Entrance Exam

2024



QUESTION PAPER

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FINAL ANSWER KEY

Question Paper Code: 7/2024/OL
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1. Choose the INCORRECT dimensions:

A) Linear momentum: MLT^{-1}

B) Angular momentum: ML^2T^{-1}

C) Speed of Light: M^0LT^{-2}

D) Kinetic energy: ML^2T^{-2}

E) Angular frequency: $M^0L^0T^{-1}$

Correct Answer : Option C

2. The length of the side of a cube is 1.1×10^{-2} m . Its volume in m^3 up to correct significant figures is

A) 1.4×10^{-6}

B) 1.33×10^{-6}

C) 1.23×10^{-6}

D) 1.42×10^{-6}

E) 1.3×10^{-6}

Correct Answer : Option E

3. A person travels in a car from *p* to *q* with uniform speed *u* and returns to *p* with uniform speed *v*. The average speed for his round trip is

A) $\frac{u+v}{2}$

B) $\frac{uv}{u+v}$

C) $\sqrt{uv}$

D) $\frac{2uv}{u+v}$

E) $\sqrt{\frac{uv}{u+v}}$

Correct Answer : Option D

4. If $\vec{a} = 0.4\hat{i} + 0.3\hat{j} + b\hat{k}$ is a unit vector, then the value of b is

A) $\sqrt{3}$

B) $\frac{2}{\sqrt{5}}$

C) $\frac{\sqrt{5}}{2}$

D) $\frac{1}{\sqrt{3}}$

E) $\frac{\sqrt{3}}{2}$

Correct Answer : Option E

5. The velocity (v)-time (t) graph for the motion of a body is a straight line making an angle 60^0 with the time axis. Then the body is moving with an acceleration (in m s^{-2}) of

A) 1

B) $\frac{\sqrt{3}}{2}$

C) $\frac{1}{\sqrt{3}}$

D) $\sqrt{3}$

E) zero

Correct Answer : Option D

6. A body of weight *W* is suspended from the ceiling of a room through a chain of weight *w*. The ceiling pulls the chain by a force

A) w

B) Wg

C) $\frac{w+W}{2g}$

D) $\frac{w-W}{2}$

E) $w+W$

Correct Answer : Option E

7. The coefficient of friction between the road and the tyres of a cyclist is 0.1. The maximum speed with which he can take a circular turn of radius 2 m without skidding is (g=10 ms^{-2})

A) $\sqrt{2}\ ms^{-1}$

B) $\sqrt{3}\ ms^{-1}$

C) $\sqrt{5}\ ms^{-1}$

D) $2\,ms^{-1}$

E) $3\,ms^{-1}$

Correct Answer : Option A

8. A person standing in an elevator, experiences weight loss, when the elevator

A) moves down with uniform velocity
B) moves upward with constant acceleration
C) moves downward with constant acceleration
D) moves upward with uniform velocity
E) moves down with variable acceleration

Correct Answer : Option C

9. The ratio of the maximum kinetic energy to the maximum potential energy of a bob of a simple pendulum executing small oscillations is

A) 1 : 1
B) 1 : 2
C) 2 : 1
D) 1 : 4
E) 4 : 1

Correct Answer : Option A

10. A constant force of 6 N acting on a stationary body displaces it by 3 m in 2 s. The average power delivered is

A) 18 W
B) 15 W
C) 12 W
D) 9 W
E) 6 W

Correct Answer : Option D

11. A block of mass 3 kg executes simple harmonic motion under the restoring force of a spring. The amplitude and the time period of the motion are 0.1 m and 3.14 s respectively. The maximum force exerted by the spring on the block is

A) 1.2 N
B) 3 N
C) 12 N
D) 30 N
E) 90 N

Correct Answer : Option A

12. The principle involved in the performance of a circus acrobat is the conservation of

A) translational energy
B) linear momentum
C) angular momentum
D) mass
E) rotational energy

Correct Answer : Option C

13. For a smoothly running analog clock, the ratio of the angular velocity of the minute hand to the angular velocity of hour hand is

A) 2
B) 12
C) 24
D) 60
E) 360

Correct Answer : Option B

14. The height above the surface of the earth at which the acceleration due to gravity becomes half of that on the surface of the earth is (R is the radius of earth)

A) R
B) 2R
C) 4R
D) $\frac{R}{2}$
E) $\frac{R}{4}$

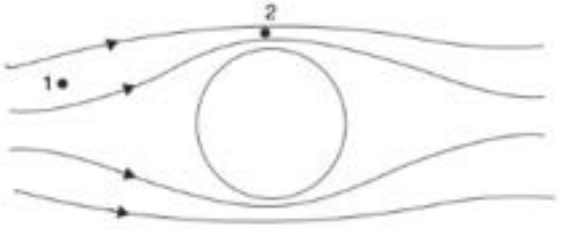
Correct Answer:-Question Cancelled

15. A particle of 100 g mass is projected vertically up with a kinetic energy of 20 J. The maximum height reached by the particle is ($g = 10\ ms^{-2}$) (neglecting air resistance)

A) 5 m
B) 10 m
C) 15 m
D) 20 m
E) 25 m

Correct Answer : Option D

16. A ball is projected in still air. With respect to the ball the streamlines appear as shown in the figure. If speed of air passing through the region 1 and 2 are v_1 and v_2, respectively and the respective pressures, P_1 and P_2, respectively, then



A) $v_1 = v_2 ; P_1 = P_2$
B) $v_1 > v_2 ; P_1 > P_2$
C) $v_1 < v_2 ; P_1 < P_2$
D) $v_1 > v_2 ; P_1 < P_2$
E) $v_1 < v_2 ; P_1 > P_2$

Correct Answer : Option E

17. If the radii of two soap bubbles are respectively 2 cm and 3 cm, then the ratio of the excess pressures inside the soap bubbles is

A) 5:3
B) 3:2
C) 2:3
D) 1:1
E) 3:5

Correct Answer : Option B

18. The elastic energy stored per unit volume in a stretched wire is (Y= Young's modulus of the material of the wire; S= stress acting on the wire)

A) $\frac{1}{2}\left(\frac{S}{Y}\right)$

B) $\frac{1}{2}\left(\frac{S}{Y^2}\right)$

C) $\frac{1}{2}\left(\frac{S^2}{Y}\right)$

D) $\frac{1}{2}\left(\frac{S^2}{Y^2}\right)$

E) $\frac{1}{2}(SY)$

Correct Answer : Option C

19. The zeroth law of thermodynamics leads to the concept of

A) carnot engine
B) work
C) temperature
D) heat
E) internal energy

Correct Answer : Option C

20. If m_a and m_i are the slopes of the adiabatic and isothermal curves for an ideal gas, then $\left(\frac{c_p}{c_v}=\gamma\right)$

A) $m_a=\gamma m_i$

B) $m_i=\gamma m_a$

C) $m_a m_i=\gamma$

D) $m_a m_i=\gamma^2$

E) $\sqrt{\frac{m_a}{m_i}}=\gamma$

Correct Answer : Option A

21. The work done by a gas on the system is zero in

A) adiabatic process
B) isothermal compression
C) isochoric process
D) isobaric process
E) isothermal expansion

Correct Answer : Option C

22. If c_p, c_v and f are the specific heat capacity at constant pressure, specific heat capacity at constant volume and number of degrees of freedom for a polyatomic gaseous system, then the ratio $\frac{c_p}{c_v}$ is equal to

A) $\frac{3+f}{4+f}$

B) $\frac{3}{4f}$

C) $\frac{4f}{3}$

D) $\frac{f}{3}$

E) $\frac{4+f}{3+f}$

Correct Answer:-Question Cancelled

23. When the number of molecules per unit volume of an ideal gas is 0.8×10^{24} the mean free path length for its molecules is $2.2\times10^{-5}\,m$. If the number of molecules per unit volume is 1.0×10^{24}, then the mean free path is

A) $17.6\times10^{-5}\,m$

B) $1.76\times10^{-5}\,m$

C) $3.52\times10^{-5}\,m$

D) $35.2\times10^{-5}\,m$

E) $8.8\times10^{-5}\,m$

Correct Answer : Option B

24. A particle executes a linear SHM with an amplitude a and angular velocity ω. The ratio between its acceleration amplitude and displacement amplitude is

A) $\frac{\omega}{4}$

B) ω^2

C) ω

D) $\frac{\omega}{2}$

E) 2ω

Correct Answer : Option B

25. Speed of a transverse wave on a stretched string under tension T and linear density μ is

A) $\sqrt{\frac{\mu}{T}}$

B) $\sqrt{\frac{T}{\mu}}$

C) $\sqrt{\mu T}$

D) μT

E) $\frac{\mu}{T}$

Correct Answer : Option B

26. The lowest frequency of the air column in an open pipe of length L is (v= velocity of sound in air)

A) $\frac{v}{2L}$

B) $\frac{v}{4L}$

C) $\frac{v}{L}$

D) $\frac{v}{8L}$

E) $\frac{2v}{L}$

Correct Answer : Option A

27. If E is the electric field intensity between the plates of a charged parallel plate capacitor, energy stored per unit volume in it is (permittivity of free space $= \varepsilon_o$)

A) $\varepsilon_o E^2$

B) $\frac{1}{2}\varepsilon_o E^2$

C) $\frac{1}{8}\varepsilon_o E^2$

D) $\frac{1}{4}\varepsilon_o E^2$

E) $\frac{1}{16}\varepsilon_o E^2$

Correct Answer : Option B

28. Two like charges kept in air medium experience a force F, when they are separated by a certain distance *r*. When the same charges are kept in a dielectric medium at the same distance of the separation the force between them is 0.5F. The dielectric constant of the medium is

A) 5

B) $\frac{3}{2}$

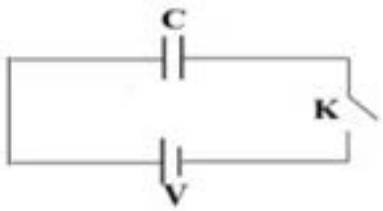
C) $\frac{5}{2}$

D) 2

E) $\frac{2}{5}$

Correct Answer : Option D

29. The energy stored in the capacitor after closing the key K is



A) $\frac{3}{4}CV^2$

B) $\frac{1}{4}CV^2$

C) $\frac{1}{2}CV^2$

D) CV^2

E) $\frac{3}{2}CV^2$

Correct Answer : Option C

30. Masses of three copper wires are in the ratio 1 : 3 : 5 and their lengths are in the ratio 5 : 3 : 1. Then the ratio of their electric resistances is

A) 125 : 15 : 1

B) 5 : 3 : 1
C) 1: 25:125
D) 1 : 3: 5
E) 5 : 21 : 25

Correct Answer : Option A

31. Mobility μ of an electron is related to average collision time τ as (e=electronic charge, m=mass of the electron)

A) $\frac{1}{\tau} = \mathrm{m}\mu$

B) $\mu = \frac{\mathrm{m}\tau}{\mathrm{e}}$

C) $\frac{1}{\mu} = \tau$

D) $\mu = \frac{\mathrm{e}\tau}{\mathrm{m}}$

E) $\mu\tau = \mathrm{e}\,\mathrm{m}$

Correct Answer : Option D

32. The electric power delivered by a transmission cable of resistance R_c at a voltage V is P. The power dissipated is

A) $\frac{PV}{R_c}$

B) $\frac{PR_c}{V}$

C) PVR_c

D) $\frac{P^2R_c}{V^2}$

E) $\frac{P^2R_c{}^2}{V}$

Correct Answer : Option D

33. The ratio of radii of the circular paths of a proton and a deuteron when projected perpendicular to the direction of a uniform magnetic field with the same speed is

A) 1 : 1
B) 1 : 2
C) 2 : 1
D) 4 : 1
E) 1: 4

Correct Answer : Option B

34. An alternative form of Biot-Savart's law is

A) Gauss's law
B) Ohm's law
C) Coulomb's law
D) Ampere's circuital law
E) Joule's law

Correct Answer : Option D

35. In an LCR series resonance circuit driven by the alternating voltage $V = V_0 \sin \omega t$, inductance $L = 1\ \mu H$, capacitance $C = 1\ \mu F$ and resistance $R = 1\ k\Omega$. The resonant angular frequency (in rad s^{-1}) is :

A) 10^6
B) 10^{-6}
C) 10^{12}
D) 10^{-12}
E) 10^{16}

Correct Answer : Option A

36. Electromagnetic waves of frequency 5×10^{14} Hz lie in the

A) ultraviolet region
B) infrared region
C) visible region
D) radio region
E) Microwave region

Correct Answer : Option C

37. Whenever light travels from rarer medium into denser medium its

A) frequency increases
B) wavelength increases
C) frequency decreases
D) wavelength decreases
E) wavelength remains unchanged

Correct Answer : Option D

38. Young's double-slit experiment is carried out by using green, red and blue lights, one at a time. The fringe widths recorded are β_G, β_R and β_B respectively. Then

A) $\beta_G < \beta_R < \beta_B$
B) $\beta_B < \beta_R < \beta_G$
C) $\beta_G < \beta_B < \beta_R$
D) $\beta_B < \beta_G < \beta_R$
E) $\beta_G = \beta_R = \beta_B$

Correct Answer : Option D

39. The number of de Broglie waves associated with Bohr electron when it completes one revolution in its third orbit is

A) 1

B) 3

C) 5

D) 6

E) ∞

Correct Answer : Option B

40. The particle which is expected to be emitted along with Y in the following nuclear reaction is

$$^{198}_{80}\mathrm{X} \rightarrow {}^{197}_{79}\mathrm{Y} + ?$$

A) α - particle

B) β^{+}- particle

C) β^{-} - particle

D) proton

E) neutron

Correct Answer : Option D

41. In a nuclear fusion process, the masses of the fusing nuclei are M_A and M_B . Then the mass of the product nucleus M_C is related to M_A and M_B as

A) $M_C < M_A + M_B$

B) $M_C > M_A + M_B$

C) $M_C = |M_A - M_B|$

D) $M_C = M_A + M_B$

E) $M_C = \frac{M_A + M_B}{2}$

Correct Answer : Option A

42. The electron concentration (n_e) and hole concentration (n_h) in semiconductor are related to the number of intrinsic charge concentration n_i as

A) $n_e n_h = n_i^2$

B) $n_e + n_h = n_i^2$

C) $n_e + n_h = 2n_i^2$

D) $n_e n_h = n_i$

E) $n_e n_h^2 = n_i$

Correct Answer : Option A

43. The half-life period of a radioactive element is 2 days. If $\frac{1}{32}$ part of the initial amount remains undecayed after a time t, then the value of t in days is

A) 8
B) 10
C) 6
D) 12
E) 4

Correct Answer : Option B

44. An intrinsic semiconductor at T= 0 K behaves like

A) insulator
B) n- type semiconductor
C) p- type semiconductor
D) conductor
E) superconductor

Correct Answer : Option A

45. When a diode is reverse biased

A) applied voltage in the p - side is positive
B) the depletion layer width decreases
C) the applied voltage is in the opposite direction of barrier potential
D) minority carriers are not allowed to cross the barrier
E) the barrier height increases

Correct Answer : Option E

46. 10 g of alcohol is dissolved in 90 g of water. The percentage of alcohol in the solution is

A) 10%
B) 90%
C) 20%
D) 100%
E) 1%

Correct Answer : Option A

47. Which of the following set of quantum numbers possible?

A) $n = 3, l = 2, m_l = -4, m_s = ½$
B) $n = 2, l = 2, m_l = 0, m_s = ½$
C) $n = 2, l = 2, m_l = -1, m_s = 1$
D) $n = 3, l = 2, m_l = -2, m_s = ½$
E) $n = 3, l = 3, m_l = -2, m_s = ½$

Correct Answer : Option D

48. The electronic configuration of Pd (Z=46) is

A) $[Kr]\ 4d^8\ 5s^2 5p^0$

B) $[Kr]\ 4d^9\ 5s^1 5p^0$

C) $[Kr]\ 4d^{10} 5s^0 5p^0$

D) $[Kr]\ 4d^5 5s^2\ 5p^3$

E) $[Kr]\ 4d^6 5s^2\ 5p^2$

Correct Answer : Option C

49. Which of the following has square planar structure?

A) NH_4^+

B) XeF_4

C) CCl_4

D) $SiCl_4$

E) CH_4

Correct Answer : Option B

50. Which of the following molecule is paramagnetic?

A) O_2

B) C_2

C) N_2

D) F_2

E) H_2

Correct Answer : Option A

51. The vapour pressure of H2O at 323K is 95 mm of Hg. 176g of sucrose (Molar mass =342 $gmol^{-1}$) is added to 900g of H2O at 323K. The vapour pressure of solution is about

A) 93.94 mm

B) 92.88 mm

C) 96.06 mm

D) 95.33 mm

E) 94.06 mm

Correct Answer : Option E

52. Which of the following statement is incorrect?

A) The greater the disorder in an isolated system, the higher is the entropy.

B) The crystalline solid state of a substance is the state of lowest entropy.

C) Entropy is not the measure of average chaotic motion of particles in the system.

D) The gaseous state of a substance is state of highest entropy.

E) ΔS is related to q and T for a reversible reaction as $\Delta S = q_{rev}/T$.

Correct Answer : Option C

53. $PCl_5(g)$, $PCl_3(g)$ and $Cl_2(g)$ are at equilibrium at 500 K. The equilibrium concentrations of $PCl_3(g)$, $Cl_2(g)$ and $PCl_5(g)$ are respectively 4.0 M ,4.0 M and 2.0 M. Calculate Kc for the reaction, $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$

A) $2\ mol\ dm^{-3}$

B) $4\ mol\ dm^{-3}$

C) $6\ mol\ dm^{-3}$

D) $8\ mol\ dm^{-3}$

E) $10\ mol\ dm^{-3}$

Correct Answer : Option D

54. Which of the following statement is true with regard to Daniell cell?

A) Oxidation occurs at cathode

B) Reduction occurs at anode

C) E^0 cell is 1.1 V

D) Electrical energy produces chemical reaction

E) Electrolytes are aqueous solutions of $CuSO_4$ and $FeSO_4$.

Correct Answer : Option C

55. The conductivity of 0.02 mol L^{-1} KCl solution is 0.248 S m^{-1}. Its molar conductivity is

A) 20 S m^2 mol^{-1}

B) 1.24×10^{-3} S m^2 mol^{-1}

C) 1.24×10^{-4} S m^2 mol^{-1}

D) 2.48×10^{-2} S m^2 mol^{-1}

E) 1.24×10^{-2} S m^2 mol^{-1}

Correct Answer : Option E

56. Which of the following compound has the lowest boiling point?

A) Carbon disulphide

B) Water

C) Ethanol

D) Benzene

E) Chloroform

Correct Answer : Option A

57. Radioactive decay follows

A) first order

B) second order

C) third order

D) zero order

E) Pseudo first order

Correct Answer : Option A

58. In which of the following system, the number of moles of the substance present at equilibrium not be shifted by change in the volume of the system at constant temperature?

A) $N_2\,(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

B) $PCl_3\,(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$

C) $CO\,(g) + 3H_2(g) \rightleftharpoons CH_4(g)$

D) $2SO_2\,(g) + O_2\,(g) \rightleftharpoons 2SO_3\,(g)$

E) $NO_2\,(g) + SO_2\,(g) \rightleftharpoons SO_3(g) + NO(g) + H_2O(g)$

Correct Answer:-Question Cancelled

59. Which of the following has the least atomic radius?

A) B

B) C

C) N

D) O

E) F

Correct Answer : Option E

60. Which of the following tripositive ion has smallest size?

A) Ce^{3+}

B) Nd^{3+}

C) La^{3+}

D) Sm^{3+}

E) Gd^{3+}

Correct Answer : Option E

61. Lanthanides (Ln) when heated with carbon at 2773K form product with general formula

A) LnC

B) Ln_2C_3

C) LnC_3

D) LnC_2

E) Ln_3C_2

Correct Answer : Option D

62. Which of the following is an acidic oxide?

A) CrO_3

B) CrO

C) V_2O_4

D) V_2O_5

E) V_2O_3

Correct Answer : Option A

63. The catalyst used in the Wacker process is

A) V_2O_5

B) $PdCl_2$

C) $TiCl_4$ with $Al(CH_3)_3$

D) Fe
E) Mo

Correct Answer : Option B

64. The coordination number of Pt and Fe in the complexes $[PtCl_6]^{2-}$ and $[Fe(C_2O_4)_3]^{3-}$ are respectively

A) 4 and 6
B) 6 and 6
C) 4 and 4
D) 6 and 8
E) 4 and 8

Correct Answer : Option B

65. The IUPAC name of $HOCH_2(CH_2)_3CH_2COCH_3$

A) 2-oxo-heptan-7-ol
B) 7-hydroxyheptan-2-one
C) hydroxyheptan-6-one
D) 2-oxo-heptan-7-ol
E) hydroxy pentyl methyl ketone

Correct Answer : Option B

66. Which of the following statement is incorrect with Kolbe's electrolytic method?

A) It gives an alkane with even number of carbon atoms at the anode.
B) At anode decarboxylation and formation of methyl radical occurs.
C) Methane cannot be prepared by this method.
D) At anode acetate ion accepts electrons to give acetate free radical.
E) At cathode hydrogen gas is liberated.

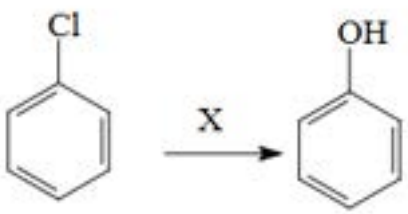
Correct Answer : Option D

67. Which of the following substitution reaction with methane requires HIO_3 as an oxidising agent?

A) Chlorination
B) Bromination
C) Iodination
D) Fluorination
E) Friel-Crafts acylation

Correct Answer : Option C

68. The reagents and conditions (X) required for the following conversion



A) X = H_2O,623 K, 300 atm & H^+
B) X = KOH, 443 K,100 atm & H^+

C) $X = NaOH, 368K, 300 atm \& H^+$

D) $X = warm, H_2O \& H^+$

E) $X = NaOH, 623 K, 300 atm \& H^+$

Correct Answer : Option E

69. Which of the following statement is incorrect?

A) (-)-2-bromooctane reacts with NaOH gives (+)-octan-2-ol by S_N2 reaction.

B) 2-Bromobutane reacts with NaOH gives racemic mixture by S_N1 reaction.

C) β-elimination of 2-bromopentane gives pent-1-ene as major product.

D) The hybridization of the carbon in the intermediate formed in S_N1 reaction is sp^2.

E) Primary alkyl halide undergoes S_N2 faster than secondary alkyl halide.

Correct Answer : Option C

70. Compound 'X' (C_6H_6O) reacts with aqueous NaOH to give compound 'Y'. 'Y' reacts with CO_2 followed by acidification to give compound 'Z'. The compounds X, Y and Z are respectively

A) benzene, phenol, salicylaldehyde

B) phenol, benzene, benzoic acid

C) phenol, sodium phenoxide, benzophenone

D) benzaldehyde, sodium phenoxide, salicylic acid

E) phenol, sodium phenoxide, salicylic acid

Correct Answer : Option E

71. The decreasing order of basic strength in aqueous solution of amines is

A) Dimethylamine > Methylamine > Trimethylamine > Ammonia

B) Methylamine > Dimethylamine > Trimethylamine > Ammonia

C) Trimethylamine > Dimethylamine > Methylamine > Ammonia

D) Ammonia > Trimethylamine > Dimethylamine > Methylamine

E) Ammonia > Dimethylamine > Trimethylamine > Methylamine

Correct Answer : Option A

72. The melting point of β-form of crystalline glucose is

A) 473 K

B) 303 K

C) 423 K

D) 371 K

E) 503 K

Correct Answer : Option C

73. Kjeldahl method can be used to estimate nitrogen in

A) azobenzene

B) aniline

C) o-nitrophenol

D) nitrobenzene

E) pyridine

Correct Answer : Option B

74. Which of the following vitamin deficiency causes increased fragility of RBCs and muscular weakness?

A) Vitamin A
B) Vitamin B_{12}
C) Riboflavin
D) Vitamin D
E) Vitamin E

Correct Answer : Option E

75. Which of the following is the most reactive in aromatic electrophilic substitution reaction?

A) Benzene
B) Chlorobenzene
C) Phenol
D) Benzaldehyde
E) Nitrobenzene

Correct Answer : Option C

76. Let A, B, C denote the set of students in a college who play football, basketball and cricket respectively. If $n(A) = 60,\ n(B) = 55,\ n(C) = 70,\ n(A \cup B \cup C) = 100$ and $n(A \cap B \cap C) = 20,$ then the number of students who play exactly two of these sports is

A) 40
B) 45
C) 60
D) 75
E) 85

Correct Answer : Option B

77. Let $f(x) = \sqrt{4 - x^2}$, $g(x) = \sqrt{x^2 - 1}$. Then the domain of the function $h(x) = f(x) + g(x)$ is equal to

A) $(-\infty, -1] \cup [1, \infty)$
B) $(-\infty, -2] \cup [2, \infty)$
C) $[-2, -1]$
D) $[-2, -1] \cup [1, 2]$
E) $[1, 2]$

Correct Answer : Option D

78. The range of the function $f(x) = 8 + \sqrt{x - 5}$ is

A) $(-\infty, 5]$

B) $[5,\infty)$

C) $(-\infty,5]\cup[8,\infty)$

D) $[5,8]$

E) $[8,\infty)$

Correct Answer : Option E

79. If x satisfies the inequality $-3<\frac{1}{2}+\frac{-3x}{2}\le 6$, then x lies in the interval

A) $\left[\frac{-11}{3},\frac{7}{3}\right)$

B) $\left(\frac{-11}{3},\frac{7}{3}\right]$

C) $\left(\frac{7}{3},\frac{11}{3}\right]$

D) $\left[\frac{-10}{3},\frac{7}{3}\right)$

E) $\left[\frac{7}{3},\frac{10}{3}\right)$

Correct Answer : Option A

80. Let $f(x)=6x^2+9x+10$ and $g(x)=x^2-9x-9$. Then the value of $(f\circ g)(10)$ is equal to

A) 10
B) 15
C) 25
D) 35
E) 45

Correct Answer : Option C

81. If the complex number $\frac{2+i}{\lambda+i}$ lies on the line $y=x$ of the first quadrant, then the value of λ is equal to

A) 3
B) -3
C) 2
D) -2
E) 0

Correct Answer : Option B

82. Let $z=x+iy$, where $y>0$. If $z+\overline{z}=6$ and $|z|+|\overline{z}|=10$, then $z=$

A) $3+2i$

B) $3+5i$

C) $3+3i$

D) $3+4i$

E) $3+i\sqrt{5}$

Correct Answer : Option D

83. If the complex number $2+i$ is rotated through an angle 90° in the anti-clockwise direction about the origin in the complex plane, then the resulting complex number is

A) $2-i$

B) $1+2i$

C) $-1+2i$

D) $-2+i$

E) $1-2i$

Correct Answer : Option C

84. The number of positive integers that have at most seven digits and contain only the digits 0 and 9 is

A) 112

B) 127

C) 136

D) 142

E) 150

Correct Answer : Option B

85. The sum of first 20 terms of the G.P $\sqrt{3}+\frac{-1}{\sqrt{3}}+\frac{1}{3\sqrt{3}}+\frac{-1}{3^2\sqrt{3}}+\cdots$ is equal to

A) $\frac{\sqrt{3}}{4}\left(\frac{3^{20}-1}{3^{19}}\right)$

B) $\frac{\sqrt{3}}{2}\left(\frac{3^{20}-1}{3^{19}}\right)$

C) $\frac{\sqrt{3}}{4}\left(\frac{3^{20}-1}{3^{20}}\right)$

D) $\sqrt{3}\left(\frac{3^{20}-1}{3^{19}}\right)$

E) $\frac{\sqrt{3}}{2}\left(\frac{3^{20}-1}{3^{20}}\right)$

Correct Answer : Option A

86. Let $A = \{1, 3, 5, 7, \ldots, 21\}$. The number of ways 4 numbers, containing always 11, can be selected from the set A is equal to

A) 120
B) 160
C) 240
D) 260
E) 320

Correct Answer : Option A

87. The relation R in the set of integers $\mathbb{Z}$ is given by $R = \{(a,b) : b = 2a + 3\}$. Then the relation R is

A) reflexive, symmetric and transitive
B) neither reflexive nor symmetric nor transitive
C) not reflexive but symmetric and transitive
D) reflexive and symmetric but not transitive
E) reflexive but not symmetric and transitive

Correct Answer : Option B

88. The value of the sum $\sum_{k=0}^{48} \frac{1}{(k+1)(k+2)}$ is equal to

A) $\frac{51}{50}$
B) $\frac{51}{49}$
C) $\frac{49}{50}$
D) $\frac{48}{49}$
E) $\frac{50}{49}$

Correct Answer : Option C

89. If the G.M. of the numbers 2 and α is 16, then the A.M. of these two numbers is equal to

A) 10
B) 20
C) 45
D) 50
E) 65

Correct Answer : Option E

90. Let $a_n = \frac{n(n-5)}{n+2}$, $n = 1, 2, 3, \ldots$. If $a_m = \frac{12}{5}$ for some m, then the value of m is equal to

A) 6
B) 7
C) 8
D) 9
E) 10

Correct Answer : Option C

91. In the binomial expansion of $\left(\sqrt{x}-\frac{3}{x^3}\right)^7$, the constant term is

A) 21
B) -21
C) 14
D) -14
E) 7

Correct Answer : Option B

92. $23\left({}^{50}C_{23}\right)=$

A) $50\left({}^{49}C_{27}\right)$
B) ${}^{49}C_{23}$
C) ${}^{50}C_{22}$
D) $27\left({}^{50}C_{23}\right)$
E) ${}^{49}C_{27}$

Correct Answer : Option A

93. Let $p(x)=\left(1+x+x^2+\cdots+x^{10}\right)\left(1-x+x^2-x^3+\cdots+x^{10}\right)$. Then the sum of all coefficients of $p(x)$ is equal to

A) 121
B) 66
C) 11
D) 10
E) 0

Correct Answer : Option C

94. Let $A=\begin{pmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{pmatrix}$ and $B=\begin{pmatrix} a_1 & 2b_1 & 4c_1 \\ 2a_2 & 4b_2 & 8c_2 \\ 4a_3 & 8b_3 & 16c_3 \end{pmatrix}$. If $|B|=16$, then the value of $|A|$ is equal to

A) 4

B) $\frac{1}{4}$

C) 8

D) $\frac{1}{8}$

E) 16

Correct Answer : Option B

95. If A is an invertible matrix and satisfies the equation $5A^2 - 4A - 7I = 0$, where I is the identity matrix and 0 is the zero matrix, then $7A^{-1} =$

A) $5A - 4I$

B) $4A - 7I$

C) $7A - 5I$

D) $4A - 5I$

E) $5A - 7I$

Correct Answer : Option A

96. Let A be a 3×3 matrix with $|A| = 7$. If $B = 3A$, then the value of $\frac{|\text{adj } A|}{|B|}$ is equal to

A) $\frac{7}{3}$

B) $\frac{7}{9}$

C) $\frac{49}{9}$

D) $\frac{7}{27}$

E) $\frac{49}{27}$

Correct Answer : Option D

97. If $A = \begin{pmatrix} -7 & 3 \\ 3 & -1 \end{pmatrix}$, then $\det(A^5)$ is equal to

A) 81

B) -81

C) 243

D) -243

E) -32

Correct Answer : Option E

98. The means of two samples of size 30 and 40 are 35 and 42 respectively. Then the mean of the combined sample of size 70 is

A) 36
B) 37
C) 38
D) 39
E) 40

Correct Answer : Option D

99. The standard deviation of a data set $x_1, x_2, \cdots, x_9$ $(x_i > 0)$ is 2. If $\sum_{i=1}^{9} x_i^2 = 360$, then the mean of the data set is

A) 4
B) 6
C) 8
D) 10
E) 12

Correct Answer : Option B

100. If two dice are rolled simultaneously, then the probability that the difference of the numbers on the two dice equals to zero is

A) $\frac{1}{12}$
B) $\frac{1}{9}$
C) $\frac{5}{36}$
D) $\frac{7}{36}$
E) $\frac{1}{6}$

Correct Answer : Option E

101. Let A and B be two events. If $P(A) = 0{\cdot}49$, $P(B) = 0{\cdot}3$ and $P(A \mid B') = 0{\cdot}4$, then $P(A \mid B)$ is equal to

A) 0.45
B) 0.28
C) 0.4
D) 0.7
E) 0.3

Correct Answer : Option D

102. $\tan x - \cot x + \operatorname{cosec} x \sec x =$

A) $2 \tan x$

B) $2 \operatorname{cosec} x \sec x$

C) $2 \tan x \sec x$

D) $2 \cot x$

E) $2 \cot x \operatorname{cosec} x$

Correct Answer : Option A

103. The value of $\tan\left(\cos^{-1}\left(\frac{-24}{25}\right)\right)$ is equal to

A) $\frac{7}{24}$

B) $\frac{-7}{24}$

C) $\frac{-7}{25}$

D) $\frac{-24}{7}$

E) $\frac{24}{7}$

Correct Answer : Option B

104. If $\sin t + \cos t = \sqrt{2}$, then $\tan t + \cot t$ is equal to

A) $\frac{1}{2}$

B) 1

C) $\frac{3}{2}$

D) $\frac{5}{2}$

E) 2

Correct Answer : Option E

105. $\operatorname{cosec} x + \cot x =$

A) $\tan\left(\frac{x}{2}\right)$

B) $\sec\left(\frac{x}{2}\right)$

C) $\cot\left(\frac{x}{2}\right)$

D) $\cos\left(\frac{x}{2}\right)$

E) $\sin\left(\frac{x}{2}\right)$

Correct Answer : Option C

106. The value of $\sin\left(2\cos^{-1}\left(\frac{5}{12}\right)+\sin^{-1}\left(\frac{5}{12}\right)\right)$ is equal to

A) $\frac{5}{12}$

B) $\frac{12}{13}$

C) $\frac{5}{13}$

D) $\frac{10}{13}$

E) $\frac{5}{6}$

Correct Answer : Option A

107. $\tan^{-1}\left(\frac{1}{3}\right)+\tan^{-1}\left(\frac{2}{3}\right)+\cot^{-1}\left(\frac{9}{7}\right)=$

A) $\frac{\pi}{6}$

B) $\frac{\pi}{4}$

C) $\frac{\pi}{3}$

D) $\frac{\pi}{2}$

E) 0

Correct Answer : Option D

108. Let $\sum_{k=1}^{15}\sin(t_k)=0$ and $\sum_{k=1}^{15}\sin(3t_k)=\frac{-24}{5}$, where $t_1, t_2, t_3, \ldots$ are real numbers. Then the value of the sum $\sum_{k=1}^{15}\sin^3(t_k)$ is equal to

A) $\frac{4}{5}$

B) $\frac{6}{5}$

C) $\frac{3}{10}$

D) $\frac{24}{5}$

E) $\frac{96}{5}$

Correct Answer : Option B

109. If $7\cos^2 x+3\sin^2 x=6$, then the value of $\cos 2x$ is equal to

A) $\frac{1}{2}$

B) $\frac{3}{2}$

C) $\frac{5}{2}$

D) 1

E) 2

Correct Answer : Option A

110. $\frac{\text{cosec}^2(\theta)-1}{\text{cosec}^2(\theta)}-\frac{\sec^2(\theta)-1}{\sec^2(\theta)}=$

A) $2\cos^2\theta$

B) $2\cos\theta$

C) $2\sin^2\theta$

D) $\cos 2\theta$

E) $2\sin\theta$

Correct Answer : Option D

111. The equation of the line perpendicular to the line $7x-5y=11$ and passing through $(7,-9)$ is

A) $5x+7y+28=0$

B) $5x+7y-28=0$

C) $5x+7y+38=0$

D) $5x+7y-38=0$

E) $5x-7y+28=0$

Correct Answer : Option A

112. The values of α for which the circle $x^2+y^2+\alpha x-8y+56=0$ has radius 3 are

A) 7,-7

B) 9,-9

C) 12,-12

D) 18,-18

E) 14,-14

Correct Answer : Option E

113. The coordinates of the vertex of the parabola $y=2x^2-12x+26$ are

A) (6,13)

B) (3,-8)

C) (3,8)

D) (6,-13)

E) (3,11)

Correct Answer : Option C

114. The equation of the parabola with focus at (3, 1) and vertex at (5, 1) is

A) $(y-1)^2=-8(x-5)$

B) $(y-1)^2=8(x-5)$

C) $(y-1)^2=8(x-3)$

D) $(y-1)^2=-8(x-3)$

E) $(y-1)^2=-4(x-5)$

Correct Answer : Option A

115. The eccentricity of the ellipse $px^2+5y^2=80$, where $p>5$, is $\frac{\sqrt{3}}{2}$. Then the value of p is equal to

A) $\frac{5}{8}$

B) 16

C) $\frac{5}{4}$

D) 20

E) 25

Correct Answer : Option D

116. For an ellipse the foci are $F(3,0)$ and $F'(-3,0)$. If the length of the minor axis is 8, then the length of the major axis is equal to

A) 16

B) 15

C) 14

D) 12

E) 10

Correct Answer : Option E

117. If $(a,-6)$ lies on the perpendicular bisector of the line segment joining $(-2,-1)$ and $(4,-13)$, then the value of a is equal to

A) 1

B) -2

C) 2

D) -3

E) 3

Correct Answer : Option E

118. If (3, 2) and (5 ,6) are end points of a diameter of a circle, then the equation of the circle is

A) $x^2+y^2-6x+4y+3=0$

B) $x^2+y^2-8x-4y+3=0$

C) $x^2+y^2-8x-4y-3=0$

D) $x^2+y^2-6x+4y+17=0$

E) $x^2+y^2-8x-4y-17=0$

Correct Answer:-Question Cancelled

119. Let α,β,γ be the direction cosines of a vector $\vec{a}=x\hat{i}+y\hat{j}+z\hat{k}$, where $z<0$. If $\alpha=\frac{-4}{\sqrt{105}}$ and $\beta=\frac{\sqrt{5}}{\sqrt{21}}$, then γ is equal to

A) $\frac{-8}{\sqrt{105}}$

B) $\frac{-\sqrt{8}}{\sqrt{105}}$

C) $\frac{-5}{\sqrt{105}}$

D) $\frac{-5}{\sqrt{21}}$

E) $\frac{-8}{\sqrt{21}}$

Correct Answer : Option A

120. Let $A(0,3,-3)$, $B(1,1,1)$ and $C(2,0,3)$ be three points in space. Then the projection of $\overrightarrow{AB}$ on $\overrightarrow{AC}$ is equal to

A) $\frac{26}{7}$

B) $\frac{32}{7}$

C) $\frac{34}{7}$

D) $\frac{24}{7}$

E) $\frac{20}{7}$

Correct Answer : Option B

121. If $\vec{a}=5\hat{i}-7\hat{j}+9\hat{k}$ and $\vec{b}=-5\hat{i}+7\hat{j}-9\hat{k}$, then $\vec{a}\cdot\left(\vec{a}\times\vec{b}\right)+\left(\vec{a}+\vec{b}\right)\cdot\hat{b}$ is equal to

A) 50
B) -50
C) 49
D) -49
E) 0

Correct Answer : Option E

122. The line joining the points (2, 2, 2) and (6, 6, 6) meets the line $\frac{x-1}{3}=\frac{y-2}{2}=\frac{z-5}{-1}$ at the point

A) (1,1,1)
B) (2,2,2)
C) (3,3,3)
D) (4,4,4)
E) (6,6,6)

Correct Answer : Option D

123. The angle between the vectors $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{3}$. If $\left|\vec{a}\cdot\vec{b}\right|^2=15$, then $\left|\vec{a}\times\vec{b}\right|^2$ is equal to

A) 5

B) $15\sqrt{3}$

C) $\frac{15}{\sqrt{3}}$

D) $5\sqrt{3}$

E) 45

Correct Answer : Option E

124. The symmetric equation of the straight line passing through the points (-1, 4, 2) and (-3, 0, 5) is

A) $\frac{x-1}{-2}=\frac{y+4}{-4}=\frac{z+2}{3}$

B) $\frac{x+1}{2}=\frac{y-4}{4}=\frac{z-2}{5}$

C) $\frac{x+1}{-2}=\frac{y-4}{-4}=\frac{z-2}{3}$

D) $\frac{x-3}{-2}=\frac{y}{-4}=\frac{z+5}{3}$

E) $\frac{x+1}{4}=\frac{y-4}{-4}=\frac{z-2}{3}$

Correct Answer : Option C

125. The angle between the lines $\frac{x-1}{2}=\frac{2y+3}{4}=\frac{z+5}{-2}$ and $\frac{x-3}{4}=\frac{y+1}{-4}=\frac{z+3}{-4}$ is equal to

A) $\cos^{-1}\left(\frac{1}{8}\right)$

B) $\cos^{-1}\left(\frac{1}{3}\right)$

C) $\cos^{-1}\left(\frac{1}{4}\right)$

D) $\cos^{-1}\left(\frac{1}{12}\right)$

E) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

Correct Answer : Option B

126. If the function $f(x)=\begin{cases} x^2, & \text{for } x<4 \\ 5x-k, & \text{for } x\geq 4 \end{cases}$ is continuous at $x=4$, then the value of k is equal to

A) 2
B) 3
C) 4
D) 5
E) 6

Correct Answer : Option C

127. If $f(x)=\sqrt[3]{x^2}+\sqrt{x}$, then the value of $f'(64)$ is equal to

A) $\frac{11}{48}$
B) $\frac{9}{48}$
C) $\frac{7}{48}$
D) $\frac{5}{48}$
E) $\frac{1}{16}$

Correct Answer : Option A

128. Ice is coated uniformly around a sphere of radius 15cm. If ice is melting at the rate of 80 cm^3 / min when the thickness is 5cm, then the rate of change of thickness of ice is

A) $\frac{1}{10\pi}$ cm / min
B) $\frac{1}{50\pi}$ cm / min
C) $\frac{1}{80\pi}$ cm / min
D) $\frac{1}{40\pi}$ cm / min
E) $\frac{1}{20\pi}$ cm / min

Correct Answer : Option E

129. $\int \frac{e^x}{2^x} dx =$

A) $\frac{e^x}{(\log_e 2)2^x}+C$

B) $\frac{e^x}{2(2^x)}+C$

C) $\frac{2}{e}\left(\frac{e}{2}\right)^{x-1}+C$

D) $\frac{e^x}{(1-\log_e 2)2^x}+C$

E) $\frac{e^x}{2^x}+C$

Correct Answer : Option D

130. The area bounded by the parabola $y=x^2+4$ and the straight line passing through the points $(-1,2)$ and $(1, 6)$ is (in square units)

A) $\frac{20}{3}$

B) $\frac{4}{3}$

C) $\frac{8}{3}$

D) $\frac{16}{3}$

E) $\frac{14}{3}$

Correct Answer : Option B

131. Let $g(x)=4x+3$ and $f(g(x))=x^2+9$. Then the value of $f(7)$ is equal to

A) 7
B) 9
C) 10
D) 12
E) 14

Correct Answer : Option C

132. The range of the function $f(x)=7\cos(10x+4\pi)$ is

A) $[-1,1]$

B) $[-4\pi,4\pi]$

C) $[-10,10]$

D) $[-7,7]$

E) $[-2\pi,2\pi]$

Correct Answer : Option D

133. Let $f(x)=\log_e\left(\frac{x^2+30}{11x}\right), x\in[5,6]$. Then the point $c\in(5,6)$ at which $f'(c)=0$ is

A) $\sqrt{30}$

B) $4\sqrt{2}$

C) $2\sqrt{7}$

D) $\sqrt{35}$

E) $\sqrt{26}$

Correct Answer : Option A

134. Let $f(x)=ax^3+bx^2+cx+d$. If f has a local maximum value 21 at $x=-1$ and a local minimum value 7 at $x=1$, then $f(0)$ is equal to

A) 10

B) 11

C) 12

D) 13

E) 14

Correct Answer : Option E

135. The value of $\int_{-2}^{2} x|x|dx$ is equal to

A) $\frac{1}{8}$

B) $\frac{1}{4}$

C) $\frac{-1}{4}$

D) $\frac{-1}{8}$

E) 0

Correct Answer : Option E

136. $\int x^5 e^{x^3} dx =$

A) $\frac{e^{x^3}}{3}\left(x^3-1\right)+C$

B) $\frac{e^{x^3}}{5}\left(x^5-1\right)+C$

C) $\frac{e^{x^3}}{4}\left(x^4-1\right)+C$

D) $\frac{e^{x^3}}{3}\left(x^5-1\right)+C$

E) $\frac{x^3 e^{x^3}}{3}+C$

Correct Answer : Option A

137. $\lim_{x\to 6}\frac{\sqrt{x^2+13}-7}{x^2-36} =$

A) $\frac{1}{7}$

B) $\frac{1}{13}$

C) $\frac{13}{36}$

D) $\frac{1}{14}$

E) $\frac{1}{36}$

Correct Answer : Option D

138. If $x^4+2\sqrt{y+1}=3$, then $\frac{dy}{dx}$ at (1, 0) is equal to

A) 4

B) 2

C) -4

D) -2

E) $\frac{-1}{8}$

Correct Answer : Option C

139. If $\lim_{x\to 9} f(x)=6$ and $\lim_{x\to 9} g(x)=3$, then $\lim_{x\to 9}\frac{f(x)-2g(x)}{g(x)} =$

A) 2

B) -2

C) $\frac{1}{3}$

D) $\frac{-1}{3}$

E) 0

Correct Answer : Option E

140. For the curve $y = \alpha x^2 + \cos y + \beta$, the value of $\frac{dy}{dx}$ at (1, 0) is 2. Then the value of $\alpha\beta$ is equal to

A) 1

B) -1

C) 2

D) -2

E) 0

Correct Answer : Option D

141. $\lim_{x\to 4}\left(\frac{1}{x-4} - \frac{5}{x^2-3x-4}\right) =$

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

B) $\frac{1}{5}$

C) $\frac{1}{3}$

D) $\frac{1}{2}$

E) 1

Correct Answer : Option B

142. If $y = \log_e\left(\frac{1+2x^2}{1-3x^2}\right)$, then $\frac{dy}{dx} =$

A) $\frac{10x}{1-x^2-6x^4}$

B) $\frac{12x^3}{1-x^2-6x^4}$

C) $\frac{10x}{1-6x^4}$

D) $\frac{-10x}{1-x^2-6x^4}$

E) $\frac{-12x^3}{1-x^2-6x^4}$

Correct Answer : Option A

143. Let α and β be real numbers such that $f(x)=\begin{cases}2x^2+4x+\alpha, & \text{if } x<1\\ \beta x^2+5, & \text{if } x\geq 1\end{cases}$ is differentiable at $x=1$. Then $\alpha+\beta$ is equal to

A) 5
B) 6
C) 7
D) 8
E) 9

Correct Answer : Option C

144. If $f(x)=x^2+2xf'(1)+f''(2)$ for all x, then $f(0)$ is equal to

A) 4
B) 3
C) 2
D) 1
E) 0

Correct Answer : Option C

145. The function $f(x)=6x^4-3x^2-5$ is increasing in the set

A) $\left(-\infty,\frac{-1}{2}\right)\cup\left(\frac{1}{2},1\right)$

B) $\left(\frac{-1}{2},0\right)\cup\left(\frac{1}{2},\infty\right)$

C) $\left(\frac{-1}{2},\frac{1}{2}\right)$

D) $\left(-\infty,\frac{1}{2}\right)$

E) $\left(-\infty,\frac{-1}{2}\right)\cup\left(\frac{1}{2},\infty\right)$

Correct Answer : Option B

146. The general solution of the differential equation $2y\tan x+\frac{dy}{dx}=5\sin x$ is

A) $y=5\sec x+C\sec^2 x$

B) $y=5+C\cos x$

C) $y=5\cos x+C$

D) $y=5\cos x+C\cos^2 x$

E) $y=5\sec^2 x+C\sec x$

Correct Answer : Option D

147. $\int\frac{\sin\theta\sin 2\theta}{1-\cos 2\theta}d\theta=$

A) $1+\cos\theta+C$

B) $1+\sin\theta+C$

C) $\sin\theta+C$

D) $1+\cos 2\theta+C$

E) $1+\sin 2\theta+C$

Correct Answer : Option C

148. $\int\frac{6x^3+9x^2}{x^4+3x^3-9x^2}dx=$

A) $3x\log\left|x^2+3x-9\right|+C$

B) $6x\log\left|x^2+3x-9\right|+C$

C) $6\log\left|x^2+3x-9\right|+C$

D) $x\log\left|x^2+3x-9\right|+C$

E) $3\log\left|x^2+3x-9\right|+C$

Correct Answer : Option E

149. The value of $\int_0^3|x-2|\,dx$ is equal to

A) $\frac{2}{3}$

B) $\frac{3}{2}$

C) $\frac{5}{2}$

D) $\frac{2}{5}$

E) $\frac{9}{2}$

Correct Answer : Option C

150. The integrating factor of the differential equation $(3\sin x\cos x)dy=\left(1+3y\sin^2 x\right)dx$, where $0<x<\frac{\pi}{2}$, is

A) $\sec x$

B) $\sin x$

C) $\tan x$

D) $\cos x$

E) $\cot x$

Correct Answer : Option D

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