> Each question is followed by the five choices. Choose the best and write corresponding letter
> A, B, C, D, or E on the **ANSWER SHEET**.

Q.01. The graph of the function $y = x - x^2$, $x \in \mathbb{R}$ is:

(A)

(B)

(C)

(D)
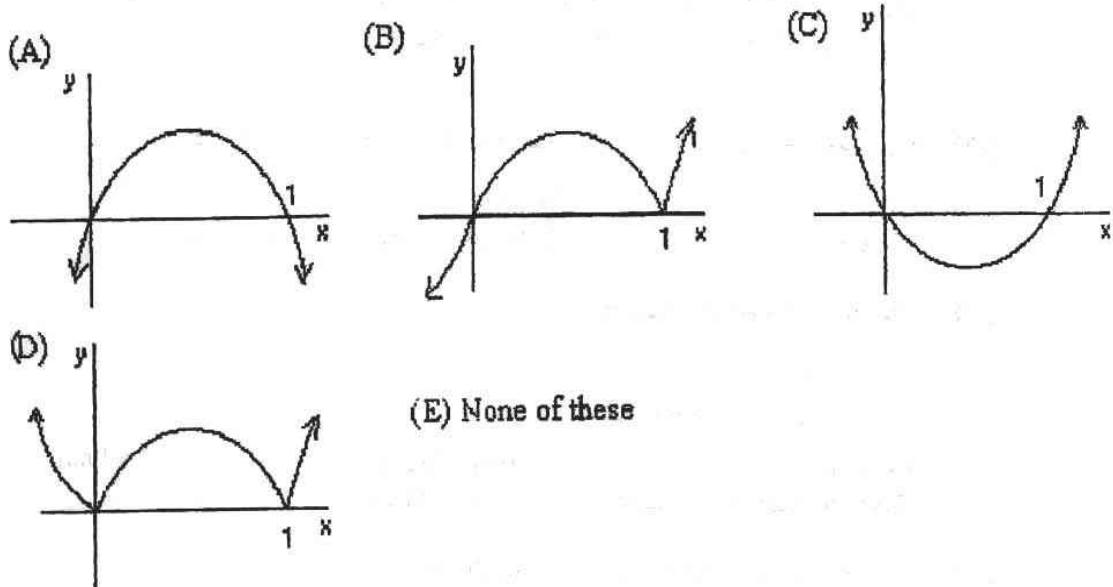
(E) None of these

Q.02. The absolute value function
$y = |x|$, $x \in \mathbb{R}$ is:

(A) Continuous at all points
(B) Differentiable at all points
(C) Differentiable at all points except $x = 1$
(D) Continuous at all points except $x = 0$
(E) None of these

Q.03. A possible value of $\int \frac{2\ln x}{x} dx$ is:

(A) $2/x^2 - 1$
(B) $2/x^2 + 2\ln x$
(C) $(\ln x)^2 - 100$
(D) $1000 + \ln x$
(E) None of these

Q.04. The graphical representation of the solution of initial value problem $x\frac{dy}{dx} = y$, $y(1) = 1$ is :

(A)

(B)

(C)

(D)

(E) None of these
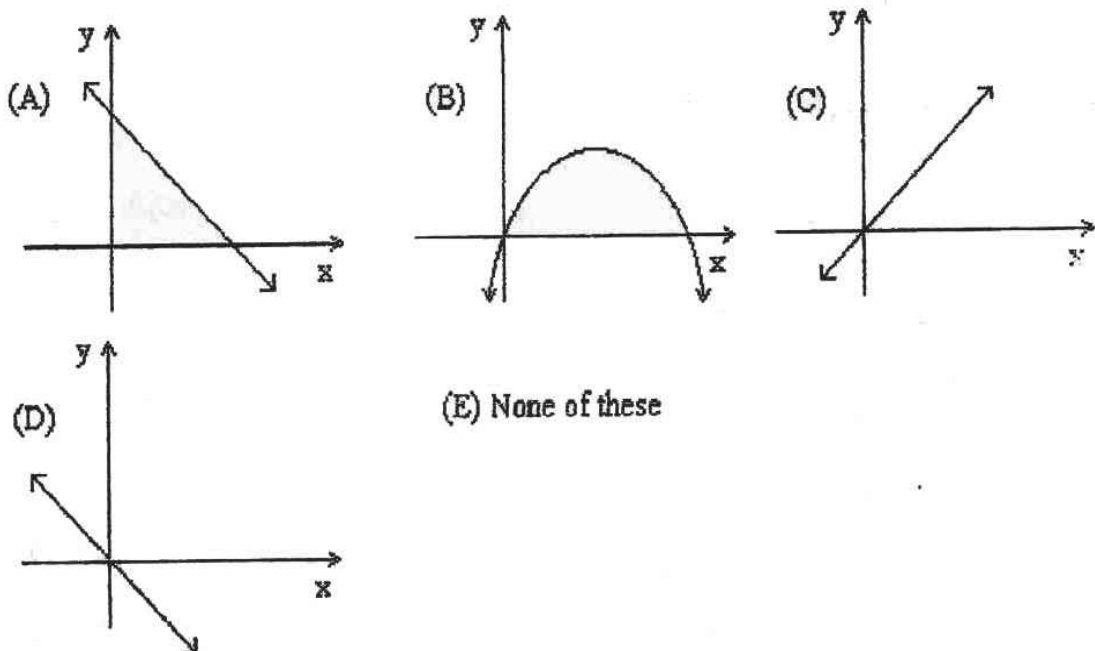
Q.05. The orthogonal trajectories of the circles $x^2 + y^2 = c^2$ are given by

(A) $2x^2 + y^2 = d$ (B) $x^2 + 2y = d$ (C) $y = dx$

(D) $x + y = d$ (E) $2x + y^2 = d$

Q.06. A general solution of the differential equation $(D^2 + D - 6)y = -12$ is

(A) $y = Ae^{2x} + Be^{-3x} - 2$ (B) $y = Ae^{-2x} + Be^{3x} + 2$ (C) $y = Ae^{2x} + Be^{-3x} + 2$

(D) $y = Ae^{-2x} - Be^{3x} + 2$ (E) $y = Ae^{-2x} + Be^{-3x} - 2$

Q.07. Suppose the matrix $M = \begin{bmatrix} 1 & b \\ a & 1 \end{bmatrix}$ satisfies the equation $M^2 = M$ then

(A) $a = 2$, $b = 3$ (B) $a = 0$, $b = 0$ (C) $a = 3$, $b = 2$

(D) $a = 6$, $b = 7$ (E) None of these

Q.08. The linear system of equations
$$3x + 2y + z = 3$$
$$2x + y + z = 0$$
$$6x + 2y + 4z = 6 \text{ has}$$

(A) One solution   (B) Two solution   (C) No solution

(D) More than two solution   (E) None of these

Q.09. The homogeneous linear system of equations
$$3x + 2y + z = 0$$
$$2x + y + z = 0$$
$$6x + 2y + 4z = 0 \text{ has}$$

(A) trivial solution only

(B) exactly one solution which is $x = 1$, $y = z = -1$

(C) exactly one solution which is $x = -1$, $y = z = 1$

(D) exactly two solutions which are given in part (B) & (C)

(E) None of these

Q.10. Consider the matrix $N = \begin{bmatrix} Cos\theta & Sin\theta \\ -Sin\theta & Cos\theta \end{bmatrix}$, then

(A) Inverse of N does no exist   (B) N is a singular matrix

(C) $N^{-1} = \begin{bmatrix} Cos\theta & -Sin\theta \\ Sin\theta & Cos\theta \end{bmatrix}$ (D) Rank of N is 1   (E) None of these

Q 11. The value of the determinant $\begin{vmatrix} 3 & 6 & -4 \\ 1 & -1 & 3 \\ -6 & -12 & 8 \end{vmatrix}$ is

(A) -24   (B) -2   (C) 0

(D) 102   (E) 5

Q 12. The series $1 + x^2 + \dfrac{x^2}{2!} + \dfrac{x^3}{3!} + \ldots$ is the Maclaurin expansion of

(A) $\dfrac{1}{1-x}$ (B) e^{-x} (C) e^x

(D) $\dfrac{1}{1+x}$ (E) $1 + x + \dfrac{x^2}{2} + \dfrac{x^3}{6}$

Q.13. A curve passes through the point $P(0, 7/2)$ and is such that $\dfrac{dy}{dx} = 2 - x$. Then the curve must be

(A) $y = 2x - \dfrac{1}{2}x^2 + \dfrac{7}{2}$ (B) $y = -1$ (C) $y = x - \dfrac{7}{2}$

(D) $y = \dfrac{1}{2-x}$ (E) None of these

Q.14. It is known that $(x + 1)$ and $(x - 2)$ are factors of $2x^3 - 9x^2 + mx + n$. Then a possible set of values of m and n are :
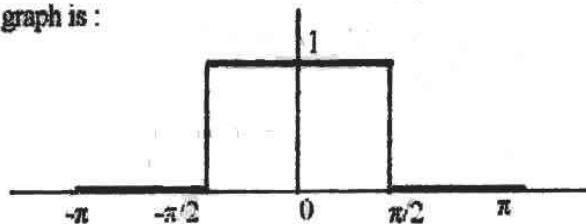
(A) -1, 2 (B) 3, 14 (C) 31, -2
(D) -1, 42 (E) 31, -42

Q.15. The region between the lines L_1 and L_2 can be represented by
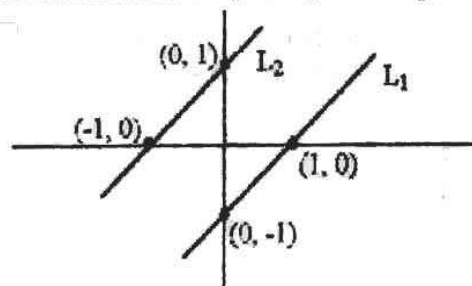
(A) $|x - y| < 1$ (B) $|x + y| > 1$ (C) $|x + y| < 1$
(D) $|x - y| > 1$ (E) None of these

Q.16. The Fourier series of the function $f(x)$ which is assumed to have the period 2π and whose graph is :

is given by

(A) $1/2 + 2/\pi (Sinx + 1/3 Sin3x + 1/5 Sin5x + \ldots)$
(B) $1/2 + 2/\pi (Cosx - 1/3 Cos3x + 1/5 Cos5x + \ldots)$
(C) $4/\pi (Cosx - 1/3 Cos3x + 1/5 Cos5x + \ldots)$
(D) $2 (Sinx - 1/2 Sin2x + 1/3 Sin3x + \ldots)$
(E) None of these

Q.17. The direction cosines of the line given by the equations $x + 3y - z = 3$, $2x + z = 3$ are

(A) 1, -1, -2 (B) $\dfrac{5}{\sqrt{30}}, \dfrac{-1}{\sqrt{30}}, \dfrac{2}{\sqrt{30}}$ (C) $\dfrac{-1}{\sqrt{2}}, \dfrac{2}{\sqrt{2}}, 0$

(D) $\dfrac{-1}{\sqrt{6}}, \dfrac{1}{\sqrt{6}}, \dfrac{2}{\sqrt{6}}$ (E) None of these

Q.18. It is known that K root(s) of $x^4 - x^3 + x^2 - x + 1 = 0$ are also the root(s) of $x^5 + 1 = 0$. Then value of K is :

(A) 1 (B) 2 (C) 3
(D) 4 (E) 5

Q.19. The value of $\dfrac{(Cos\alpha - iSin\alpha)^{11}}{(Cos\alpha + iSin\alpha)^{9}}$ is :

(A) $(Cos20\alpha - iSin20\alpha)$ (B) $(Cos20\alpha + iSin20\alpha)$
(C) $1/(Cos20\alpha - iSin20\alpha)$ (D) $1/(Cos20\alpha + iSin20\alpha)$
(E) None of these

Q.20. The dimension of the vector space spanned by $(1, -4, -2, 1)$, $(1, -3, -1, 2)$ and $(3, -8, -2, 7)$ is :

(A) 1 (B) 2 (C) 3
(D) 4 (E) 5

Q 21. The differential equation $2xydx + (x^2 + 3y^2)dy = 0$ has an integrating factor which is :

(A) 5   (B) x   (C) y
(D) xy   (E) None of these

Q.22. The particular integral of $(D^3 - D^2 - D + 1)y = x$ is :

(A) x   (B) $1+x$ (C) $1-x$
(D) e^x (E) None of these

Q 23. The matrix $\begin{bmatrix} 0 & -2 & 3 \\ 2 & 0 & 4 \\ -3 & -4 & 0 \end{bmatrix}$ is :

(A) skew symmetric   (B) symmetric   (C) non-singular
(D) invertable   (E) None of these

Q 24. The equation of the circle which touches both axes and contains the point (-8, -4) is:

(A) $(x - 4)^2 + (y - 4)^2 = 16$ (B) $(x + 4)^2 + (y - 4)^2 = 16$
(C) $(x - 4)^2 + (y + 4)^2 = 16$ (D) $(x + 4)^2 + (y + 4)^2 = 16$ (E) None of these

Q 25. A curve is given by $r = \dfrac{3}{2 - Cos\theta}$ where r and θ are polar coordinates This equation represents

(A) an ellipse   (B) a hyperbola   (C) a parabola
(D) a circle   (E) None of these

Q.26 The time, in seconds to compile a computer program written by a certain student is a random variable T with probability density function

$$f_T(t) = \begin{cases} \dfrac{3}{(1+t)^4} & , t \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

The probability that it takes more then 1.5 seconds to compile a program is:

(A) 0.5   (B) 0.064   (C) .936
(D) .0312   (E) None of these

Q 27. The probability of a random variable X is given by

$$f_X(x) = \begin{cases} a + bx^2 & , 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

If $E[X]=3/5$, what are the values of a and b?

(A) a=6/5, b=3/5   (B) a=0, b=2   (C) a=1, b=2
(D) a=3/5, b=6/5   (E) a=2/5, b=3/5

Q 28. There are nine books on a shelf. Of these, two have blue covers, three have red covers and four have green covers Two books are selected at random. What is the probability that both books are the same colour?

(A) 13/18   (B) 1/3   (C) 5/18
(D) 0   (E) None of these

Q.29. Suppose X has uniform distribution on the interval 0 to 10, then what is $P(X + \dfrac{12}{X} \geq 7)$?

(A) 4 10   (B) 3/10   (C) 9/50
(D) 9/10   (E) 3/5

Q.30. If m people are seated at a round table then the probability that two named individuals will be next to each other is:

(A) $2/(m+1)$ (B) 0   (C) 1

(D) $2/(m-1)$ (E) None of these

Q.31. Suppose $X_1, X_2, \ldots, X_n$ is a random sample from a distribution with the density function

$$f(x) = \begin{cases} \dfrac{x^7 e^{-x/\beta}}{\beta^7 7!} & , \; x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

What is the maximum likelihood estimate of β?

(A) $\dfrac{\sum x_i}{7n}$ (B) $\dfrac{\sum x_i}{7}$ (C) $\dfrac{\sum x_i}{n}$

(D) $\sqrt{\dfrac{\sum (x_i - \bar{x})^2}{7n}}$ (E) $\sqrt{\dfrac{\sum (x_i - \bar{x})^2}{6n}}$

Q.32 To test the hypothesis: $H_0 : \mu = 60$ against the alternative $H_1 : \mu \neq 60$, a sample of size 101 was taken. A summary of the data is shown below. Which of the following is approximate 95% confidence interval for μ?

(A) 60 ± 19.6 (B) 60 ± 1.96 (C) 50 ± 19.6

(D) 50 ± 1.96 (E) 55 ± 10

Q.33. Suppose X and Y are two random variables with $E[Y \mid X=x] = -x+3$ for all x and $E[X \mid Y=y] = -1/9\, x +6$ for all y. What is the correlation coefficient of X and Y?

(A) $-1/3$ (B) $-1/2$ (C) 0

(D) $1/27$ (E) $1/3$

Q.34. Suppose the joint density function of X and Y is uniform over the region $R=\{(x,y) \mid x + y < 2, x>0, y>0\}$. What is the probability that exactly one of the two events $A=\{X < 1\}$ and $B = \{Y>1\}$ occurs?

(A) $1/16$ (B) $1/4$ (C) $1/2$

(D) $5/8$ (E) $3/4$

Q.35. Given 5 data points shown here

Y	0	0	5	6	3
X	0	-2	4	3	1

What line of the form $y = x + b$ best fits the data by the method of least squares?

(A) $y = x + 6/5$ (B) $y = x + 14/5$ (C) $y = x + 14/5$

(D) $y = x + 11/6$ (E) $y = x + 8/5$

Q.36. The time T (in minutes) a student has to wait for shuttle service at Silver Gate is found to be a random phenomenon. The cumulative distribution of T is given by

$$F_T(t) = \begin{cases} 0 & \text{for } t \leq 0 \\ t/2 & \text{for } 0 < t \leq 1 \\ 1/2 & \text{for } 1 < t \leq 2 \\ t/4 & \text{for } 2 < t \leq 4 \\ 1 & \text{for } t > 0 \end{cases}$$

The probability that the student has to wait less then 3 minutes is:

(A) $3/4$ (B) $1/2$ (C) 1

(D) 0   (E) None of these

Q.37. Let X_1 and X_2 be two uniform random variables defined over the interval (0, 1).

$P(X_1^2 + X_2^2 \leq 1) = $ _____

(A) 0   (B) 1/2   (C) $\pi/2$
(D) $\pi/4$ (E) 2π

Q.38. If f(x) and F(x) are probability density and distribution functions of an exponential distribution with mean 3. The value of f(x)/(1-F(x)) is:

(A) 3   (B) 1/3   (C) $e^{(-1/3)}$
(D) $1/3\ e^{(-1/3)}$ (E) 1

Q.39. If X_1 and X_2 are respectively two independent normal random variables with means 3 and 4 and variances 4 and 4 respectively. Then, the random variable $Y=2\,X_1 - 3\,X_2$ has variance:

(A) 8   (B) –4   (C) 13
(D) 52   (E) 25

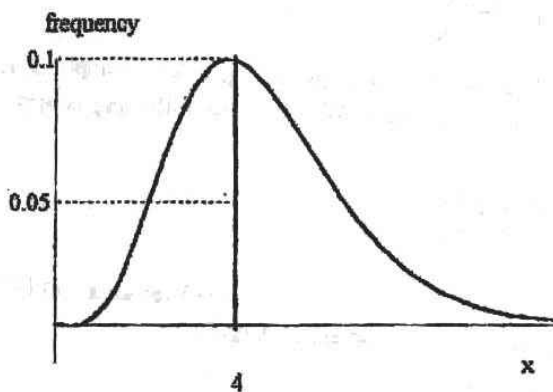Q.40. For the given frequency distribution shown in figure 1. Mode of the distribution is:

Figure -1

(A) 0.1   (B) 0.05   (C) 4
(D) 0   (E) ∞

Q.41. To process the data collected in analog form digitally needs _____ computers.

(A) Personal   (B) Hybrid   (C) Digital
(D) Analog   (E) Super

Q.42. The translators that translate and then execute only one instruction at a time are called _____ .

(A) Assembler   (B) Compiler   (C) Interpreter
(D) Linker   (E) Loader

Q.43. Frequently accessed data items are stored in _____ memory because of the faster speed.

(A) Cache   (B) CD-ROM   (C) Hard disk
(D) RAM   (E) ROM

Q.44. The _____ key is used to enable or disable the numeric keypad.

(A) Break   (B) CapsLock   (C) Esc
(D) NumLock   (E) PrtSc

Q.45. Which of these is not a type of display visual units.

(A) CGA   (B) EGA   (C) LGA
(D) SVGA   (E) VGA

Q.46. Concentric circles on the surface of disk on which the data is recorded is called _____

(A) Head   (B) Jacket   (C) Notch
(D) Sector   (E) Track

Q.47. The smallest addressable unit of storage is a _____.

(A) Bit   (B) Byte   (C) Nibble
(D) Word   (E) None of these

Q.48. Another name of string data is _____ data.

(A) Alphabetic   (B) Alphanumeric   (C) Digital
(D) Graphic   (E) Numeric

Q.49. Which of these is not an operating system?

(A) CPM   (B) DOS   (C) RDB
(D) UNIX   (E) VMS

Q.50. Binary equivalent of the decimal number 114 is _____.

(A) 1110011_2 (B) 1110010_2 (C) 1110001_2
(D) 1110000_2 (E) None of these

Q.51. A hexadecimal number can be converted into a _____ number.

(A) Binary   (B) Octal   (C) Decimal
(D) 32-base   (E) All of above

Q.52. Which of these is not a DBMS software?

(A) FoxPro   (B) MS Access   (C) Oracle
(D) RDB   (E) SQL

Q.53. _____ defines the rules for communication of data over a network.

(A) Certification   (B) License   (C) Link
(D) Organization   (E) Protocol

Q.54. Which of these is a type of network?

(A) Bus   (B) Distributed   (C) Ring
(D) Star   (E) All of above

Q.55. In _____ communication, data can be transmitted in both directions simultaneously.

(A) Synchronous   (B) Asynchronous   (C) Simplex
(D) Half duplex   (E) Full duplex

Q.56. RISC stands for _____ instruction set computer.

(A) Residual   (B) Relational   (C) Related
(D) Reduced   (E) Real

Q.57. Digital data can be converted into audio signals by _____.

(A) Telephone   (B) Modem   (C) Cable
(D) Computer   (E) None of these

Q.58. A _____ is a data structure in which the data is ordered in a first-in-first-out fashion.

(A) Array   (B) Linked list   (C) Stack
(D) Queue   (E) Tree

Q.59. _____ processing refers to the requirement that the software co-ordinates its activities with those of its environment.

(A) Batch   (B) Real-time   (C) Time-sharing
(D) Distributed   (E) Intelligent

Q.60. _____ software normally associated with an operating system includes a collection of programs for manipulating files.

(A) Utility   (B) Resource   (C) File processing
(D) Networking   (E) None of these

Q.61. When each process ends up waiting for the other to finish, this condition is called

(A) Locked   (B) Deadlock   (C) Error
(D) Hacking   (E) Parity check

Q.62. OSI stands for open system _____.

(A) Intelligent   (B) Interrupt   (C) Interrogation
(D) Interconnection   (E) Intermediate

Q.63. Which of these is not a sorting algorithm·

(A) Bubble   (B) Quick   (C) Radix
(D) Binary   (E) Selection

Q.64. During _____ phase of software development, the needs of an organisation are recognised as a potential computer application.

(A) Analysis   (B) Design   (C) Compilation
(D) SDLC   (E) Implementation

Q.65. Most high-level languages provide methods for implementing _____.

(A) Neither global nor local data   (B) Only global data
(C) Only local data   (D) Both global and local data
(E) None of these

Q.66. A _____ is a pictorial representation of the data paths in a system.

(A) Dataflow diagram   (B) Entity-relationship diagram   (C) Flowchart
(D) System diagram   (E) Datamation diagram

Q.67. A central depository of information about the data items appearing throughout the system is called _____.

(A) Database   (B) Data dictionary   (C) Data reservoir
(D) Metadata   (E) None of these

Q.68. Set of similar objects is called _____.

(A) Class   (B) Object-orientation   (C) Polymorphism
(D) Union   (E) Inheritance

Q.69. The data is collected in the form of tables in _____ database.

(A) Hierarchical   (B) Network   (C) Relational
(D) All of these   (E) None of these

Q.70. The frequently used term _____ is used for mentioning the difference between the lowest and the highest frequencies transmitted.

(A) Amplitude   (B) Bandwidth   (C) Modulation
(D) Mobile   (E) Cable

Q.71. An object is thrown straight up from ground level with a speed of 50 m/s. If $g = 10$ m/s^2 its distance above ground level is·

(A) 40 m   (B) 45 m   (C) 50 m
(D) 55 m   (E) 60 m

Q.72 A string carries a sinusoidal wave with an amplitude of 2.0 cm and frequency of 100 Hz. The maximum speed of any point on the string is:

(A) 2.0 m/s (B) 4.0 m/s (C) 6.3 m/s
(D) 13 m/s (E) Unknown

Q.73 The mass of an oxygen molecule is 16 times that of a hydrogen molecules. At room temperature, the ratio of rms speed of an oxygen molecule is:

(A) 16 (B) 4 (C) 1
(D) 1/4 (E) 1/16

Q.74 Two particles have charges Q and -Q. For a net force of zero to be exerted on a third charge it must be placed:

(A) midway between Q and -Q
(B) on the perpendicular bisector line joining Q and -Q
(C) on the line joining Q and -Q, to the side of Q opposite -Q
(D) on the line joining Q and -Q, to the side of -Q opposite Q
(E) at none of these places

Q.75 The Pauli exclusion principle states that:

(A) particles with integer and half integer spin cannot exist in the same state.
(B) particles with integer spin cannot exist in the same state.
(C) particles with integer spin can exist in the same state,
(D) particles with half integer spin can exist in the same state.
(E) particles with half integer spin cannot exist in the same state.

Q.76 Radio waves are readily diffracted around buildings whereas light waves are negligibly diffracted around buildings. This is because radio waves:

(A) are plane polarized
(B) have much longer wavelength than light waves.
(C) have much shorter wave lengths than light waves
(D) are nearly monochromatic
(E) are amplitude modulated

Q.77 If the magnitude of the sum of two vectors is greater than the magnitude of either vector, then:

(A) The scalar product of the vectors must be negative.
(B) The scalar product of the vectors must be positive.
(C) The vectors must be parallel and in opposite directions.
(D) The vectors must be parallel and in same directions.
(E) None of the above.

Q.78. Three strings are made of the same material. String 1 has length L and tension T, string 2 has length 2L and tension 2T, and string 3 has length 3L and tension 3T. A pulse is started at one end of each string. If the pulses start at the same, the order in which they reach the other end is:

(A) 123 (B) 321 (C) 231
(D) 312 (E) they all take the same time

Q.79 Two metallic strips that constitute some thermostats must differ in:

(A) length (B) thickness (C) mass
(D) rate at which they conduct heat (E) Coefficient of liner expansion

Q.80. The outer surface of the cardboard center of a paper towel roll:

(A) is a possible Gaussian surface
(B) cannot be a Gaussian surface because it encloses no charge
(C) cannot be a Gaussian surface since it is an insulator
(D) isn't a closed surface
(E) None of the above

Q 81   No heroine of ancient or modern days can surpass the Dutch with her lofty contempt of death and the _____ with which she sustains its cruelest affliction

(A) regard   (B) fortitude   (C) guide
(D) loss   (E) reverence

Q 82   Either you _____ or I must try to carry out my task alone

(A) must help me   (B) helped me   (C) must have helped me
(D) will help   (E) none of these

Q.83. Industrial leaders are worried lest new inventions make their plants _____ to oper... they therefore wish to protect themselves against possible _____ .

(A) unprofitable .. obsolescence   (B) illegal . despoliation   (C) useless . bank-ruptcy
(D) costly . depreciation   (E) expansive . causalities

Q.84   I can vouch for his _____ . I have always found him _____

(A) talent . efficient   (B) truth . voracious   (C) honesty .. veracious
(D) steadiness . volatile   (E) reputation .. venal

Q.85   Quarrels would not _____ if the faults were only on one side.

(A) have taken place   (B) started   (C) ended
(D) last long   (E) none of these

Q.86. Criticism that tears down without suggesting areas of improvement is not _____ and should be avoided if possible.

(A) conciliatory   (B) reprehensible   (C) mandatory
(D) constructive   (E) sagacious

Q 87   He is a man of deep learning, but totally ignorant _____ manners.

(A) with life and   (B) with politics and   (C) with sports and
(D) of life and   (E) none of these

Q.88   In the terrific _____ . many people lost their lives and countless others were _____

(A) typhoon . scorched   (B) holocaust .. burned   (C) upheaval .. drowned
(D) maelstrom . crushed   (E) accident . staring

Q.89. ASTUTE

(A) shrewd   (B) departing   (C) foolish
(D) callow   (E) winning

Q.90   DISPUTATIOUS

(A) disgusting   (B) composed   (C) disposed
(D) conciliatory   (E) delicious