

## 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)  $90^\circ$
  - 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

- 17.** 1 g of ice at  $0^\circ\text{C}$  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  $0^\circ\text{C}$  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:-Question Cancelled

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  $0^{\circ}\text{C}$  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  $50^{\circ}\text{C}$  is
- A)  $20\ \Omega$

- 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  $30 \text{ As}^{-1}$  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:-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)  $5 \times 10^{-5}$  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

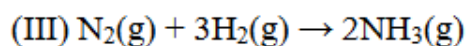
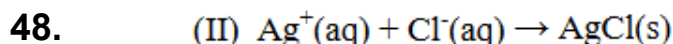
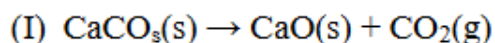
46. The unit of an universal constant is  $\text{cm}^{-1}$ . What is the constant?
- A) Planck's constant
  - B) Boltzmann constant
  - C) Rydberg constant
  - D) Avogadro constant
  - E) Molar gas constant

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

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

| 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                            |

54.

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 JK<sup>-1</sup>
- C) 198 JK<sup>-1</sup>
- D) 191 JK<sup>-1</sup>
- E) -1219 JK<sup>-1</sup>

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) 372.482K
  - 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<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

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

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

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

**Correct Answer :** Option D