km downstream in 9 hours. The ratio of speed of boat in still water and speed of the stream is

(A) 0.2

(B) 0.5

(C) 2

(D) 5

59. A man is engaged for 70 days. He is to receive Rs. 24 per day when he works but has to pay a fine of Rs.6 for every day that he is absent. He receives altogether Rs. 1380. How many days he was absent?

(A) 5

(B) 10

(C) 15

(D) 20

60. Let a_1 and a_2 be the length of the sides of two solid metallic cubes and if they are melted into one solid cube, then the length of the side of new cube is

(A) $\sqrt[2]{a_1^3 + a_2^3}$

(B) $\sqrt[2]{a_1^2 + a_2^2}$

(C) $\sqrt[3]{a_1^2 + a_2^2}$

(D) $\sqrt[3]{a_1^3 + a_2^3}$

61. What is the probability that the sum of two different single-digit prime numbers will NOT be prime?

(A) 0

(B) 1/2

(C) 2/3

(D) 5/6

62. The positive sequence S_1, S_2, S_3, ... S_n ... is defined by $S_n = S_{n-1} + 5$ for $n \geq 2$. If $S_1 = 7$ then the nth term in the sequence is

(A) $5n - 5$

(B) $5n - 2$

(C) $5n$

(D) $5n + 2$

63. If a and b are positive and ab/x = sqrt(a), then x/sqrt(b) =

(A) sqrt(a)

(B) sqrt(ab)

(C) sqrt(a/b)

(D) sqrt(b/a)

64. Points A and B are seperated by 50 miles on a straight road. Cyclist A leaves point A, heading toward point B, at a constant speed of 15 miles per hour. At the same time, cyclist B leaves point B, traveling toward point A, at a constant speed of 10 miles per hour. After how many minutes have elapsed will the two meet?

(A) 120

(B) 240

(C) 150

(D) 180

65. If a is 60% of b, b is 40% of c, and c is 20% of d, then 6d is what percent of 20a?

(A) 620

(B) 625

(C) 575

(D) 375

66. A sports league encourages collaboration by awarding 3 points for each goal scored without assistance and 5 points for each goal scored with assistance. A total of 48 points were scored by a team in a single game. Which of the following CANNOT be the numbr of goals scored without assistance by this team in this game?

(A) 1

(B) 6

(C) 11

(D) 12

67. During a sale, the original price of a garment is lowered by 20%. Because the garment did not sell, its sale price was reduced by 10%. The final price of the garment could have been obtained with a single discount by x% form the original price, where x =

(A) 25

(B) 26

(C) 27.5

(D) 28

68. Assume that at a particular zoo, 2/5 of all the animals are mammals, and 2/3 of the mammals are allowed to interact directly with the public. If 24 mammals are allowed to interact directly with the public, how many animals in this zoo are NOT mammals?

(A) 36

(B) 48

(C) 54

(D) 60

69. In a certain game, players have three chances during each turn to earn points. Each consecutive win awards more points than the previous win. The second win awards 100 points more than the first and the third win awards twice as many points as the second win. Tammy won the maximum number of points during her turn and received a total of 700 points. How many points are awarded for the first win?

(A) 50

(B) 75

(C) 100

(D) 200

70. Wendy, Yvonne, and Elizabeth are baking cookies for a bake sale. Wendy can bake all of the cookies in 10 hours, Yvonne can bake half of the cookies in 3 hours, and Elizabeth can bake a third of the cookies in 5 hours. If Wendy and Elizabeth bake for 2 hours, how long will it take Y vonne to finish baking the rest of the cookies?

(A) 1.8 Hrs.

(B) 2 Hrs.

(C) 3.6 Hrs.

(D) 4 Hrs.