

## PROVISIONAL 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)  $90^\circ$
- B)  $60^\circ$
- C)  $180^\circ$
- D)  $0^\circ$
- E)  $270^\circ$

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  $20 \text{ ms}^{-1}$ . The velocity (in  $\text{ms}^{-1}$ ) and acceleration (in  $\text{ms}^{-2}$ ) 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  $500 \text{ Nm}^{-1}$ . It is extended to the maximum and released. If the maximum speed of the block is  $3 \text{ ms}^{-1}$ , 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

- 1 g of ice at  $0^\circ\text{C}$  is converted into water by supplying a heat of 418.72 J. The quantity of
- 17.** heat that is used to increase the temperature of water from  $0^\circ\text{C}$  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  $\text{N}_2$  at  $27^\circ\text{C}$  is mixed with 0.5 mole of  $\text{O}_2$  at  $42^\circ\text{C}$ . The temperature of the mixture is
- A)  $42^\circ\text{C}$
  - B)  $34.5^\circ\text{C}$
  - C)  $32.5^\circ\text{C}$

- D)  $37.5^{\circ}\text{C}$
- E)  $27^{\circ}\text{C}$

**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 ( $\epsilon_0$  - electrical permittivity of free space)
- A) 1
  - B)  $\frac{q}{\epsilon_0}$
  - C)  $q$
  - D)  $q\epsilon_0$
  - E)  $\epsilon_0$

**Correct Answer :** Option C

- 23.** Three capacitances  $1\ \mu\text{F}$ ,  $4\ \mu\text{F}$  and  $5\ \mu\text{F}$  are connected in parallel with a supply voltage. If the total charge flowing through the capacitors is  $50\ \mu\text{C}$ , 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  $0\text{ }^{\circ}\text{C}$  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  $50\text{ }^{\circ}\text{C}$  is
- A)  $20\ \Omega$
  - B)  $10\ \Omega$
  - C)  $6\ \Omega$
  - D)  $8\ \Omega$
  - E)  $5\ \Omega$

Correct Answer : Option E

25. n 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  $30 \text{ As}^{-1}$  the emf induced in the coil is 12 V. If the current passing through this coil changes at a rate of  $20 \text{ As}^{-1}$  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  $\Omega$ ) is

- A) zero
- B)  $4\pi$
- C)  $40\pi$
- D)  $400\pi$
- 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 :** Option E

**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)  $5 \times 10^{-5}$  m
  - B)  $3 \times 10^{-5}$  m
  - C)  $2.5 \times 10^{-5}$  m
  - D)  $2 \times 10^{-5}$  m
  - E)  $1 \times 10^{-5}$  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)  $\mu\text{m}$
- B)  $\text{cm}$
- C)  $\text{mm}$
- D)  $\text{nm}$
- E)  $\text{m}$

**Correct Answer :** Option A

**46.** The unit of an universal constant is  $\text{cm}^{-1}$ . What is the constant?

- A) Planck's constant
- B) Boltzmann constant
- C) Rydberg constant
- D) Avogadro constant
- E) Molar gas constant

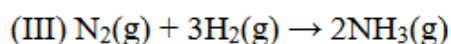
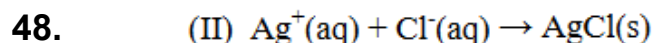
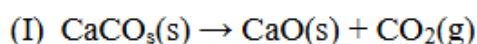
**Correct Answer :** Option C

47. Which of the following molecule has the most polar bond?

- A)  $\text{Cl}_2$
- B)  $\text{HCl}$
- C)  $\text{PCl}_3$
- D)  $\text{N}_2$
- E)  $\text{HF}$

Correct Answer : Option E

$\Delta S$  would be negative for which of the following reactions?



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  $\text{H}^+$  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) CS<sub>2</sub>
- C) NO
- D) CCl<sub>4</sub>
- E) PF<sub>3</sub>

**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] <sub>0</sub> /M	[B] <sub>0</sub> /M	Initial rate/ M s <sup>-1</sup>
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 SO<sub>2</sub>(g), SO<sub>3</sub>(g) and O<sub>2</sub>(g) are 250 JK<sup>-1</sup>, 257 JK<sup>-1</sup> and are 205 JK<sup>-1</sup> respectively. Calculate standard molar entropy change for the reaction  $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$

- A) -198 JK<sup>-1</sup>

- B)  $-191 \text{ JK}^{-1}$
- C)  $198 \text{ JK}^{-1}$
- D)  $191 \text{ JK}^{-1}$
- E)  $-1219 \text{ JK}^{-1}$

**Correct Answer :** Option B

- 56.** An aqueous solution contains 20g of a non-volatile strong electrolyte  $A_2B$  (Molar mass= $60 \text{ g mol}^{-1}$ ) 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)  $372.482\text{K}$
  - B)  $374.56\text{K}$
  - C)  $373.52\text{K}$
  - D)  $371.44\text{K}$
  - E)  $374.02\text{K}$

**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)  $\text{CH}_4\text{O}$
  - B)  $\text{C}_2\text{H}_3\text{O}$
  - C)  $\text{CH}_3\text{O}_2$
  - D)  $\text{C}_2\text{H}_4\text{O}$
  - E)  $\text{CH}_3\text{O}$

**Correct Answer :** Option A

- 58.** How many grams of HCl will completely react with 17.4g of pure  $\text{MnO}_2(\text{s})$  to liberate  $\text{Cl}_2(\text{g})$ ? (Atomic mass Mn= $55.0$ ; H= $1$ ; Cl= $35.5$ )
- A)  $14.6\text{g}$
  - B)  $7.3\text{g}$
  - C)  $21.9\text{g}$
  - D)  $29.2\text{g}$
  - E)  $34.8\text{g}$

**Correct Answer :** Option D

- 59.** What is the quantity of current required to liberate 16g of  $\text{O}_2(\text{g})$  during electrolysis of water? (Given  $1\text{F}=96500\text{C}$ )
- A)  $4.825 \times 10^4\text{C}$
  - B)  $9.65 \times 10^4\text{C}$
  - C)  $2.895 \times 10^5\text{C}$
  - D)  $4.825 \times 10^5\text{C}$
  - E)  $1.93 \times 10^5\text{C}$

**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<sup>-1</sup> & Br = 80 g mol<sup>-1</sup>)
- 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)  $\text{CH}_3\text{O}^-$
  - B)  $\text{HO}^-$
  - C)  $\text{CH}_3\text{COO}^-$
  - D)  $\text{H}_2\text{O}$
  - E)  $\text{CN}^-$

**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  $\text{H}_2$  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)  $3\pi$

E)  $2\pi$

**Correct Answer :** Option A

**81.** The value of  $\alpha$  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  $\alpha$  and the least value of  $\beta$  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  $\alpha$  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  $\frac{1}{2^{10}} + \frac{1}{2^{11}} + \dots + \frac{1}{2^{19}}$  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 6<sup>th</sup> 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

102. Two circles  $C_1$  and  $C_2$  have radii 18 and 12 units, respectively. If an arc of length  $\ell$  of  $C_1$  subtends an angle  $80^\circ$  at the centre, then the angle subtended by an arc of same length  $\ell$  of  $C_2$  at the centre is

A)  $90^\circ$

B)  $100^\circ$

C)  $110^\circ$

D)  $120^\circ$

E)  $135^\circ$

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  $\alpha$  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

$5x - 13y = 19$  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  $\alpha$ ,  $\beta$  and  $\gamma$  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  $30^\circ$ , the angle between  $\vec{a}$  and  $\vec{c}$  is  $60^\circ$  and the angle between  $\vec{a}$  and  $\vec{b} + \vec{c}$  is  $45^\circ$ . 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  $\lambda$  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)  $4\pi$
  - C)  $-4\pi$
  - 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 C

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

Correct Answer : Option D