

FINAL ANSWER KEY

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1. If the time period T of a satellite revolving close to the earth is given as $T = 2\pi R^a g^b$, then the value of a and b are respectively (R – Radius of the earth)
- A) $-\frac{1}{2}$ and $-\frac{1}{2}$
- B) $\frac{1}{2}$ and $-\frac{1}{2}$
- C) $\frac{1}{2}$ and $\frac{1}{2}$
- D) $\frac{3}{2}$ and $-\frac{1}{2}$
- E) $-\frac{1}{2}$ and $\frac{1}{2}$

Correct Answer : Option B

2. The angle between $\vec{A} \times \vec{B}$ and $\vec{B} \times \vec{A}$ is
- A) 90°
- B) 60°
- C) 180°
- D) 0°
- E) 270°

Correct Answer : Option C

3. If the initial speed of the car moving at constant acceleration is halved, then the stopping distance S becomes
- A) $2S$
- B) $\frac{S}{2}$
- C) $4S$
- D) $\frac{S}{4}$
- E) $\frac{S}{8}$

Correct Answer : Option D

4. When a cricketer catches a ball in 30 s, the force required is 2.5 N. The force required to catch that ball in 50 s is
- A) 1.5 N
 - B) 1 N
 - C) 2.5 N
 - D) 3 N
 - E) 5 N

Correct Answer : Option A

5. A ball is thrown vertically upwards with an initial speed of 20 ms^{-1} . The velocity (in ms^{-1}) and acceleration (in ms^{-2}) at the highest point of its motion are respectively
- A) 20 and 9.8
 - B) 0 and 9.8
 - C) 0 and 0
 - D) 10 and 9.8
 - E) 0 and 4.9

Correct Answer : Option B

6. Which one is an INCORRECT statement?
- A) Forces always occur in pairs
 - B) Impulsive force is a force that acts for a shorter duration
 - C) Impulse is the change in momentum of the body
 - D) Momentum and change in momentum both have the same direction
 - E) Action and reaction forces act on different bodies

Correct Answer : Option D

7. Impending motion is opposed by
- A) static friction
 - B) fluid friction
 - C) sliding friction
 - D) kinetic friction
 - E) rolling friction

Correct Answer : Option A

8. A block of 50 g mass is connected to a spring of spring constant 500 Nm^{-1} . It is extended to the maximum and released. If the maximum speed of the block is 3 ms^{-1} , then the length of extension is
- A) 4 cm
 - B) 1 cm
 - C) 2.5 cm
 - D) 3 cm
 - E) 5 cm

Correct Answer : Option D

9. A particle is displaced from P ($3\hat{i} + 2\hat{j} - \hat{k}$) to Q ($2\hat{i} + 2\hat{j} + 2\hat{k}$) by a force $F = \hat{i} + \hat{j} + \hat{k}$. The work done on the particle (in J) is

- A) 2
- B) 1
- C) 2.5
- D) 3
- E) 5

Correct Answer : Option A

10. The motion of a cylinder on an inclined plane is a

- A) rotational but not translation
- B) translation but not rotational
- C) translational but not rolling
- D) rotational, translational and rolling motion
- E) rotational and rolling but not translational motion

Correct Answer : Option D

11. A flywheel ensures a smooth ride on the vehicle because of its

- A) larger speed
- B) zero moment of inertia
- C) large moment of inertia
- D) lesser mass with smaller radius
- E) small moment of inertia

Correct Answer : Option C

12. The escape speed of the moon when compared with escape speed of the earth is approximately

- A) twice smaller
- B) thrice smaller
- C) 4 times smaller
- D) 5 times smaller
- E) 6 times smaller

Correct Answer : Option D

13. The force of gravity is a

- A) strong force
- B) noncentral force
- C) nonconservative force
- D) contact force
- E) conservative force

Correct Answer : Option E

14. The terminal velocity of a small steel ball falling through a viscous medium is

- A) directly proportional to the radius of the ball
- B) inversely proportional to the radius of the ball
- C) directly proportional to the square of the radius of the ball
- D) directly proportional to the square root of the radius of the ball
- E) inversely proportional to the square of the radius of the ball

Correct Answer : Option C

- 15.** The stress required to produce a fractional compression of 1.5 % in a liquid having bulk modulus of $0.9 \times 10^9 \text{ Nm}^{-2}$ is
- A) $2.48 \times 10^7 \text{ Nm}^{-2}$
 - B) $0.26 \times 10^7 \text{ Nm}^{-2}$
 - C) $3.72 \times 10^7 \text{ Nm}^{-2}$
 - D) $1.35 \times 10^7 \text{ Nm}^{-2}$
 - E) $4.56 \times 10^7 \text{ Nm}^{-2}$

Correct Answer : Option D

- 16.** When heat is supplied to the gas in an isochoric process, the supplied heat changes its
- A) volume only
 - B) internal energy and volume
 - C) internal energy only
 - D) internal energy and temperature
 - E) temperature only

Correct Answer : Option D

- 17.** 1 g of ice at 0°C is converted into water by supplying a heat of 418.72 J. The quantity of heat that is used to increase the temperature of water from 0°C is (Latent heat of fusion of ice = $3.35 \times 10^5 \text{ Jkg}^{-1}$)
- A) 83.72 J
 - B) 33.52 J
 - C) 335.72 J
 - D) 837.24 J
 - E) 418.72 J

Correct Answer : Option A

- 18.** All real gases behave like an ideal gas at
- A) high pressure and low temperature
 - B) low temperature and low pressure
 - C) high pressure and high temperature
 - D) at all temperatures and pressures
 - E) low pressure and high temperature

Correct Answer : Option E

- 19.** 0.5 mole of N_2 at 27°C is mixed with 0.5 mole of O_2 at 42°C . The temperature of the mixture is
- A) 42°C
 - B) 34.5°C
 - C) 32.5°C

- D) 37.5°C
 E) 27°C

Correct Answer : Option B

- 20.** A wave with a frequency of 600 Hz and wavelength of 0.5 m travels a distance of 200 m in air in a time of
- A) 1.67 s
 B) 0.67 s
 C) 1 s
 D) 0.33 s
 E) 1.33 s

Correct Answer : Option B

- 21.** If the fundamental frequency of the stretched string of length 1 m under a given tension is 3 Hz, then the fundamental frequency of the stretched string of length 0.75 m under the same tension is
- A) 1 Hz
 B) 2 Hz
 C) 6 Hz
 D) 4 Hz
 E) 5 Hz

Correct Answer : Option D

- 22.** The product of the total electric flux emanating from a closed surface enclosing a charge q in free space is (ϵ_0 - electrical permittivity of free space)
- A) 1
 B) $\frac{q}{\epsilon_0}$
 C) q
 D) $q\epsilon_0$
 E) ϵ_0

Correct Answer:-Question Cancelled

- 23.** Three capacitances 1 μF , 4 μF and 5 μF are connected in parallel with a supply voltage. If the total charge flowing through the capacitors is 50 μC , then the supply voltage is
- A) 2 V
 B) 10 V
 C) 6 V
 D) 3 V
 E) 5 V

Correct Answer : Option E

- 24.** The resistance of a wire at 0°C is $4\ \Omega$. If the temperature coefficient of resistance of the material of the wire is $5 \times 10^{-3}/^{\circ}\text{C}$, then the resistance of a wire at 50°C is
- A) 20 Ω

- B) $10\ \Omega$
- C) $6\ \Omega$
- D) $8\ \Omega$
- E) $5\ \Omega$

Correct Answer : Option E

- 25.** A number of electrons flowing in a copper wire for 1 minute constitute a current of 0.5 A. Twice the number of electrons flowing through the same wire for 20 s will constitute a current of
- A) 0.25 A
 - B) 3 A
 - C) 1 A
 - D) 1.25 A
 - E) 2.25 A

Correct Answer : Option B

- 26.** If a cell of 12 V emf delivers 2 A current in a circuit having a resistance of $5.8\ \Omega$, then the internal resistance of the cell is
- A) $1\ \Omega$
 - B) $0.2\ \Omega$
 - C) $0.3\ \Omega$
 - D) $0.6\ \Omega$
 - E) $0.8\ \Omega$

Correct Answer : Option B

- 27.** Torque on a coil carrying current I having N turns and area of cross section A when placed with its plane perpendicular to a magnetic field B is
- A) $2NBIA$
 - B) $\frac{NBIA}{3}$
 - C) 0
 - D) $\frac{NBIA}{2}$
 - E) $NBIA$

Correct Answer : Option C

A long straight wire carrying a current 3 A produces a magnetic field B at certain distance.

- 28.** The current that flows through the same wire will produce a magnetic field $\frac{B}{3}$ at the same distance is
- A) 1.5 A
 - B) 1 A
 - C) 2.5 A
 - D) 3 A
 - E) 5 A

Correct Answer : Option B

29. Which one of the following statement is INCORRECT?

- A) Isolated magnetic poles do not exist
- B) Magnetic field lines do not intersect
- C) Moving charges do not produce magnetic field in the surrounding space
- D) Magnetic field lines always form closed loops
- E) Magnetic force on a negative charge is opposite to that on a positive charge

Correct Answer : Option C

30. When a current passing through a coil changes at a rate of 30 As^{-1} the emf induced in the coil is 12 V. If the current passing through this coil changes at a rate of 20 As^{-1} the emf induced in this coil is

- A) 8 V
- B) 10 V
- C) 2.5 V
- D) 3 V
- E) 5 V

Correct Answer : Option A

31. The reactance of an induction coil of 4 H for a dc current (in Ω) is

- A) zero
- B) 4π
- C) 40π
- D) 400π
- E) infinity

Correct Answer : Option A

32. If the total momentum delivered to a surface by an em wave is $3 \times 10^{-4} \text{ kgms}^{-1}$, then the total energy transferred to this surface is

- A) $3 \times 10^4 \text{ J}$
- B) $4.5 \times 10^4 \text{ J}$
- C) $6 \times 10^4 \text{ J}$
- D) $2 \times 10^4 \text{ J}$
- E) $9 \times 10^4 \text{ J}$

Correct Answer:-Question Cancelled

33. The radiations used in LASIK eye surgery are

- A) IR radiations
- B) micro waves
- C) radio waves
- D) gamma rays
- E) UV radiations

Correct Answer : Option E

34. When two coherent sources each of individual intensity I_0 interfere, the resultant intensity due to constructive and destructive interference are respectively

- A) $4I_0$ and 0
- B) I_0 and $2I_0$
- C) 0 and $2I_0$
- D) $2I_0$ and I_0
- E) $2I_0$ and 0

Correct Answer : Option A

35. If the power of a lens is +4 D, then the lens is a

- A) convex lens of focal length 25 cm
- B) concave lens of focal length 25 cm
- C) concave lens of focal length 40 cm
- D) convex lens of focal length 50 cm
- E) concave lens of focal length 20 cm

Correct Answer : Option A

36. In a single slit diffraction experiment, the width of the slit and the wavelength of the light are respectively 5 mm and 500 nm. If the focal length of the lens is 20 cm, then the size of the central bright fringe will be

- A) 5×10^{-5} m
- B) 3×10^{-5} m
- C) 2.5×10^{-5} m
- D) 2×10^{-5} m
- E) 1×10^{-5} m

Correct Answer : Option D

37. A particle having mass 2000 times that of an electron travels with a velocity thrice that of the electron. The ratio of the de Broglie wavelength of the particle to that of the electron is

- A) $\frac{1}{3000}$
- B) $\frac{1}{2000}$
- C) $\frac{1}{6000}$
- D) $\frac{1}{8000}$
- E) $\frac{1}{1500}$

Correct Answer : Option C

38. The process by which the electrons can come out of the metal in a spark plug is

- A) field emission
- B) ionic emission

- C) secondary emission
- D) thermionic emission
- E) photoelectric emission

Correct Answer : Option A

- 39.** The energy required to excite the hydrogen atom from its first excited state to second excited state is
- A) 12.09 eV
 - B) 1.89 eV
 - C) 10.2 eV
 - D) 3.40 eV
 - E) 1.51 eV

Correct Answer : Option B

- 40.** If the maximum number of neighbours of a nucleon within the range of nuclear force is p and k is a constant, then the binding energy per nucleon is approximately
- A) p^2k
 - B) pk
 - C) $p^{1/2}k$
 - D) $p^{1/3}k$
 - E) p^3k

Correct Answer : Option B

- 41.** In gamma emission, the nucleus emits
- A) a photon
 - B) a neutron
 - C) a neutrino
 - D) an electron
 - E) a positron

Correct Answer : Option A

- 42.** If the initial decay rate of a radioactive sample is R_0 , then the decay rate after a half-life time $T_{1/2}$ is
- A) $2R_0$
 - B) R_0
 - C) $\sqrt{R_0}$
 - D) $3R_0$
 - E) $\frac{R_0}{2}$

Correct Answer : Option E

43. An external voltage V is supplied to a semiconductor diode having built-in potential V_0 . The effective barrier height under forward bias is
- A) $V_0 + V$
 - B) $\left(\frac{V_0 + V}{2} \right)$
 - C) $V_0 - V$
 - D) $\left(\frac{V_0 - V}{2} \right)$
 - E) $2V_0 + V$

Correct Answer : Option C

44. If the conductivity of the material lies in the range $10^2 - 10^8 \Omega^{-1}\text{m}^{-1}$, then it is a
- A) insulator
 - B) semiconductor
 - C) superconductor
 - D) dielectric
 - E) metal

Correct Answer : Option E

45. The thickness of the depletion layer on either side of the p-n junction is of the order of
- A) μm
 - B) cm
 - C) mm
 - D) nm
 - E) m

Correct Answer : Option A

46. The unit of an universal constant is cm^{-1} . What is the constant?
- A) Planck's constant
 - B) Boltzmann constant
 - C) Rydberg constant
 - D) Avogadro constant
 - E) Molar gas constant

Correct Answer : Option C

47. Which of the following molecule has the most polar bond?
- A) Cl_2
 - B) HCl
 - C) PCl_3
 - D) N_2
 - E) HF

Correct Answer : Option E

ΔS would be negative for which of the following reactions?

- (I) $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
48. (II) $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$
 (III) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$

Choose the correct answer from the codes given below:

- A) I and III only
 B) II and III only
 C) I only
 D) III only
 E) I, II, and III

Correct Answer : Option B

- 49.** Equal volumes of pH 3, 4 & 5 are mixed in a container. The concentration of H^+ in the mixture is (Assume there is no change in the volume during mixing)

- A) $1 \times 10^{-3}\text{M}$
 B) $3.7 \times 10^{-4}\text{M}$
 C) $1 \times 10^{-4}\text{M}$
 D) $3.7 \times 10^{-5}\text{M}$
 E) $3 \times 10^{-5}\text{M}$

Correct Answer : Option B

The reaction $\text{H}_2\text{O}(\text{g}) + \text{Cl}_2\text{O}(\text{g}) \rightleftharpoons 2 \text{HOCl}(\text{g})$ is allowed to attain equilibrium at 400K.

- 50.** At equilibrium the partial pressure of $\text{H}_2\text{O}(\text{g})$ is 300mm of Hg, and those of $\text{Cl}_2\text{O}(\text{g})$ and $\text{HOCl}(\text{g})$ are 20 mm and 60 mm respectively. The value of K_P for the reaction at 300K is

- A) 36
 B) 6.0
 C) 60
 D) 3.6
 E) 0.60

Correct Answer : Option E

- 51.** Strong intra-molecular hydrogen bond is present in

- A) water
 B) hydrogen fluoride
 C) o-cresol
 D) o-nitrophenol
 E) ammonia

Correct Answer : Option D

- 52.** Which of the following molecule has a Lewis structure that does not obey the octet rule?

- A) HCN
- B) CS₂
- C) NO
- D) CCl₄
- E) PF₃

Correct Answer : Option C

53. The rate and the rate constant of a reaction has the same units. The order of the reaction is

- A) one
- B) two
- C) three
- D) zero
- E) half

Correct Answer : Option D

For the reaction $2A + B \rightarrow 2C + D$, the following kinetic data were obtained for three different experiments performed at the same temperature.

54.

Experiment	[A] ₀ /M	[B] ₀ /M	Initial rate/ M s ⁻¹
I	0.10	0.10	0.10
II	0.20	0.10	0.40
II	0.20	0.20	0.40

The total order and order in [B] for the reaction are respectively

- A) 2,1
- B) 1,1
- C) 1,2
- D) 2,2
- E) 2,0

Correct Answer : Option E

55. The standard molar entropies of SO₂(g), SO₃(g) and O₂(g) are 250 JK⁻¹, 257 JK⁻¹ and are 205 JK⁻¹ respectively. Calculate standard molar entropy change for the reaction $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$

- A) -198 JK⁻¹
- B) -191 JK⁻¹
- C) 198 JK⁻¹
- D) 191 JK⁻¹
- E) -1219 JK⁻¹

Correct Answer : Option B

56. An aqueous solution contains 20g of a non-volatile strong electrolyte A_2B (Molar mass = 60 g mol^{-1}) in 1 kg of water. If the electrolyte is 100% dissociated at this concentration, what is the boiling point of the solution? (K_b of water is $0.52 \text{ K kg mol}^{-1}$)
- A) 372.482K
B) 374.56K
C) 373.52K
D) 371.44K
E) 374.02K

Correct Answer : Option C

57. An organic compound contains 37.5% C, 12.5% H and the rest oxygen. What is the empirical formula of the compound?
- A) CH_4O
B) C_2H_3O
C) CH_3O_2
D) C_2H_4O
E) CH_3O

Correct Answer : Option A

58. How many grams of HCl will completely react with 17.4g of pure $MnO_2(s)$ to liberate $Cl_2(g)$? (Atomic mass $Mn=55.0$; $H=1$; $Cl=35.5$)
- A) 14.6g
B) 7.3g
C) 21.9g
D) 29.2g
E) 34.8g

Correct Answer : Option D

59. What is the quantity of current required to liberate 16g of $O_2(g)$ during electrolysis of water? (Given $1F=96500C$)
- A) $4.825 \times 10^4 C$
B) $9.65 \times 10^4 C$
C) $2.895 \times 10^5 C$
D) $4.825 \times 10^5 C$
E) $1.93 \times 10^5 C$

Correct Answer : Option E

Co-ordination compounds exhibit different types of isomerism. Some complexes are

Given in column I and type of isomerism is given in column II.

Column I

Column II

- | | | |
|-----|--|----------------------------|
| 60. | (a) $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ | (i) ionisation isomerism |
| | (b) $[\text{Co}(\text{en})_3]^{3+}$ | (ii) linkage isomerism |
| | (c) $[\text{Cr}(\text{NH}_3)_5(\text{SO}_4)]\text{Br}$ | (iii) optical isomerism |
| | (d) $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]\text{Cl}_2$ | (iv) geometrical isomerism |

Choose the correct matching from the codes given below:

- A) (a) –(ii), (b)-(iv), (c)-(i), (d)-(iii)
 B) (a)-(iv), (b)-(i), (c)-(ii), (d)- (iii)
 C) (a)-(iv), (b)-(iii), (c)-(i), (d)- (ii)
 D) (a)-(iv), (b)- (ii), (c)-(iii), (d)-(i)
 E) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)

Correct Answer : Option C

61. Which of the following amines will not undergo carbylamine reaction?

- A) N-methylethanamine
 B) Phenylmethanamine
 C) Aniline
 D) Ethanamine
 E) Propan-2-amine

Correct Answer : Option A

62. The 3d block metal having positive standard electrode potential (M^{2+}/M) is

- A) Titanium
 B) Vanadium
 C) Iron
 D) Copper
 E) Chromium

Correct Answer : Option D

63. Which of the following statement is incorrect with regard to interstitial compounds of transition elements?

- A) They have high melting points.
 B) They are very hard.
 C) They have metallic conductivity.
 D) They are chemically inert.
 E) They are stoichiometric compounds.

Correct Answer : Option E

64. The alloy containing about 95% lanthanoids, 5% iron and traces of S, C, Ca and Al which is used in producing Mg-based bullets is

- A) bell metal
 B) monel metal
 C) misch metal

- D) bronze
- E) german silver

Correct Answer : Option C

65. The IUPAC name of the complex $[\text{Cr}(\text{NH}_3)_3(\text{H}_2\text{O})_3]\text{Cl}_3$ is

- A) triaquatrimminechromium(III) chloride
- B) triamminetriaquachromium(III) chloride
- C) triaquatrimminechromium(II) chloride
- D) triamminetriaquachromium(II) chloride
- E) triaquatrimminechromium(III) trichloride

Correct Answer : Option B

In the Carius method of estimation of halogen, 0.4g of an organic compound gave 0.188g of AgBr.

66. What is the percentage of bromine in the organic compound? (The atomic mass of Ag = 108 g mol⁻¹ & Br = 80 g mol⁻¹)

- A) 20%
- B) 10%
- C) 15%
- D) 25%
- E) 30%

Correct Answer : Option A

67. Which one of the following compounds can exhibit both optical isomerism and geometrical isomerism?

- A) 2-chloropent-2-ene
- B) 5-chloropent-2-ene
- C) 4-chloropent-2-ene
- D) 3-chloropent-1-ene
- E) 3-chloropent-2-ene

Correct Answer : Option C

68. Which one of the following nucleophiles is an ambident nucleophile?

- A) CH_3O^-
- B) HO^-
- C) CH_3COO^-
- D) H_2O
- E) CN^-

Correct Answer : Option E

69. Choose the achiral molecule in the following:

- A) 2-bromobutane
- B) 3-nitropentane
- C) 3-chlorobut-1-ene
- D) 1-bromoethanol
- E) 2-hydroxypropanoic acid

Correct Answer : Option B

70. Phenol can be converted to salicylaldehyde by

- A) Kolbe reaction
- B) Williamson reaction
- C) Etard reaction
- D) Reimer-Tiemann reaction
- E) Stephen reaction

Correct Answer : Option D

71. The order of decreasing acid strength of carboxylic acids is

- A) $\text{FCH}_2\text{COOH} > \text{ClCH}_2\text{COOH} > \text{NO}_2\text{CH}_2\text{COOH} > \text{CNCH}_2\text{COOH}$
- B) $\text{CNCH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{NO}_2\text{CH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$
- C) $\text{NO}_2\text{CH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{ClCH}_2\text{COOH} > \text{CNCH}_2\text{COOH}$
- D) $\text{FCH}_2\text{COOH} > \text{NO}_2\text{CH}_2\text{COOH} > \text{ClCH}_2\text{COOH} > \text{CNCH}_2\text{COOH}$
- E) $\text{NO}_2\text{CH}_2\text{COOH} > \text{CNCH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$

Correct Answer : Option E

72. Chlorophenylmethane is treated with ethanolic NaCN and the product obtained is reduced with H_2 in the presence of finely divided nickel to give

- A) Phenylmethanamine
- B) 1-phenylethanamine
- C) 2-phenylethanamine
- D) 1-methyl-2-phenylethanamine
- E) phenylmethanamine

Correct Answer : Option C

73. A reagent that can be used to reduce benzene diazonium chloride to benzene is

- A) ethanol
- B) methanol
- C) methanoic acid
- D) acetone
- E) phosphorous acid

Correct Answer : Option A

74. Which one of the following is not an essential amino acid?

- A) Lysine
- B) Tyrosine
- C) Threonine
- D) Tryptophan
- E) Methionine

Correct Answer : Option B

75. 14g of cyclopropane burnt completely in excess oxygen. The number of moles of water formed is

- A) 1.4 moles

- B) 2.8 moles
- C) 2.0 moles
- D) 1.0 mole
- E) 4 moles

Correct Answer : Option D

76. Let $f(x) = \log_e(x)$ and let $g(x) = \frac{x-2}{x^2+1}$. Then the domain of the composite function $f \circ g$ is
- A) $(2, \infty)$
 - B) $(-1, \infty)$
 - C) $(0, \infty)$
 - D) $(1, \infty)$
 - E) $(1, 0)$

Correct Answer : Option A

77. Let S denote the set of all subsets of integers containing more than two numbers. A relation R on S is defined by $R = \{ (A, B) : \text{the sets } A \text{ and } B \text{ have at least two numbers in common} \}$. Then the relation R is
- A) reflexive, symmetric and transitive
 - B) reflexive and symmetric but not transitive
 - C) not reflexive, not symmetric and not transitive
 - D) not reflexive but symmetric and transitive
 - E) reflexive but not symmetric and transitive

Correct Answer : Option B

78. For two sets A and B we have $n(A \cup B) = 50$, $n(A \cap B) = 12$ and $n(A - B) = 15$. Then $n(B - A)$ is equal to
- A) 27
 - B) 35
 - C) 38
 - D) 29
 - E) 23

Correct Answer : Option E

79. The value of $\left(\frac{10i}{(2-i)(3-i)} \right)^{2024}$ is equal to
- A) 2^{2024}
 - B) 2^{1012}
 - C) 4^{2024}

- D) $\left(\frac{1}{2}\right)^{2024}$
- E) $\left(\frac{1}{2}\right)^{1012}$

Correct Answer : Option B

80. The period of the function $f(x) = \sin\left(\frac{3x}{2}\right)$ is equal to

- A) $\frac{4\pi}{3}$
- B) $\frac{2\pi}{3}$
- C) $\frac{\pi}{3}$
- D) 3π
- E) 2π

Correct Answer : Option A

81. The value of α for which the complex number $\frac{2 - \alpha i}{\alpha - i}$ is purely imaginary, is

- A) 2
- B) -2
- C) 1
- D) -1
- E) 0

Correct Answer : Option E

82. The centre of a square is at the origin of the complex plane. If one of the vertices is at $-3i$, then the area of the square is

- A) 9
- B) 12
- C) 18
- D) 24
- E) 27

Correct Answer : Option C

83. The modulus of the complex number $\frac{(1+i)^{10}(2-i)^6}{(2i-4)^4}$ is equal to

- A) 8
- B) 10
- C) 16
- D) 30

E) 32

Correct Answer : Option B

84. If $0 \leq x \leq 5$, then the greatest value of α and the least value of β satisfying the inequalities $\alpha \leq 3x + 5 \leq \beta$ are, respectively,

- A) 0,5
- B) 10,15
- C) 5,10
- D) 5,15
- E) 5,20

Correct Answer : Option E

85. Let $A = \begin{pmatrix} 3 & -2 & 1 \\ -1 & 3 & -1 \end{pmatrix}$ and $B = \begin{pmatrix} 1 \\ \alpha \\ -1 \end{pmatrix}$. If $AB = \begin{pmatrix} -2 \\ 6 \end{pmatrix}$, then the value of α is equal to

- A) -1
- B) 1
- C) -2
- D) 2
- E) 0

Correct Answer : Option D

86. If 2 is a solution of the inequality $\frac{x-a}{a-2x} < -3$, then a must lie in the interval

- A) (4,5)
- B) (2,5)
- C) (4,10)
- D) (2,10)
- E) (0,10)

Correct Answer : Option A

87. The coefficient of $x^{14}y$ in the expansion of $(x^2 + \sqrt{y})^9$ is

- A) 84
- B) 36
- C) 63
- D) 252
- E) 128

Correct Answer : Option B

88. The value of x that satisfies the equation $\begin{vmatrix} x & 1 & 1 \\ 2 & 2 & 0 \\ 1 & 0 & -2 \end{vmatrix} = 6$ is

- A) 1
- B) 2
- C) 3
- D) -2
- E) -1

Correct Answer : Option E

89. The sum of the series $\frac{1}{2^{10}} + \frac{1}{2^{11}} + \cdots + \frac{1}{2^{19}}$ is equal to

- A) $\frac{2^{10} - 1}{2^{21}}$
- B) $\frac{2^9 - 1}{2^{20}}$
- C) $\frac{2^{10} - 1}{2^{19}}$
- D) $\frac{2^9 - 1}{2^{19}}$
- E) $\frac{2^{10} - 1}{2^{20}}$

Correct Answer : Option C

90. Let A and B be two sets each containing more than one element. If $n(A) < n(B)$ and $n(A \times B) = 155$, then $n(A)$ is equal to

- A) 5
- B) 3
- C) 7
- D) 15
- E) 25

Correct Answer : Option A

91. There are 3 different mathematics books and 4 different physics books in a shelf. Then the number of ways these books can be arranged so that the mathematics books are together is

- A) 144
- B) 120
- C) 520
- D) 720
- E) 620

Correct Answer : Option D

92. $11({}^{10}P_7) =$

- A) ${}^{11}P_7$
- B) ${}^{10}P_8$
- C) ${}^{11}P_8$
- D) ${}^{11}P_9$
- E) ${}^{10}P_9$

Correct Answer : Option C

93. The value of the sum ${}^{15}C_6 + {}^{14}C_6 + {}^{13}C_6 + {}^{12}C_6 + {}^{11}C_6 + {}^{10}C_6$ is equal to

- A) ${}^{15}C_7 - {}^{10}C_6$
- B) ${}^{15}C_7 - {}^{10}C_7$
- C) ${}^{16}C_7 - {}^{10}C_7$
- D) ${}^{16}C_7 - {}^{10}C_6$
- E) ${}^{16}C_7 - {}^{11}C_6$

Correct Answer : Option C

94. Let $A = \begin{pmatrix} 2 & -1 & 1 \\ -1 & 0 & 2 \\ 1 & -2 & -1 \end{pmatrix}$ and let $B = \frac{1}{|A|}A$. Then the value of $|B|$ is equal to

- A) $\frac{1}{9}$
- B) $\frac{1}{11}$
- C) $\frac{1}{81}$
- D) $\frac{1}{121}$
- E) 1

Correct Answer : Option C

95. Let $f(x) = 2 - 7 \sin\left(\frac{2x}{7}\right)$. Then the maximum value of $f(x)$ is

- A) -5
- B) 5
- C) 4

- D) 9
E) -9

Correct Answer : Option D

96. The second term of a G.P is $\frac{1}{2}$. If the product of first five terms is 32, then the common ratio of the G. P. is

- A) $\frac{1}{4}$
B) 4
C) $\frac{1}{8}$
D) 8
E) $\frac{1}{2}$

Correct Answer : Option B

97. The first term and the 6th term of a G. P. are 2 and $\frac{64}{243}$ respectively. Then the sum of first 10 terms of the G.P. is

- A) $6 - \frac{2^{11}}{3^9}$
B) $1 - \frac{2^{11}}{3^9}$
C) $6 - \frac{2^{10}}{3^9}$
D) $1 - \frac{2^{10}}{3^9}$
E) $6 - \frac{2^{11}}{3^{10}}$

Correct Answer : Option A

An assignment of probabilities for outcomes of the sample spaces $S = \{1, 2, 3, 4, 5, 6\}$

- | | | | | | | |
|-----|-----|------|------|------|------|-------|
| 98. | 1 | 2 | 3 | 4 | 5 | 6 |
| | k | $3k$ | $5k$ | $7k$ | $9k$ | $11k$ |

If this assignment is valid, then the value of k is

- A) $\frac{1}{34}$

- B) $\frac{1}{35}$
- C) $\frac{1}{38}$
- D) $\frac{1}{37}$
- E) $\frac{1}{36}$

Correct Answer : Option E

99. Three coins are tossed simultaneously. Then the probability that exactly two tails appear is

- A) $\frac{1}{8}$
- B) $\frac{1}{4}$
- C) $\frac{3}{8}$
- D) $\frac{1}{2}$
- E) $\frac{5}{8}$

Correct Answer : Option C

100. A bag contains 10 green balls and 5 red balls. If two balls are selected randomly, then the probability that both are green balls, is

- A) $\frac{9}{35}$
- B) $\frac{2}{7}$
- C) $\frac{3}{7}$
- D) $\frac{5}{27}$
- E) $\frac{2}{15}$

Correct Answer : Option C

101. Let A , B , C be three mutually and exhaustive events of an experiment. If $2P(A) = 3P(B) = 4P(C)$, then $P(C)$ is equal to

- A) $\frac{3}{13}$
 B) $\frac{4}{13}$
 C) $\frac{5}{13}$
 D) $\frac{6}{13}$
 E) $\frac{7}{13}$

Correct Answer : Option A

- Two circles C_1 and C_2 have radii 18 and 12 units, respectively. If an arc of length ℓ of C_1 subtends an angle 80° at the centre, then the angle subtended by an arc of same length ℓ of C_2 at the centre is

- A) 90°
 B) 100°
 C) 110°
 D) 120°
 E) 135°

Correct Answer : Option D

103. $\frac{1}{\tan A - \tan B} =$

- A) $\frac{\sin A \sin B}{\cos(A - B)}$
 B) $\frac{\sin A \sin B}{\sin(A - B)}$
 C) $\frac{\cos A - \cos B}{\sin A - \sin B}$
 D) $\cot A - \cot B$
 E) $\frac{\cos A \cos B}{\sin(A - B)}$

Correct Answer : Option E

104. $\cos^{-1}\left(\cos\left(\frac{-7\pi}{9}\right)\right) =$

- A) $\frac{-7\pi}{9}$
- B) $\frac{7\pi}{9}$
- C) $\frac{2\pi}{9}$
- D) $\frac{-2\pi}{9}$
- E) $\frac{-4\pi}{9}$

Correct Answer : Option B

105. The value of $\frac{\cos^{-1}(0) + \sin^{-1}\left(\frac{\sqrt{3}}{2}\right) + \cos^{-1}\left(\frac{1}{2}\right)}{\sin^{-1}(1) + \cos^{-1}\left(\frac{\sqrt{3}}{2}\right) + \sin^{-1}\left(\frac{1}{\sqrt{2}}\right)}$ is equal to

- A) $\frac{7}{11}$
- B) $\frac{11}{12}$
- C) $\frac{7}{10}$
- D) $\frac{14}{11}$
- E) $\frac{7}{5}$

Correct Answer : Option D

106. If $\sec \theta + \tan \theta = 2 + \sqrt{3}$, then $\sec \theta - \tan \theta =$

- A) $2 - \sqrt{3}$
- B) $\frac{1}{2 - \sqrt{3}}$
- C) $\frac{1}{\sqrt{3}}$
- D) $\frac{2}{\sqrt{3}}$
- E) $\frac{2}{2 - \sqrt{3}}$

Correct Answer : Option A

107. If $a = \frac{1 + \tan \theta + \sec \theta}{2 \sec \theta}$ and $b = \frac{\sin \theta}{1 - \sec \theta + \tan \theta}$, then $\frac{a}{b}$ is equal to

- A) 1
- B) -1
- C) 2
- D) -2
- E) 0

Correct Answer : Option A

108. If $\frac{1}{1 - \tan x} = \frac{3 + \sqrt{3}}{2}$, $0 \leq x < \frac{\pi}{2}$, then the value of x is equal to

- A) $\frac{\pi}{3}$
- B) $\frac{\pi}{5}$
- C) $\frac{\pi}{6}$
- D) $\frac{\pi}{8}$
- E) $\frac{\pi}{12}$

Correct Answer : Option C

109. If $a = \tan^{-1}\left(\frac{4}{3}\right)$ and $b = \tan^{-1}\left(\frac{1}{3}\right)$, where $0 < a, b < \frac{\pi}{2}$, then $a - b =$

- A) $\tan^{-1}(3)$
- B) $\tan^{-1}\left(\frac{3}{13}\right)$
- C) $\tan^{-1}(5)$
- D) $\tan^{-1}\left(\frac{9}{13}\right)$
- E) $\tan^{-1}\left(\frac{5}{13}\right)$

Correct Answer : Option D

110. If $0 \leq \alpha \leq \frac{\pi}{2}$ and $\sin\left(\alpha - \frac{\pi}{12}\right) = \frac{1}{2}$, then α is equal to

- A) $\frac{\pi}{6}$
- B) $\frac{\pi}{4}$
- C) $\frac{\pi}{3}$
- D) $\frac{5\pi}{12}$
- E) $\frac{7\pi}{12}$

Correct Answer : Option B

111. The equation of the line passing through the point $(-9, 5)$ and parallel to the line

$$5x - 13y = 19 \text{ is}$$

- A) $5x - 13y + 110 = 0$
- B) $5x - 13y + 100 = 0$
- C) $5x - 13y + 65 = 0$
- D) $5x - 13y - 110 = 0$
- E) $5x - 13y - 100 = 0$

Correct Answer : Option A

112. The radius of the circle with centre at $(-4, 0)$ and passing through the point $(2, 8)$ is

- A) 6
- B) 8
- C) 10
- D) 12
- E) 14

Correct Answer : Option C

113. The axis of a parabola is parallel to y -axis and its vertex is at $(5, 0)$. If it passes through the point $(2, 3)$, then its equation is

- A) $y^2 = 3(x - 5)$
- B) $3y = (x - 5)^2$
- C) $3y^2 = x - 5$
- D) $y = 3(x - 5)^2$

E) $y = 9(x - 5)^2$

Correct Answer : Option B

114. The foci of the ellipse $\frac{x^2}{49} + \frac{y^2}{24} = 1$ are

- A) (7,0) and (-7,0)
- B) (6,0) and (-6,0)
- C) (4,0) and (-4,0)
- D) (5,0) and (-5,0)
- E) (3,0) and (-3,0)

Correct Answer : Option D

115. The line $y=5x+7$ is perpendicular to the line joining the points (2, 12) and (12, k). Then the value of k is equal to

- A) 12
- B) -12
- C) 8
- D) -8
- E) 10

Correct Answer : Option E

116. The centre of the hyperbola $16x^2 - 4y^2 + 64x - 24y - 36 = 0$ is at the point

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

Correct Answer : Option A

117. The focus of the parabola $y^2 + 4y - 8x + 20 = 0$ is at the point

- A) (0,-2)
- B) (2,-2)
- C) (4,-2)
- D) (2,0)
- E) (4,-4)

Correct Answer : Option C

118. For a hyperbola, the vertices are at (6, 0) and (-6,0). If the foci are at $(2\sqrt{10}, 0)$ and $(-2\sqrt{10}, 0)$, then the equation of the hyperbola is

- A) $\frac{x^2}{36} - \frac{y^2}{76} = 1$

- B) $\frac{x^2}{76} - \frac{y^2}{36} = 1$
- C) $\frac{x^2}{6} - \frac{y^2}{2} = 1$
- D) $\frac{x^2}{4} - \frac{y^2}{36} = 1$
- E) $\frac{x^2}{36} - \frac{y^2}{4} = 1$

Correct Answer : Option E

119. If a line makes angle α , β and γ with positive direction of x , y , and z -axis respectively, then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma =$

- A) 1
- B) -1
- C) 2
- D) -2
- E) 0

Correct Answer : Option B

120. Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors. The angle between $\vec{a}$ and $\vec{b}$ is 30° , the angle between $\vec{a}$ and $\vec{c}$ is 60° and the angle between $\vec{a}$ and $\vec{b} + \vec{c}$ is 45° . If $|\vec{b}| = \sqrt{6}$ and $|\vec{c}| = 2\sqrt{2}$, then

$$|\vec{b} + \vec{c}| =$$

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

Correct Answer : Option E

121. The vectors $\vec{a} = 4\hat{i} - 3\hat{j} - \hat{k}$ and $\vec{b} = 3\hat{i} + 2\hat{j} + \lambda\hat{k}$ are perpendicular to each other. Then the value of λ is equal to

- A) 3
- B) 4
- C) -3
- D) -4
- E) 6

Correct Answer : Option E

122. The centre of a circle lies on the y -axis. If it passes through the points $(-4, 3)$ and $(3, -4)$, then its radius is

A) $7\sqrt{2}$
 B) 4
 C) $4\sqrt{2}$
 D) 5
 E) $5\sqrt{2}$

Correct Answer : Option D

123. The point of intersection of the lines $\frac{x-3}{2} = \frac{y-2}{2} = \frac{z-6}{1}$ and $\frac{x-2}{3} = \frac{y-4}{2} = \frac{z-1}{3}$ is

A) (3, 4, 3)
 B) (7, 6, 6)
 C) (4, 3, 3)
 D) (10, 11, 10)
 E) (11, 10, 10)

Correct Answer : Option E

124. The angle between the lines $\frac{x-1}{6} = \frac{y-5}{8} = \frac{z-3}{10}$ and $\frac{x+1}{2} = \frac{2y+3}{2} = \frac{z+3}{2}$ is

A) $\cos^{-1}\left(\frac{\sqrt{2}}{6}\right)$
 B) $\cos^{-1}\left(\frac{2\sqrt{2}}{3}\right)$
 C) $\cos^{-1}\left(\frac{\sqrt{2}}{3}\right)$
 D) $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$
 E) $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

Correct Answer : Option B

125. The angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{3}$. If $|\vec{a}| = 5$ and $|\vec{b}| = 10$, then $|\vec{a} + \vec{b}|$ is equal to

A) $7\sqrt{5}$
 B) $5\sqrt{5}$

- C) 15
- D) $5\sqrt{3}$
- E) $5\sqrt{7}$

Correct Answer : Option E

126. Let $f(x) = a^{3x}$ and $a^5 = 8$. Then the value of $f(5)$ is equal to

- A) 64
- B) 128
- C) 256
- D) 512
- E) 1024

Correct Answer : Option D

127. Let $f(x) = \begin{cases} x^2 - \alpha, & \text{if } x < 1 \\ \beta x - 3, & \text{if } x \geq 1 \end{cases}$. If f is continuous at $x = 1$, then the value of $\alpha + \beta$ is

- A) -2
- B) 2
- C) 4
- D) -4
- E) 0

Correct Answer : Option C

128. $\int e^x \sqrt{e^x} dx =$

- A) $\frac{3}{2} e^x \sqrt{e^x} + C$
- B) $\frac{2}{3} e^x \sqrt{e^x} + C$
- C) $\frac{5}{2} e^{2x} \sqrt{e^x} + C$
- D) $\frac{2}{5} e^{2x} \sqrt{e^x} + C$
- E) $\frac{2}{3} e^{2x/3} + C$

Correct Answer : Option B

129. The area bounded by the parabola $y = x^2 + 2$ and the lines $y = x$, $x = 1$ and $x = 2$ is (in square units)

- A) $\frac{31}{6}$

- B) $\frac{29}{6}$
 C) $\frac{25}{6}$
 D) $\frac{17}{6}$
 E) $\frac{13}{6}$

Correct Answer : Option D

130. Let $f(x) = x \sin(x^4)$. Then $f'(x)$ at $x = \sqrt[4]{\pi}$ is equal to

- A) $4\pi + 1$
 B) 4π
 C) -4π
 D) $4\pi - 1$
 E) $4\pi + 4$

Correct Answer : Option C

131. For $1 \leq x < \infty$, let $f(x) = \sin^{-1}\left(\frac{1}{x}\right) + \cos^{-1}\left(\frac{1}{x}\right)$. Then $f'(x) =$

- A) $\frac{2}{x^2\sqrt{1-x^2}}$
 B) $\frac{-2}{x^2\sqrt{1-x^2}}$
 C) $\frac{2}{x\sqrt{1-x^2}}$
 D) $\frac{-2}{x\sqrt{1-x^2}}$
 E) 0

Correct Answer : Option E

132. The value of the limit $\lim_{t \rightarrow 0} \frac{(5-t)^2 - 25}{t}$ is equal to

- A) -10
 B) -5
 C) 10
 D) 5
 E) 0

Correct Answer : Option A

133. A particle is moving along the curve $y = 8x + \cos y$, $0 \leq y \leq \pi$. If at a point the ordinate is changing 4 times as fast as the abscissa, then the coordinates of the point are

- A) $\left(\frac{\pi}{16}, \frac{\pi}{2}\right)$
 B) $\left(\frac{-1}{8}, 0\right)$
 C) $\left(\frac{1}{8}, 0\right)$
 D) $\left(\frac{-\pi}{2}, \frac{-\pi}{16}\right)$
 E) $\left(\frac{\pi}{2}, \frac{9\pi}{16}\right)$

Correct Answer : Option A

134. The value of the limit $\lim_{x \rightarrow 0} \frac{(2 + \cos 3x) \sin^2 x}{x \tan(2x)}$ is equal to

- A) $\frac{3}{2}$
 B) 2
 C) $\frac{1}{2}$
 D) 3
 E) 0

Correct Answer : Option A

135. $\int_{\pi/5}^{3\pi/10} \frac{\sqrt{\tan x}}{1 + \sqrt{\tan x}} dx =$

- A) $\frac{\pi}{4}$
 B) $\frac{\pi}{5}$
 C) $\frac{\pi}{10}$
 D) $\frac{\pi}{20}$

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

Correct Answer : Option D

136. Let $f(x) = \begin{cases} x\left(\frac{\pi}{2} + x\right), & \text{if } x \geq 0 \\ x\left(\frac{\pi}{2} - x\right), & \text{if } x < 0 \end{cases}$. Then $f'(-4)$ is equal to

A) $\frac{\pi - 8}{2}$

B) $\frac{16 + \pi}{2}$

C) $\frac{8 + \pi}{2}$

D) $\frac{\pi - 16}{2}$

E) $\pi - 16$

Correct Answer : Option B

137. Let $f(x) = \frac{|5-x|(x+5)}{\tan(x-5)}$ for $x \neq 5$. Then $\lim_{x \rightarrow 5^+} f(x)$ is equal to

A) 10

B) -10

C) 5

D) -5

E) 0

Correct Answer : Option A

138. The function $f(x) = x^{3/5}(5x - 12)$ is increasing in the set

A) $\left(\frac{5}{12}, \infty\right)$

B) $(-\infty, 0) \cup \left(\frac{9}{10}, \infty\right)$

C) $(-\infty, 0) \cup \left(\frac{5}{12}, \infty\right)$

D) $\left(0, \frac{9}{10}\right)$

E) $\left(\frac{9}{10}, \infty\right)$

Correct Answer : Option E

139. The value of $\lim_{x \rightarrow 1} \frac{\frac{1}{2x+1} - \frac{1}{3}}{x-1}$ is equal to

- A) $\frac{-2}{9}$
- B) $\frac{2}{9}$
- C) $\frac{-2}{3}$
- D) $\frac{2}{3}$
- E) 0

Correct Answer : Option A

140. The critical points of the function $f(x) = (x-3)^3 (x+2)^2$ are

- A) -1,3,-2
- B) 1,3,-2
- C) 3,3,-2
- D) 0,3,-2
- E) 0,-3,2

Correct Answer : Option D

141. The integrating factor of the differential equation $x \frac{dy}{dx} + 2y = xe^x$ is

- A) $\log_e x$
- B) $\log_e 2x$
- C) x
- D) x^2
- E) $2x$

Correct Answer : Option D

142. The minimum value of the function $f(x) = x^4 - 4x - 5$, $x \in \mathbb{R}$ is

- A) -7
- B) 7
- C) 8
- D) -8
- E) 0

Correct Answer : Option D

143. $\int_0^{\pi/4} (\tan^3 x + \tan^5 x) dx =$

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

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

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

D) $\frac{1}{6}$

E) $\frac{1}{12}$

Correct Answer : Option C

144. Let $I = \int_{-\pi/4}^{\pi/4} \frac{\tan^2 x}{1+5^x} dx$. Then

A) $I = \int_{-\pi/4}^{\pi/4} \tan^2 x dx$

B) $2I = \int_{-\pi/4}^{\pi/4} \tan^2 x dx$

C) $I = \int_{-\pi/4}^{\pi/4} \frac{1}{1+5^x} dx$

D) $2I = \int_{-\pi/4}^{\pi/4} 5^x \tan^2 x dx$

E) $2I = \int_{-\pi/4}^{\pi/4} \frac{1}{1+5^x} dx$

Correct Answer : Option B

145. $\int \left(\frac{\log_e t}{1+t} + \frac{\log_e t}{t(1+t)} \right) dt =$

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

B) $\frac{t^2 (\log_e t)^2}{2} + C$

C) $\frac{(1+\log_e t)^2}{2} + C$

- D) $\frac{(\log_e t)^2}{2t^2} + C$
- E) $\frac{(\log_e t)^2}{2} + \frac{1}{(1+t)^2} + C$

Correct Answer : Option A

146. $\int \frac{x^2 - 1}{x^4 + 3x^2 + 1} dx =$
- A) $\frac{1}{\sqrt{3}} \tan^{-1} \left(\frac{x^2 + 1}{\sqrt{3}x} \right) + C$
- B) $\tan^{-1}(x^2 - 1) + C$
- C) $\tan^{-1} \left(x - \frac{1}{x} \right) + C$
- D) $\frac{1}{\sqrt{5}} \tan^{-1} \left(\frac{x^2 + 1}{\sqrt{5}x} \right) + C$
- E) $\tan^{-1} \left(x + \frac{1}{x} \right) + C$

Correct Answer : Option E

147. $\int \frac{4x \cos \sqrt{4x^2 + 7}}{\sqrt{4x^2 + 7}} dx =$
- A) $\frac{1}{2} \sin \sqrt{4x^2 + 7} + C$
- B) $\frac{7}{2} \sin \sqrt{4x^2 + 7} + C$
- C) $\sin \sqrt{4x^2 + 7} + C$
- D) $\frac{1}{4} \sin \sqrt{4x^2 + 7} + C$
- E) $\frac{7}{4} \sin \sqrt{4x^2 + 7} + C$

Correct Answer : Option C

148. The general solution of the differential equation $\frac{dy}{dx} = xy - 2x - 2y + 4$ is

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

- B) $\log_e |y-2| = \frac{(x-2)^2}{2} + C$
- C) $(y-2)^2 = \frac{(x-2)^2}{2} + C$
- D) $\log_e |y-2| = C$
- E) $\log_e |y-2| = (x-2)^2 + C$

Correct Answer : Option B

149. Let $f(x) = \frac{x^2 + 40}{7x}$, $x \neq 0, x \in [4, 5]$. The value of $c \in [4, 5]$ at which $f'(c) = \frac{-1}{7}$ is equal to

- A) $3\sqrt{2}$
- B) $2\sqrt{5}$
- C) $\frac{49}{\sqrt{3}}$
- D) $\sqrt{21}$
- E) $2\sqrt{6}$

Correct Answer : Option B

150. If $f'(x) = 4x \cos^2 x \sin\left(\frac{x}{4}\right)$, then $\lim_{x \rightarrow 0} \frac{f(\pi + x) - f(\pi)}{x}$ is equal to

- A) 4π
- B) $(\sqrt{2})\pi$
- C) 2π
- D) $(2\sqrt{2})\pi$
- E) 0

Correct Answer : Option D