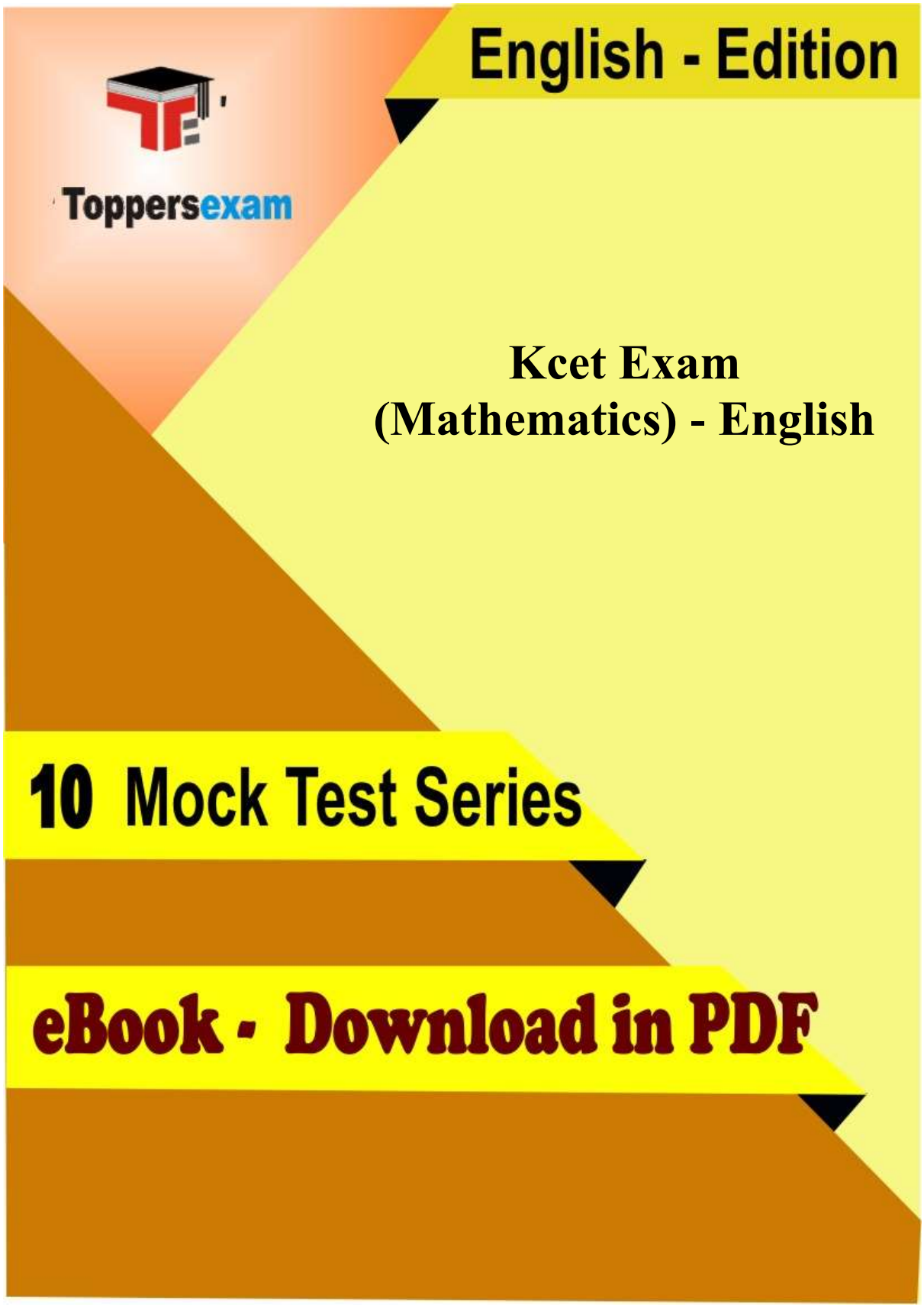

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Kcet Exam (Mathematics) - English

Paper Questions

SUBJECT: Physics

Question 1 : In ruby laser, the stimulated emission is due to transition from

(A) metastable state to any lower state

(B) any higher state of lower state

(C) metastable state to ground state

(D) any higher state to ground state

Correct Answer: ●

Question 2 : A direct current *I* flows along the length of an infinitely long straight thin walled pipe, then the magnetic field is

(A) uniform throughout the pipe not zero

(B) zero only along the axis of the pipe

(C) zero at any point inside the pipe

(D) maximum at the centre and minimum at the edge

Correct Answer: ●

Question 3 : convex lens made of glass has focal length 0.15m in air. If the refractive index of glass is 3/2, and that of water is 4/3 the focal length of lens when immersed in water is

(A) 0.45 m

(B) 0.15 m

(C) 0.30 m

(D) 0.6 m

Correct Answer:

Question 4 : Two sources are said to be coherent if they produce waves

(A) having a constant phase difference

(B) of equal wavelength

(C) of equal speed

(D) having same shape of wavefront

Correct Answer:

Question 5 : Three resistors 1 Ω, 2 Ω, 3Ω resistor a 3 V battery is connected. The current through 3 Ω resistor is

(A) 0.75 A

(B) 1 A

(C) 2 A

(D) 1.5 A

Correct Answer: ●

Question 6 : In a common emitter amplifier the input signal is applied across

(A) anywhere

(B) emitter-collector

(C) collector-base

(D) base-emitter

Correct Answer: ●

Question 7 : Adding detergents to water helps in removing dirty greasy stains. This is because
1. It increases greasy stains. This is because
2. It decreases the oil-water surface tension
3. It increases the viscosity of the solution
4. Dirt is held suspended surrounded by detergent molecules

(A) 2 and 4

(B) 1 only

(C) 3 and 4

(D) 4 only

Correct Answer: ●

Question 8 : Choose the correct statement (a) for a cricket ball that is spinning clockwise through air
S1 : Statemlines of air are symmetric around the ball.
S2 : The velocity of air above the ball relative to it is larger than that below the ball.
S3 : The velocity of air above the ball relative to it is smaller than that below the ball.
S4 : There is a net upward force on the ball.

(A) S1,S2 and S4

(B) S2 and S4

(C) S4 only

(D) S3 only

Correct Answer: ●

Question 9 : Ferromagnetic materials used in a transformer must have

(A) low permeability and high hysterisis loss

(B) high permeability and low hysterisis loss

(C) high permeability and high hysterisis loss

(D) low permeability and low hysterisis loss

Correct Answer: ●

Question 10 : According to Newton's corpuscular theory, the speed of light is

(A) same in all the medium

(B) lesser in rarer medium

(C) lesser in denser medium

(D) independent of the medium

Correct Answer:

Question 11 : For the constructive interference the path difference between the two interfering waves must be equal to

(A) $(2\pi + 1)\lambda$

(B) $2n\pi$

(C) $n\lambda$

(D) n

Correct Answer:

Question 12 : The accurate measurement of emf can be obtained using

(A) multimeter

(B) voltmeter

(C) voltameter

(D) potentiometer

Correct Answer:

Question 13 : A person, with outstretched arms, is spinning on a rotating stool. He suddenly brings his arms down to his sides. Which the following is true about his kinetic energy K and angular momentum L?

(A) Both K and L increase

(B) Both K and L remain unchanged

(C) K remains constant, L increases

(D) K increases but L remains constant

Correct Answer:

Question 14 : Which of the following is not a thermodynamic coordinate?

(A) Gas constant (R)

(B) Pressure (p)

(C) Volume (V)

(D) Temperature (T)

Correct Answer:

Question 15 : Two solid pieces, one of steel and the other of aluminum when immersed completely in

water have equal weights. When the solid pieces are weighed in air

(A) the weight of aluminum is half the weight of steel

(B) steel piece will weigh more

(C) they have the same weight

(D) aluminium piece will weigh more

Correct Answer: ●

Question 16 : The amount of energy released when one microgram of matter is annihilated is

(A) 25 kWh

(B) 9×10^{10} kWh

(C) 3×10^{10} kWh

(D) 0.5×10^{5} kWh

Correct Answer: ●

Question 17 : The number of significant figures in the numbers 4.8000×10^{4} 48000.50 are respectively

(A) 5 and 6

(B) 5 and 7

(C) 2 and 7

(D) 2 and 6

Correct Answer:

Question 18 : β-decay means emission of electron from

(A) innermost electron orbit

(B) a stable nucleus

(C) outermost electron orbit

(D) radioactive nucleus

Correct Answer:

Question 19 : An electric heater rated 220 V and 550 W is connected to AC mains. The current drawn by it is

(A) 0.8 A

(B) 2.5 A

(C) 0.4 A

(D) 1.25 A

Correct Answer:

Question 20 : A string is wound round the rim of a mounted flywheel of mass 20 kg and radius 20 cm. A steady pull of 25 N is applied on the cord. Neglecting friction and mass of the string, the angular acceleration of the wheel is

(A) 50 s^{-2}

(B) 25 s^{-2}

(C) 12.5^{-2}

(D) 6.25 s^{-2}

Correct Answer: ●

Question 21 : A billiards player hits a stationary ball by an identical ball to pocker the target ball in a corner pocket that is at an angle of 35^{o} with respect to the direction of motion of the first ball. Assuming the collision as elastic and that frictional and rotational motions are not important, the angle made by the target ball with respect to the imcoming ball is

(A) 35^{o}

(B) 50^{o}

(C) 55^{o}

(D) 60^{o}

Correct Answer: ●

Question 22 : A body of mass 0.05 kg is observed to fall with an acceleration of 9.5 ms^{-2}. The opposing force of air on the body is (g = 9.8 ms^{-2})

(A) 0.015 N

(B) 0.15 N

(C) 0.030 N

(D) zero

Correct Answer:

Question 23 : The colloidal solution in which both the dispersed phase and dispersion medium are liquids are called

(A) emulsions

(B) gels

(C) foams

(D) liquid crystals

Correct Answer:

Question 24 : In fog, photographs of the objects taken with infrared radiations are more clear than those obtained during visible light because

(A) I-R radiation has lesser wavelength than visible radiation

(B) scattering of I-R light is more the object is less

(C) the intensity of *I-R* light is more the object is less

(D) scattering of *I* – *R* light is less than visible light

Correct Answer: ●

Question 25 : Three concurrent co-planar forces 1 N, 2 N and 3 N acting along different directions on a body

(A) can keep the body in equilibrium if 1 N and 3 N act at right angle

(B) can keep the body in equilibrium if 1 N and 2 N act at right angle

(C) cannot keep the body in equilibrium

(D) can keep the body in equilibrium in 1 N and 3 N act at an acute angle

Correct Answer: ●

Question 26 : Sound waves transfer

(A) only energy not momentum

(B) energy

(C) momentum

(D) both (a) and (b)

Correct Answer: ●

Question 27 : G P Thomson experimentally confirmed the existence of matter waves by the phenomena

(A) diffraction

(B) refraction

(C) polarisation

(D) scattering

Correct Answer: ●

Question 28 : The resistance of a wire at 300 K is found to be 0.3 Ω. If the temperature coefficient of resistance of wire is 1.5 x 10^{-3} K^{-1}, the temperature at which the resistance becomes 0.6 Ω is

(A) 720 K

(B) 345 K

(C) 993 K

(D) 690 K

Correct Answer: ●

Question 29 : Two luminous points sources separated by a certain distance are at 10 km from an observer. If the aperture of his eye is 2.5 x 10^{-3} m and the wavelength of light used is 500 nm the distance of separation between the point sources just seen to be resolved is

(A) 12.2 m

(B) 24.2 m

(C) 2.44 m

(D) 1.22 m

Correct Answer:

Question 30 : A door 1.6 m wide requires a force of N to be applied at the free end to open or close it. The force that is required at a point 0.4 m distance from the hinges for opening or closing the door is

(A) 1.2 N

(B) 3.6 N

(C) 2.4 N

(D) 4 N

Correct Answer:

Question 31 : 0.1 m^3 of water at 80^o C. The final temperature of the mixture is

(A) 65^{o}C

(B) 70^{o}C

(C) 60^{o}C

(D) 75^{o}C

Correct Answer:

Question 32 : The spectral series of the hydrogen atom that lies in the visible region of the electromagnetic spectrum

(A) Paschen

(B) Balmer

(C) Lyman

(D) Brackett

Correct Answer:

Question 33 : A resistor and a capacitor are connected inseries with an AC source. If the potential drop across the capacitor is 5 V and that across resistor is 12 V, then applied voltage is

(A) 13 V

(B) 17 V

(C) 5 V

(D) 12 V

Correct Answer:

Question 34 : The amount of heat energy radiated by a metal at temperature T is E. When the temperature is increased to 3T, energy radiated is

(A) 8 1E

(B) 9E

(C) 3E

(D) 27 E

Correct Answer:

Question 35 : A man, of mass 60 kg, is riding in a lift. The weight of the man, when the lift is accelerating upwards and downwards at 2 ms-2 are respectively (taking g = 10 ms^{-2})

(A) 720 N and 480 N

(B) 480 N and 720 N

(C) 600 N and 600 N

(D) None of these

Correct Answer:

Question 36 : A galvanometer of resistance 240 Ω allows only 4% of the main current after connecting a shunt resistance. The value of the shunt resistance is

(A) 10 Ω

(B) 20 Ω

(C) 8 Ω

(D) 5 Ω

Correct Answer:

Question 37 : The phenomena in which proton flips is

(A) nuclear magnetic resonance

(B) lasers

(C) radioactivity

(D) nuclear fusion

Correct Answer:

Question 38 : According to the quark model, it is possible to build all the hadrons using

(A) 2 quarks and 3 antiquarks

(B) 1 quarks and 2 antiquarks

(C) 3 quarks and 3 antiquarks

(D) 2 quarks and 2 antiquarks

Correct Answer:

Question 39 : The surface temperature of the stars is determined using

(A) Planck's law

(B) Wien's displacement law

(C) Rayleigh-Jeans law

(D) Kirchhoff's law

Correct Answer: ●

Question 40 : A parallel beam of light is incident on a converging lens parallel to its principal axis. As one moves away from the lens on the other side of the principal axis, the intensity of light

(A) first decreases and then increases

(B) continuously increases

(C) continuously decreases

(D) first increases and then decreases

Correct Answer: ●

Question 41 : Continuous emission spectrum is produced by

(A) incandescent electric lamp

(B) mercury vapour lamp

(C) sodium vapour lamp

(D) polyatomic substances

Correct Answer:

Question 42 : A ray of light is incident on a plane mirror at an angle of 60^0. The angle of deviation produced by the mirror is

(A) 120^0

(B) 30^0

(C) 60^0

(D) 90^0

Correct Answer:

Question 43 : The electric potential at any point x,y,z in metres is given by $V = 3x^2$. The electric field at point (2,0,1) is

(A) 12 Vm^{-1}

(B) -6 Vm^{-1}

(C) 6 Vm^{-1}

(D) -12 Vm^{-1}

Correct Answer:

Question 44 : Young's double. Slit experiment gives interference fringes of width 0.3 mm. A thin glass plate made of material of refractive index 1.5 is kept in the path of light from one of the slits, then the fringe width becomes

(A) zero

(B) 0.3 mm

(C) 0.45 mm

(D) 0.15 mm

Correct Answer: ●

Question 45 : The magnetic dipole moment of a current loop is independent of

(A) magnetic field in which it is lying

(B) number of turns

(C) area of the loop

(D) current in the loop

Correct Answer: ●

Question 46 : 2 g of a radioactive sample having half-life of 15 days was synthesised on 1st Jan 2009. The amount (including both the days) is

(A) 0 g

(B) 0.125 g

(C) 1 g

(D) 0.5 g

Correct Answer:

Question 47 : The ratios of the distance traversed, in successive intervals of time by a body, falling from rest, are

(A) 1 : 3 : 5 : 7 : 9 ……

(B) 2 : 4 : 6 : 8 : 10 ……

(C) 1 : 4 ; 7 10 : 13 ……

(D) None of the above

Correct Answer:

Question 48 : A source having frequency of 240 Hz is moving towards on observer with a speed of 20 m/s. when the observer is moving towards the source with a velocity of 20m/s. then apparent frequency heard by the observer, if velocity of sound is 330m/s, will be:

(A) 268 Hz

(B) 271 Hz

(C) 368 Hz

(D) 250 Hz

Correct Answer:

Question 49 : Choose the incorrect statement out of the following.

(A) Every measurement by any measuring

(B) Every calculated physical quantity that is based on measured values has some error

(C) A measurement can have more accuracy but less precision and vice-versa

(D) The percentage error is different from relative error

Correct Answer:

Question 50 : If E,M,L and G denote energy, mass, angular momentum and gravitational constant respectively then the quantity (E^2L^2/M^5G^2) has the dimensions of

(A) angle

(B) length

(C) mass

(D) None of these

Correct Answer:

Question 51 : Which of the following does not depict the correct link between technology and physics?

(A) Optical fibres ↔ total internal reflection of light

(B) Nuclear reactor ↔ nuclear fusion

(C) Electron microscope ↔ wave nature of electrons

(D) Electric generator ↔ laws of electromagnetic induction

Correct Answer:

Question 52 : If the velocity of sound in air is 336 m/s. The maximum length of a closed pipe that

would produce a just audible sound will be

(A) 3.2 cm

(B) 4.2 m

(C) 4.2 cm

(D) 3.2 m

Correct Answer:

Question 53 : Which of the following statements is true, when spherical waves fall on a plane refracting surface, separation two media?

(A) The reflected waves form spherical wave fronts

(B) The reflected waves form plane wave fronts

(C) The refracted waves form plane wave fronts

(D) There are no refracted waves form plane wave fronts

Correct Answer:

Question 54 : The speed of electromagnetic wave in vacuum depends upon the source of radiation

(A) increases as we move from y –rays to radio waves

(B) decreases as we move from y-rays to radio waves

(C) is same for all of them x

(D) None of the above

Correct Answer:

Question 55 : Two coherent monochromatic light beams of intensities I and 4I are superposed. The maximum and minimum possible resulting intensities are

(A) 5I and 0

(B) 5I and 3I

(C) 9I and I

(D) 9I and 3I

Correct Answer: ●

Question 56 : If the radius of earth is reduced by 2% keeping its mass constant. Then the weight of the body on its surface will

(A) Increases

(B) Decreases

(C) Remain same

(D) Either b or c

Correct Answer: ●

Question 57 : A beam of light of wavelength 600 nm from a distant source falls on a single slit 1 mm wide and the resulting diffraction pattern is observed on a screen 2 m away. The distance between the first dark fringes on either side of the central bright fringe is

(A) 2.4 mm

(B) 1.2 mm

(C) 2.4 cm

(D) 1.2 cm

Correct Answer:

Question 58 : In an astronomial telescope, the focal length of objective lens and eye piece are 150 cm and 6 cm respectively. In normal adjustment the magnifying power is

(A) 20

(B) 30

(C) 60

(D) 15

Correct Answer:

Question 59 : In an experiment with Kund's tube, the distance between consecutive nodes is 5 cm, when air is inside and it is 13.4 cm, when hydrogen is inside then the velocity of sound in hydrogen will be (velocity of sound in air = 330 m/s) :

(A) 884.4 m/s

(B) 984.4 m/s

(C) 1084.4 m/s

(D) None of these

Correct Answer:

Question 60 : An element A decays into an element C by a two step process.
$A \rightarrow B + 2He^4$
$B \rightarrow C + 2e^-$
Then

(A) A and C are isobars

(B) A and C are isotopes

(C) A and B are isotopes

(D) A and B are isobars

Correct Answer:

SUBJECT: Chemistry

Question 61 : 10^{-6} M NaOH is diluted 100 times. The pH of the diluted base is

(A) between 7 and 8

(B) between 5 and 6

(C) between 6 and 7

(D) between 10 and 11

Correct Answer:

Question 62 : In the electrolysis of acidulated water, it is desired to obtain 1.12 cc of hydrogen per second under STP condition. The current to be passed is

(A) 1.93 A

(B) 9.65 A

(C) 19.3 A

(D) 0.965 A

Correct Answer: C

Question 63 : The one which decreases with dilution is

(A) molar conductance

(B) conductance

(C) specific conductance

(D) equivalent conductance

Correct Answer: D

Question 64 : Vapour pressure of pure 'A' is 70 mm of Hg at 25^{o}C. It forms an ideal solution with 'B' in which mole fraction of A is 0.8. if the vapour pressure of the solution is 84 mm of Hg at 25^{o}C, the vapour pressure of pure 'B' at 25^{o}C is

(A) 28 mm

(B) 56 mm

(C) 70 mm

(D) 140 mm

Correct Answer: C

Question 65 : A 6% solution of urea is isotonic with

(A) 1 M solution of glucose

(B) 0.05 M solution of glucose

(C) 6% solution of glucose

(D) 25% solution of glucose

Correct Answer: A

Question 66 : In countries nearer to polar region, the roads are sprinkled with $Cacl_2$. This is

(A) to minimise the wear and tear of the roads

(B) to minimise the snow fall

(C) to minimise pollution

(D) to minimise the accumulation of dust on the road

Correct Answer: A

Question 67 : A compound of 'A' and 'B' crystallises in a cubic lattice in which 'A' atoms occupy the lattice points at the corners of the cube. The 'B' atoms occupy the centre of each face of the cube. The probable empirical formula of the compound is

(A) AB_2

(B) A_2B

(C) AB

(D) AB_3

Correct Answer: B

Question 68 : In electrophilic aromatic substitution reaction, the nitro group is meta directing because it

(A) decreases electron density at ortho and para positions

(B) decreases electron density at meta position

(C) increases electron density at meta position

(D) increases electron density at ortho and para position

Correct Answer: D

Question 69 : The best method for the conversion of an alcohol into an alkyl chloride is by treating the alcohol with

(A) PCI_3

(B) PCI_3

(C) $SOCL_2$ in presence of pyridine

(D) dry HCl in the presence of anhydrous $ZnCl_2$

Correct Answer: B

Question 70 : The carbon-carbon bond length in benzene is

(A) in between C_2H_6 and C_2H_4

(B) same as in C_2H_4

(C) in between C_2H_6 and C_2H_2

(D) in between C_2H_4 and C_2H_2

Correct Answer: A

Question 71 : The compound which is not formed during the dry distillation of a mixture of calcium formate and calcium acetate is

(A) methanal

(B) propanal

(C) propanone

(D) ethanal

Correct Answer: B

Question 72 : An organic compound x is oxidised by using acidified $K_2Cr_2O_7$. The product obtained reacts with phenyl hydrazine but does not answer silver mirror test. The possible structured of X is

(A) CH_3CH_2OH

(B) $CH_3 - C - CH_3$

(C) $(CH_3)_2CHOH$

(D) CH_3CHO

Correct Answer: C

Question 73 : Arrange the following in the increasing of their. Basic strengths CH_3NH_2, $(CH_3)_2NH$, $(CH_3)_2N$,NH_3

(A) NH_3, < $(CH_3)_3N$ < $(CH_3)_2NH$ < CH_3NH_2

(B) NH_3 < $(CH_3)_3N$ < CH_3NH_2 < $(CH_3)_2NH$

(C) $(CH_3)_3N$ < NH_3 < CH_3NH_2 < $(CH_3)_2NH$

(D) CH_3NH_2 < $(CH_3)_2NH$ < $(CH_3)_3N$, NH_3

Correct Answer: B

Question 74 : The one which has least iodine value is

(A) sunflower oil

(B) ginger oil

(C) ghee

(D) groundnut oil

Correct Answer: C

Question 75 : A diabetic person carries a packet of glucose with him always, because

(A) glucose reduces the blood sugar level slowly

(B) glucose increases the blood sugar level slowly

(C) glucose reduces the blood sugar level

(D) glucose increases the blood sugar level almost instantaneously

Correct Answer: D

Question 76 : There are 20 naturally occurring among acids. The maximum number of tripeptides than can be obtained is

(A) 8000

(B) 6470

(C) 7465

(D) 5360

Correct Answer: A

Question 77 : At what temperature ill the RMS velocity of SO_2 be the same as that of O_2 at 303 K?

(A) 403 K

(B) 303 K

(C) 606 K

(D) 273 K

Correct Answer: C

Question 78 : Phenol is treated with bromine water and shaken well. The white precipitate formed during the process is

(A) m–bromophenol

(B) 2, 4, 6 tribromophenol

(C) 2-4 dibromophenol

(D) A mixture of o-and p-bromophenols

Correct Answer: B

Question 79 : In thermite process the metal used as reducing agent is:

(A) Nickel

(B) Zinc

(C) Sodium

(D) Aluminium

Correct Answer: D

Question 80 : Which of the following compounds on boiling with alkaline KMnO4 and subsequent acidification will not give benzoic acid?

(A) Benzyl alcohol

(B) Acetophenone

(C) Anisole

(D) Toluene

Correct Answer: C

Question 81 : The base present in DNA, but not in RNA is:

(A) Guanine

(B) Adenine

(C) Uracil

(D) Thymine

Correct Answer: D

Question 82 : The total number of lattice arrangements in different crystal system is:

(A) 7

(B) 3

(C) 8

(D) 14

Correct Answer: D

Question 83 :

Alcoholic potash is used to bring about :

(A) Dehydrogenation

(B) Dehydration

(C) Dehydrohalogenation

(D) Dehalogenation

Correct Answer: C

Question 84 : Which of the following is the correct statement?

(A) Order of a reaction has always an integral value

(B) Mechanism of a reaction proposed is always final

(C) Zero order reactions are multi-step reactions

(D) Order of reaction can be predicted even without knowing the rate law

Correct Answer: D

Question 85 : The unit of quantity of electricity is:

(A) Ohm

(B) Ampere

(C) Coulomb

(D) Volt

Correct Answer: C

Question 86 :

Which of the following organic compounds answers both iodoform test and fehling's test?

(A) Methanal

(B) Ethanol

(C) Propane

(D) Ethanal

Correct Answer: D

Question 87 : 10 dm^3 of N_2 gas and 10 dm^3 of gas X at the same temperature and pressure contain the same number of molecules.

(A) NO

(B) H_2

(C) CO_2 or CO

(D) All of these

Correct Answer: D

Question 88 : When the electrons of hydrogen atoms return to L shell from shells of higher energy, we get a series of lines in the spectrum. This series is called

(A) Balmer series

(B) Lyman series

(C) Bracket series

(D) Paschen series

Correct Answer: A

Question 89 : The alcohol obtained by the hydrolysis of oils and fats is:

(A) Glycol

(B) Glycerol

(C) Propanol

(D) Pentanol

Correct Answer: B

Question 90 : Which of the following alloys is used for making magnets for hearing aids?

(A) Alnico

(B) German silver

(C) Invar

(D) Monel metal

Correct Answer: A

Question 91 : One dm^3 of 2M ethanoic acid is mixed with one dm^3 of 3M ethanol to form an easter
$CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$
The decrease in the initial rate if each solution is diluted with an equal volume of water would be

(A) 2 times

(B) 4 times

(C) 0.25 times

(D) 0.5 times

Correct Answer: B

Question 92 : Which one of the following can be classified as a Bronstead base?

(A) NO_3^-

(B) H_3O^+

(C) CH_3COOH

(D) NH_4^+

Correct Answer: A

Question 93 :

Gold sol is an electronegative sol. The amount of electrolyte required to coagulate a certain amount of gold sol is minimum in the case of:

(A) $CaCl_2$

(B) NaCl

(C) $AlCl_3$

(D) Na_2SO_4

Correct Answer: C

Question 94 : Aluminium displaces hydrogen from acids, but copper does not. A Galvanic cell prepared by combining Cu/Cu^{2+} and Al/Al^{3+} has an emf of 2.0 V at 298 K. If the potential of copper electrode is +0.34 V, that of aluminium electrode is:

(A) – 2.3 V

(B) +2.34 V

(C) – 1.66 V

(D) + 1.66 V

Correct Answer: C

Question 95 : 1.5 moles of O_2 combine with Mg to form the oxide MgO. The mass of Mg that has combined is (Mg = 24):

(A) 72 g

(B) 36 g

(C) 48 g

(D) 24 g

Correct Answer: A

Question 96 : How much of NaOH is required to neutralize 1500 cm^3 of 0.1 N HCI?(Na = 23):

(A) 60 g

(B) 6 g

(C) 4 g

(D) 40 g

Correct Answer: B

Question 97 : The boiling point of water is exceptionally high because:

(A) Water molecule is not linear

(B) Water molecule is linear

(C) There is covalent bond between H and O

(D) Water molecules associate due to hydrogen bonding

Correct Answer: D

Question 98 : P_4O_{10} is not used with to dry NH_3 gas because:

(A) P_4O_{10} is basic and NH_3 is acidic

(B) P_4O_{10} is acidic and NH_3 is basic

(C) P_4O_{10} is not a drying agent

(D) P_4O_{10} reacts with moisture in NH_3

Correct Answer: B

Question 99 : A radioactive isotope has a half-life of 10 years. What percentage of the original amount of it remain after 20 years:

(B) 12.5

(C) 8

(D) 25

Correct Answer: D

Question 100 : 75% of a first order reaction is completed in 30 minutes. What is the time required for 93.75% of the reaction (in minutes)?

(A) 45

(B) 120

(C) 90

(D) 60

Correct Answer: D

Question 101 : Excess of Na^+ ions in our system causes:

(A) High B.P.

(B) Low B.P.

(C) Diabetes

(D) Anaemia

Correct Answer: A

Question 102 : Alcoholic potash is used to bring about :

(A) Dehydrogenation

(B) Dehydration

(C) Dehydrohalogenation

(D) Dehalogenation

Correct Answer: C

Question 103 : Which of the following organic compounds answers both iodoform test and fehling's test?

(A) Methanal

(B) Ethanol

(C) Propane

(D) Ethanal

Correct Answer: D

Question 104 : Gold sol is an electronegative sol. The amount of electrolyte required to coagulate a certain amount of gold sol is minimum in the case of:

(A) $CaCl_2$

(B) NaCl

(C) $AlCl_3$

(D) Na_2SO_4

Correct Answer: C

Question 105 : The oxidation number and the electronic configuration of sulphur in H_2SO_4 is:

(A) + 4; $1s^2\ 2s^2\ 2p^6\ 3s^2$

(B) +2; +6; $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$

(C) +3; $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

(D) +6; $1s^2\ 2s^2\ 2p^6$

Correct Answer: D

Question 106 : The mass of 112 cm^3 of CH_4 gas at STP is:

(A) 0.16 g

(B) 0.8 g

(C) 0.08 g

(D) 1.6 g

Correct Answer: C

Question 107 : The volume of water to be added to 100 cm^3 of 0.5 N H_2SO_4 to get decinormal concentration is:

(A) 400 cm^3

(B) 500 cm^3

(C) 450 cm^3

(D) 100 cm^3

Correct Answer: A

Question 108 : Reactions that have standard free energy changes less than zero always have equilibrium constant equal to

(A) unity

(B) greater than unity

(C) less than unity

(D) zero

Correct Answer: B

Question 109 : In order to decompose 9g water 142.5 kJ heat is required. Hence the enthalpy of formation of water is:

(A) – 142.5 kJ

(B) + 142.5 kJ

(C) – 285 kJ

(D) + 285 kJ

Correct Answer: C

Question 110 : A quantity of PCl_5 was heated in a 10 dm^3 vessel at 250^0 C PCl_5 (g) PCl_3 (g) + Cl_2 (g) At equilibrium the vessel contains 0.1 mole of PCl_5 and 0.2 mole of Cl_2. The equilibrium constant of the reaction is:

(A) 0.05

(B) 0.02

(C) 0.025

(D) 0.04

Correct Answer: D

Question 111 : Which among the following species has the highest ionization potential?

(A) B

(B) Li

(C) Ne

(D) F

Correct Answer: C

Question 112 : Which one of the following metallic hydroxides does not dissolve in sodium hydroxide solution?

(A) $Zn(OH)_2$

(B) $Al(OH)_3$

(C) $Fe(OH)_3$

(D) $Pb(OH)_2$

Correct Answer: C

Question 113 : IUPAC name of $K_3Fe(CN)_6$ is:

(A) Potassium ferricyanide

(B) Hexacyano ferrate (III)

(C) Potassium hexacyno ferrate (III)

(D) Potassium hexacyno ferrate (II)

Correct Answer: C

Question 114 : Unpleasant smell of carbylamines is obtained when chloroform and alcoholic KOH are heated with:

(A) Any aliphatic amine

(B) Any amine

(C) Any primary amine

(D) Any aromatic amine

Correct Answer: C

Question 115 : Which of the following is an aldohexose?

(A) Cellulose

(B) Sucrose

(C) Glucose

(D) Raffinose

Correct Answer: C

Question 116 : When a mixture of calcium acetate and calcium formate is dry distilled, the product formed as:

(A) Ethanal

(B) Butanone

(C) Methanal

(D) Acetophenone

Correct Answer: A

Question 117 : The test used for identifying peptide linkage in proteins is:

(A) Borsche's test

(B) Molisch's test

(C) Ninhydrin test

(D) Biuret test

Correct Answer: D

Question 118 : Which of the following is not used to distinguish ethane from ethane?

(A) Iodine in CCl_4

(B) Bromine in CCl_4

(C) Alkaline $KMnO_4$

(D) Ammonical Cu_2Cl_2

Correct Answer: D

Question 119 : To get a n-type doped semiconductor, impurity to be added to silicon should have the following number of valence electrons:

(A) 1

(B) 3

(C) 5

(D) 2

Correct Answer: A

Question 120 : Solubility)s) of CaF_2 in terms of its solubility product is given a

(A) $s = (K_{sp})^{1/3}$

(B) $s = (K_{sp}/2)^{1/3}$

(C) $s = (K_{sp}/4)^{1/3}$

(D) $s = (K_{sp}/2)^{1/2}$

Correct Answer: C

SUBJECT: Mathematics

Question 121 : The elements of the set {x : x is an integer, x^2 : 4} can be represent as .....Z..... . Here, Z refers to

(A) {–2, 2}

(B) {–1, 0, 1}

(C) {–2, –1, 0, 1, 2}

(D) {0, 1, 2}

Solution : $x^2 \le 4$
$\Rightarrow |x|^2 \le 4$
$\Rightarrow |x| \le 2$
$\Rightarrow -2 \le x \le 2$
So, the given set can be represented as {–2, –1, 0, 1, 2}

Correct Answer: C

Question 122 :

The set $\left\{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \frac{6}{7}\right\}$ in the set-builder form

(A) $\left\{x : x = \frac{n}{n+1}, \text{where } n \in N \text{ and } 1 < n < 6\right\}$

(B) $\left\{x : x = \frac{n}{n+1}, \text{where } n \in N \text{ and } 1 \le n < 6\right\}$

(C) $\left\{x : x = \frac{n}{n+1}, \text{where } n \in N \text{ and } 1 \le n \le 6\right\}$

(D) None of these

Correct Answer: C

Question 123 : If P = {1, 2}, then P × P × P = {(1, 1, 1), (1, 1, 2), (1, 2, 1), (2, 1, 2), (2, 2, 1), (2, 2, 2)}. The ordered triplet missing in P × P × P are

(A) (1, 2), (2, 1)

(B) (1, 2, 1), (2, 1, 1)

(C) (1, 2, 2), (2, 1, 2)

(D) (1, 2, 2), (2, 1, 1)

Solution :

Given, P = {1, 2}

P × P = {1, 2} × {1, 2}

= {(1, 1), (1, 2), (2, 1), (2, 2)}

P × P × P = {(1, 1, 1), (1, 1, 2), (1, 2, 1), (1, 2, 2), (2, 1, 1), (2, 1, 2), (2, 2, 1), (2, 2, 2)}

Missing ordered triplet are

(1, 2, 2) and (2, 1, 1).

Correct Answer: D

Question 124 : If A = {1, 2, 3, 4} and B = {5, 7, 9} then

(A)

A × B = B × A

(B) n(A × B) =n(B × A)

(C) Both (a) and (b)

(D) None of the above

Correct Answer: B

Question 125 : a + ib > c + id can be explained only when

(A) b = 0, c = 0

(B) b = 0, d = 0

(C) a = 0, c = 0

(D) a = 0, d = 0

Solution : Two complex numbers are either equal or not equal. Comparison of complex numbers is not possible i.e. inequality does not exist for complex numbers. If a + ib > c + id this comparison is only possible when it is purely real. Hence, b = d = 0.

Correct Answer: B

Question 126 : If $3x^2 + 4x + 2 = 0$, then equation has

(A) real roots

(B) imaginary roots

(C) one real and one imaginary root

(D) distinct real roots

Solution :

Here, a = 3, b = 4, c = 2

$D = b^2 - 4ac = 16 - 4(3)(2) = 16 - 4 = -8 \Rightarrow D < 0$

$b^2 - 4ac < 0,$

so above equation has imaginary roots.

Correct Answer: B

Question 127 :

If the sum of a certain n number of terms of the AP, 25, 22, 19,..... is 116, then the last term is

(A) 4

(B) 3

(C) 2

(D) –4

$\because S_n = \frac{n}{2}[2a + (n-1)d]$

$\therefore 116 = \frac{n}{2}[2 \times 25 + (n-1)(-3)]$

$\Rightarrow 116 \times 2 = n(50 - 3n + 3)$

$\Rightarrow 232 = n(53 - 3n)$

$\Rightarrow 232 = 53n - 3n^2$

$\Rightarrow 3n^2 - 53n + 232 = 0$

$\Rightarrow 3n^2 - 24n - 29n + 232 = 0$

$\Rightarrow 3n(n-8) - 29(n-8) = 0$

$\Rightarrow (3n - 29)(n - 8) = 0$

Solution :

$n = \frac{29}{3}, \ n = 8$

But $n = \frac{29}{3}$ is useless as n cannot be fraction, only $n = 8$ is valid.

Now, $T_n = a + (n-1)d$

$T_8 = 25 + (8-1)(-3)$

$= 25 + 7 \times (-3) = 25 - 21 = 4$

Correct Answer: A

Question 128 :

Insert three arithmetic means between 3 and 19

(A) 6, 10, 14

(B) 7, 11, 15

(C) 8, 12, 16

(D) None of these

Solution :

Now, $A^1 = 3 + d = 3 + 4 = 7$;

$A_2 = 3 + 2d = 3 + 2 \times 4 = 11$,

$A_3 = 3 + 3d = 3 + 3 \times 4 = 15$

Correct Answer: B

Question 129 : In how many ways can the number 7056 be resolved into two factors?

(A) 20

(B) 21

(C) 23

(D) 22

Solution :

$n = 7065 = 7^2 \times 3^2 \times 2^4$

$= 7^{\alpha 1} \times 3^{\alpha 2} \times 2^{\alpha 3}$

Here, n is a perfect square. Thus, the number of ways in which n may be resolved into two factors is

$$\frac{1}{2}[(\alpha_1+1)(\alpha_2+1).....(\alpha_n+1)+1]$$

$$= \frac{1}{2}[(2+1)(2+1)(4+1)+1]$$

$$= \frac{1}{2}\times 46 = 23$$

Correct Answer: C

Question 130 : The sum of the cubes of three consecutive intergers is divisible by

(A) 36

(B) 18

(C) 12

(D) 9

By hit and trial method,

$1^3+2^3+3^3=36$
$2^3+3^3+4^3=99$
$3^3+4^3+5^3=216$

Solution : All these numbers are divisible by 9

Correct Answer: D

Question 131 : How many 5-digit telephone numbers can be constructed using the digits 0 to 9, if each number starts with 67 and no digit appears more than once?

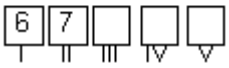
(A) 336

(B) 337

(C) 335

(D) None of these

Number of ways to fill the III place = 8
Number of ways to fill the IV place = 7



Number of ways to fill the V place = 6
Hence, by FPC total number of ways
Solution : $= 8 \times 7 \times 6 = 56 \times 6 = 336$

Correct Answer: A

Question 132 : The number of different four digit numbers that can be formed with the digits 2, 3, 4, 7 and using each digit only once is

(A) 120

(B) 96

(C) 24

(D) 100

Solution : Given, total number of digits are 4.
Total 4 digit numbers can be formed
= 4P4 = 4! = 24

Correct Answer: C

Question 133 :

The total number of terms in the expansion of $(x + a)^{100} + (x – a)^{100}$ after simplification will be

(A) 202

(B) 51

(C) 50

(D) None of these

Solution :

Correct Answer: B

Question 134 : If $(1 + ax)^n = 1 + 8x + 24^{x2} + ...$, then the values of a and n are

(A) 2, 4

(B)2, 3

(C) 3, 6

(D) 1, 2

Solution : Given that, $(1 + ax)^n = 1 + 8x + 24x^2 + ...$

$\Rightarrow 1 + \frac{n}{1}ax + \frac{n(n-1)}{1.2}a^2x^2 + ...$

$= 1 + 8x + 24x^2 + ...$

On comparing the coefficients of x, x^2, we get

$na = 8, \frac{n(n-1)}{1.2}a^2 = 24$

$\Rightarrow na(n - 1)a = 48$

$\Rightarrow 8(8 - a) = 48$

$\Rightarrow 8 - a = 6 \Rightarrow a = 2 \Rightarrow n = 4$

Correct Answer: A

Question 136 : The roots of the equation $x^4 - 8x^2 - 9 = 0$ are

(A) $\pm 1, \pm i$

(B) $\pm 3, \pm i$

(C) $\pm 2, \pm i$

(D) None of these

Solution :

Q: $x^4 - 8x^2 - 9 = 0$

$\Rightarrow x^4 - 9x^2 + x^2 - 9 = 0$

$\Rightarrow (x^2 + 1)(x^2 - 9) = 0$

$\Rightarrow x = \pm i, \pm 3$

Correct Answer: B

Question 137 : If $-3x + 17 < -13$, then

(A) $x \in (10, \infty)$

(B) $x \in [10, \infty)$

(C) $x \in (-\infty, 10)$

(D) $x \in [-10, 10)$

Solution :

Given that, $-3x + 17 < -13$
$\Rightarrow 3x - 17 > 13$
[On multiplying by –1 both sides]
$\Rightarrow 3x > 13 + 17$
[adding 17 both sides]
$\Rightarrow 3x > 30$
$\therefore x > 10$
[dividing both sides by 3]

Correct Answer: A

Question 138 : The rules for solving an inequality is / are

(A) different numbers may be added to both sides of an inequality without affecting the sign of inequality

(B) both sides of an inequality can be multiplied (or divided) by any number without affecting the sign of inequality

(C) Both (a) and (b)

(D) None of the above

Solution : We state the following rules for solving an inequality.
Rule 1: Equal numbers may be added to (or subtraced from) both sides of an inequality without affecting the sign of inequality.
Rule 2: Both sides of an inequality can be multiplied (or divided) by the same positive number. But when both sides are multiplied or divided by same negative number then the sign of inequality is reversed.

Correct Answer: D

If $A=\begin{bmatrix} a+4 & 3b \\ 8 & -6 \end{bmatrix}$ and $B=\begin{bmatrix} 2a+2 & b^2+2 \\ 8 & b^2-5b \end{bmatrix}$ such

Question 139 : that A = B, then the values of a and b is

(A) a = 2 and b = 1, 2

(B) a = 1 and b = 3

(C) $a = -2$ and $b = \frac{1}{2}$ –1

(D) None of the above

Solution :

By condition, A = B

$$\begin{bmatrix} a+4 & 3b \\ 7 & -6 \end{bmatrix}=\begin{bmatrix} 2a+2 & b^2+2 \\ 8 & b^2-5b \end{bmatrix}$$

By equality of two matrices,

$a + 4 = 2a + 2$

and $3b = b^2 + 2$

$\Rightarrow a = 2$ and $b^2 - 3b + 2 = 0$

$\Rightarrow b^2 - 2b - b + 2 = 0$

$\Rightarrow b(b - 2) - 1(b - 2) = 0$

$\Rightarrow (b - 2)(b - 1) = 0$

$\therefore b = 1, 2$

Correct Answer: A

If $2X + 3Y = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix}$ and $3X + 2Y = \begin{bmatrix} 2 & -2 \\ -1 & 5 \end{bmatrix}$, then

Question 140 : the value of X and Y is

(A) $\begin{bmatrix} -5 & 0 \\ -1 & 4 \end{bmatrix}$ and $\begin{bmatrix} 2 & 0 \\ -1 & -1 \end{bmatrix}$

(B) $\begin{bmatrix} 5/2 & 0 \\ 1 & 0 \end{bmatrix}$ and $\begin{bmatrix} 2 & 1 \\ 0 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} 4 & 1 \\ 3/2 & 2 \end{bmatrix}$ and $\begin{bmatrix} 1 & 1 \\ 1 & 5/2 \end{bmatrix}$

(D) $\begin{bmatrix} \frac{2}{5} & \frac{-12}{5} \\ \frac{-11}{5} & 3 \end{bmatrix}$ and $\begin{bmatrix} \frac{2}{5} & \frac{13}{5} \\ \frac{14}{5} & -2 \end{bmatrix}$

Solution :

Given, $2X + 3Y = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix}$ .....(i)

and $3X + 2Y = \begin{bmatrix} 2 & -2 \\ -1 & 5 \end{bmatrix}$ .....(ii)

On multiplying eq. (i) by eq. (ii) by 3 and then subtracting, we get

$2(2X + 3Y) - 3(3X + 2Y)$

$= 2\begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix} - 3\begin{bmatrix} 2 & -2 \\ -1 & 5 \end{bmatrix}$

$\Rightarrow 4X + 6Y - 9X - 6Y = \begin{bmatrix} 4 & 6 \\ 8 & 0 \end{bmatrix} - \begin{bmatrix} 6 & -6 \\ -3 & 15 \end{bmatrix}$

$\Rightarrow -5X = \begin{bmatrix} 4-6 & 6+6 \\ 8+3 & 0-15 \end{bmatrix} = \begin{bmatrix} -2 & 12 \\ 11 & -15 \end{bmatrix}$

$\Rightarrow X = -\frac{1}{5}\begin{bmatrix} -2 & 12 \\ 11 & -15 \end{bmatrix} = \begin{bmatrix} -2/5 & -12/5 \\ -11/5 & 3 \end{bmatrix}$

Then, from eq. (i),

$3Y = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix} - 2X = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix} - 2\begin{bmatrix} 2/5 & -12/5 \\ -11/5 & 3 \end{bmatrix}$

$= \begin{bmatrix} 2-\frac{4}{5} & 3+\frac{24}{5} \\ 4+\frac{22}{5} & 0-6 \end{bmatrix} = \begin{bmatrix} 6/5 & 39/5 \\ 42/5 & -6 \end{bmatrix}$

$\therefore Y = \frac{1}{3}\begin{bmatrix} 6/5 & 39/5 \\ 42/5 & -6 \end{bmatrix} = \begin{bmatrix} 2/5 & 13/5 \\ 14/5 & -2 \end{bmatrix}$

Correct Answer: D

Question 141 : The determiants of a orthogonal matrix is

(A) ± 1

(B) 2

(C) ZERO

(D) ± 2

Solution :

We know that n square matrix 'A' is an orthogonal matrix, if $AA^T = I$

$\Rightarrow |AA^T| = 1$

$\Rightarrow |A||A| = 1$ [Q $|A| = |A^T|$]

$\Rightarrow |A|^2 = 1$

$|A| = \pm 1$

Correct Answer: A

Question 142 : If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$, then the value of x is

(A) 3

(B) ± 3

(C) ± 6

(D) 6

Solution :

Given, $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$

On expanding both determinants

$2x^2 - 40 = 18 + 14$

$\Rightarrow 2x^2 = 40 + 32 = 72$

$\Rightarrow x^2 = 36$

$\Rightarrow x = \pm 6$

Correct Answer: C

Question 143 : If cos x = tan y, cot y = tan z and cot z = tan x, then sin x is equal to

(A) $\frac{\sqrt{5}+1}{4}$

(B) $\frac{\sqrt{5}-1}{4}$

(C) $\frac{\sqrt{5}+1}{2}$

(D) $\frac{\sqrt{5}-1}{2}$

Solution :

Given, $\cos x = \tan y, \cot y = \tan z$ & $\cot z = \tan x$

$\therefore \cos x = \tan y \Rightarrow \cos x = \frac{1}{\tan z}$

$\Rightarrow \cos x = \cot z \Rightarrow \cos x = \tan x$

$\Rightarrow \cos x = \sin x/\cos x \Rightarrow \cos^2 x = \sin x$

$\Rightarrow 1 - \sin^2 x = \sin x \Rightarrow \sin^2 x + \sin x - 1 = 0$

$\therefore \sin x = \frac{-1 \pm \sqrt{1-4\times(-1)}}{2\times 1} = \frac{-1\pm\sqrt{5}}{2}$ ++

$\Rightarrow \sin x = \frac{\sqrt{5}-1}{2} \quad \left[Q\ \frac{-1-\sqrt{5}}{2} < -1\right]$

Correct Answer: D

Question 144 : $3(\sin x - \cot x)^4 + 6(\sin x + \cos x)^2 + 4(\sin^6 x + \cos^6 x)$ is equal to

(A) 12

(B) 13

(C) 14

(D) 11

Solution :

$$3(\sin x - \cot x)^4 + 6(\sin x + \cos x)^2 + 4(\sin^6 x + \cos^6 x)$$
$$= 3(1 - 2\sin x \cos x)^2 + 6(1 + 2\sin x \cos x) + 4(\sin^2 x + \cos^2 x)(\sin^4 x + \cos^4 x - \sin^2 x \cos^2 x)$$
$$= 3[1 + 4\sin^2 x \cos^2 x - 4\sin x \cos x] + 6 + 12 \sin x \cos x + 4[(\sin^2 x + \cos^2 x)^2 - 2\sin^2 x \cos^2 x - \sin^2 x \cos^2 x]$$
$$= 3 + 12 \sin^2 x \cos^2 x + 6 + 4 - 12 \sin^2 x \cos^2 x = 13$$

Correct Answer: B

Question 145 : $\tan^{-1} - \sec^{-1}(-2)$ is equal to

(A) π

(B) $-\frac{\pi}{3}$

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

(D) $\frac{2\pi}{3}$

Solution :

Let $\tan^{-1}\sqrt{3} = x \Rightarrow \tan x = \sqrt{3} \Rightarrow \tan x = \tan\frac{\pi}{3}$

$\Rightarrow x = \frac{\pi}{3} \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ [principal interval]

Let $\sec^{-1}(-2) = y \Rightarrow \sec y = -2$

$\Rightarrow \sec y = -\sec\frac{\pi}{3}$

$\Rightarrow \sec y = \sec\left(\pi - \frac{\pi}{3}\right)$ [Q $\sec(\pi - \theta) = -\sec\theta$]

$\Rightarrow \sec y = \sec\left(\frac{2\pi}{3}\right) \Rightarrow y = \frac{2\pi}{3} \in [0, \pi] - \left(\frac{\pi}{2}\right)$

[principal interval]

$\therefore \tan^{-1}\sqrt{3} - \sec^{-1}(-2) = x - y = \frac{\pi}{3} - \frac{2\pi}{3} = -\frac{\pi}{3}$

Correct Answer: B

Question 146 : $\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$ is equal to

(A) $\frac{3\pi}{4}$

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

(C) $\frac{\pi}{6}$

(D) $-\frac{3\pi}{4}$

Let $\tan^{-1}(1) = \tan x \Rightarrow \tan x = 1 = \tan\frac{\pi}{4}$

$\Rightarrow x = \frac{\pi}{4}$ where principal value $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

$\therefore \tan^{-1}(1) = \frac{\pi}{4}$

Solution :

Let $\cos^{-1}\left(-\frac{1}{2}\right) = y$

$\Rightarrow \cos y = -\frac{1}{2} = -\cos\left(\frac{\pi}{3}\right) = \cos\left(\pi - \frac{\pi}{3}\right)$

$= \cos\left(\frac{2\pi}{3}\right)$ $\quad [Q \cos(\pi - \theta) = -\cos\theta]$

$\Rightarrow y = \frac{2\pi}{3}$, where principal value $y \in [0, \pi]$

$\therefore \cos^{-1}\left(-\frac{1}{2}\right) = \frac{2\pi}{3}$

Let $\sin^{-1}\left(-\frac{1}{2}\right) = z$

$\Rightarrow \sin z = -\frac{1}{2} = -\sin\left(\frac{\pi}{6}\right) = \sin\left(-\frac{\pi}{6}\right)$

$\Rightarrow z = -\frac{\pi}{6}$, where principal value $z \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

$\therefore \sin^{-1}\left(-\frac{1}{2}\right) = -\frac{\pi}{6}$

$\therefore \tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$

$= x + y + z = \frac{\pi}{4} + \frac{2\pi}{3} - \frac{\pi}{6}$

$= \frac{3\pi + 8\pi - 2\pi}{12} = \frac{9\pi}{12} = \frac{3\pi}{4}$

Correct Answer: A

Question 147 : $\lim_{x\to 1}\frac{x^m-1}{x^n-1}$ is equal to

(A) $\frac{n}{m}$

(B) $\frac{m}{n}$

(C) $\frac{2m}{n}$

(D) $\frac{2n}{m}$

$$\lim_{x\to 1}\frac{x^m-1}{x^n-1}$$

Solution : $\lim_{x\to 1}\frac{mx^{m-1}-1}{nx^{n-1}-1}=\frac{m}{n}$

Correct Answer: B

Question 148 : 287 x 287 + 269 x 269 – 2 x 287 x 269 =?

(A) 534

(B) 446

(C) 354

(D) 324

Solution : (d) Given Exp. = $a^2 + b^2 – 2ab$, where a = 287 and b = 269 = $(a – b)^2 = (287 – 269)^2 = (18)^2 = 324$

Correct Answer: D

Question 149 : The simplified value of (1 + 1/1+1/100) (1 + 1/1+1/100) – (1 – 1/1+1/100) (1-1/1+1/100) /(1 + 1/1 + 1/100) + (1 – 1/1 + 1/100) is

(A) 100

(B) 200/101

(C) 200

(D) 202/100

Solution : (b) Given Exp.
$= a^2 – b^2/a + b = a – b = (1 + 1/1 + 1/100) – (1 – 1/1 + 1/100)$
$= 2 \times 1/(101/100) = 2 \times 100/101 = 200/101$

Correct Answer: B

Question 150 : If $y = \frac{\sin x}{1+\cos x}$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{1}{1+\cos x}$

(B) $\frac{1}{1+\sin x}$

(C) $\frac{\cos x}{1+\sin x}$

(D) 1 + cosx

$$y = \frac{\sin x}{1+\cos x}$$

$$\frac{dy}{dx} = \frac{(1+\cos x)\frac{d}{dx}\sin x - \sin x \frac{d}{dx}(1+\cos x)}{(1+\cos x)^2}$$

$$= \frac{(1+\cos x)\cos x - \sin x(0-\sin x)}{(1+\cos)^2}$$

$$= \frac{\cos x + \cos^2 x + \sin^2 x}{(1+\cos x)^2}$$

Solution : $$= \frac{\cos x + 1}{(1+\cos x)^2} = \frac{1}{1+\cos x}$$

Correct Answer: A

Question 151 : If the radius of a circle increases at a uniform rate of 2 cm/s, then the rate of increase of area of circle, at the Approximations instant when the radius is 20cm, is

(A) 80 π m^2/s

(B) 80 m^2/s

(C) 80 π cm^2/s

(D) 80 cm^2/s

Solution :

Given, $\frac{dr}{dt} = 2$ cm/s (where r is radius of a circle and t is time)

Now, area of circle, $A = \pi r^2$

On differentiating with respect to time t, we get

$$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$$

$$\Rightarrow \frac{dA}{dt} = 2\pi.20.2\,cm^2/s$$

$$\Rightarrow \frac{dA}{dt} = 80\pi\ cm^2/s$$

Thus, rate of change of area of circle with respect to time is 80π cm2-/s.

Correct Answer: C

Question 152 : If $s = \frac{1}{2}t^3 - 6t$, then acceleration at the time when the velocity vanishes, is

(A) 3 unit/s_2

(B) 6 unit/s^2

(C) 2 unit/s^2

(D) None of these

Solution :

Given, $s = \frac{1}{2}t^3 - 6t$

$\therefore\ v = \frac{ds}{dt} = \left(\frac{3t^2}{2} - 6\right)$ .....(i)

and $a = \frac{dv}{dt} = \frac{d^2s}{dt^2} = 3t$ .....(ii)

When $v = 0 \Rightarrow \frac{3t^2}{2} - 6 = 0 = t^2 = 4$

$t = 2$

$\therefore$ Acceleration when velocity vanishes

$= 3 \times 2 = 6$ unit/s^2

Correct Answer: B

Question 153 : The value of $\int \frac{1}{(x-5)^2} dx$ is

(A) $\frac{1}{(x-5)} + C$

(B) $-\frac{1}{(x-5)} + C$

(C) $\frac{2}{(x-5)^3} + C$

(D) $-2(x-5)^3 + C$

Solution :

Let $I = \int \frac{1}{(x-5)^2} dx = \int (x-5)^{-2} dx$

$= \frac{(x-5)^{-2+1}}{-2+1} + C = \frac{(x-5)^{-1}}{-1} + C = -\frac{1}{(x-5)} + C$

Correct Answer: B

Question 154 : $\int \frac{\cos 2x - 1}{\cos 2x + 1} dx$ is equal to

(A) tanx – x + C

(B) x + tanx + C

(C) x – tanx + C

(D) –x – cotx + C

Solution :

$$\text{Let } I = \int \frac{\cos 2x - 1}{\cos 2x + 1} dx$$

$$\Rightarrow I = -\int \frac{(1 - \cos 2x)}{(1 + \cos 2x)} dx = -\int \frac{2\sin^2 x}{2\cos^2 x} dx$$

$$\Rightarrow I = -\int \tan^2 x \, dx = -\int (\sec^2 x - 1) dx$$

$$\Rightarrow I = -\int \sec^2 x \, dx = \int 1 \, dx$$

$$= -\tan x + x + C$$

$$= x - \tan x + C$$

Correct Answer: C

Question 155 : The order and degree of the differenital equation $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2} = k\left(\frac{d^2y}{dx^2}\right)$ are respectively

(A) 2, 2

(B) 2, 3

(C) 3, 4

(D) 1, 5

Solution :

The given equation is

$$\left[1+\left(\frac{dy}{dx}\right)^2\right]^{3/2} = k\left(\frac{d^2y}{dx^2}\right)$$

$$\Rightarrow \left[1+\left(\frac{dy}{dx}\right)^2\right]^2 = k^2\left(\frac{d^2y}{dx^2}\right)^2$$

This shows that the degree and order of the given differential equation are 2 and 2.

Correct Answer: A

Question 156 : The differential equation corresponding to $y^2 = m(a^2 - x^2)$ is

(A) $x\left[y\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^2\right] = y\frac{dy}{dx}$

(B) $2x\frac{dy}{dx} = y$

(C) $x^2\frac{dy}{dx} = 1$

(D) None of these

Solution :

Given differential equation is

$y^2 = m(a^2 - x^2)$ .....(i)

On differentiating w.r.t. x, we get

$\Rightarrow 2y\frac{dy}{dx} = m(-2x)$ .....(ii)

$\Rightarrow y\frac{dy}{dx} = -mx$

Again, differentiating w.r.t. x, we get

$\Rightarrow y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = -m$ .....(iii)

From eqs. (ii) and (iii), we get

$x\left[y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = y\frac{dy}{dx}\right]$

Correct Answer: A

Question 157 : If the points (1, 1), (–1, –1), are the vertices of a triangle, then this triangle is

(A) right angled

(B) isosceles

(C) equilateral

(D) None of these

Solution :

Let P(1, 1), Q(–1, –1) and $(-\sqrt{3}, \sqrt{3})$ are the vertices of ΔPQR

$\therefore PQ = \sqrt{(1+1)^2 + (1+1)^2} = \sqrt{8} = 2\sqrt{2}$

$QR = \sqrt{(-\sqrt{3}+1)^2 + (\sqrt{3}+1)^2}$

$= \sqrt{8} = 2\sqrt{2}$

Similarly, $PR = \sqrt{(-\sqrt{3}-1)^2 + (\sqrt{3}-1)^2}$

$= \sqrt{8} = 2\sqrt{2}$

$\Rightarrow PQ = QR = PR$

Correct Answer: C

Question 158 : If the points (k, 3, (2, k) and (–k, 3) are collinear, then the values of k are

(A) 2, 3

(B) 1, 0

(C) 1, 2

(D) 0, 3

Solution :

Since points (k, 3), (2, k) and (–k, 3) are collinear so

$$\begin{vmatrix} k & 3 & 1 \\ 2 & k & 1 \\ -k & 3 & 1 \end{vmatrix} = 0$$

$\Rightarrow k(k-3) - 3(2+k) + 1(6+k^2) = 0$

$\Rightarrow k^2 - 3k - 6 - 3k + 6 + k^2 = 0$

$\Rightarrow 2k^2 - 6k = 0$

$\Rightarrow k(k-3) = 0$

$\Rightarrow k = 0, 3$

Correct Answer: D

Question 159 : Find the centre and radius of the circle $2x^2 + 2y^2 = 3x - 5y + 7$

(A) $\left(\frac{3}{4}, \frac{-5}{4}\right), \frac{3\sqrt{10}}{4}$

(B) $\left(\frac{1}{4}, \frac{2}{4}\right), \frac{\sqrt{10}}{4}$

(C) $\left(\frac{3}{4}, \frac{-1}{4}\right), \frac{5\sqrt{10}}{4}$

(D) None of these

We have equation of circle

$\Rightarrow x^2+y^2-\frac{3}{2}x+\frac{5}{2}y-\frac{7}{2}=0$

If centre is (α, β), then

$\alpha=\frac{-1}{2}\left(\frac{-3}{2}\right)=\frac{3}{4}$, $\beta=\frac{-1}{2}\left(\frac{5}{2}\right)=\frac{-5}{4}$

$\therefore$ Centre of circle is (α, β) is $\left(\frac{3}{4},\frac{-5}{4}\right)$

and radius of the circle = $\sqrt{\alpha^2+\beta^2-\text{constant term}}$

Solution : $\sqrt{\frac{9}{16}+\frac{25}{16}+\frac{7}{2}}=\sqrt{\frac{9+25+56}{16}}=\frac{3\sqrt{10}}{4}$

Correct Answer: A

Question 160 : The number of equation of the circle with radius 5 whose centre lies on X-axis and passes through the point (2, 3), is

(A) one

(B) two

(C) three

(D) four

We have equation of circle

$$\Rightarrow x^2 + y^2 - \frac{3}{2}x + \frac{5}{2}y - \frac{7}{2} = 0$$

If centre is (α, β), then

$$\alpha = \frac{-1}{2}\left(\frac{-3}{2}\right) = \frac{3}{4}, \ \beta = \frac{-1}{2}\left(\frac{5}{2}\right) = \frac{-5}{4}$$

$\therefore$ Centre of circle is (α, β) is $\left(\frac{3}{4}, \frac{-5}{4}\right)$

and radius of the circle = $\sqrt{\alpha^2 + \beta^2 - \text{constant term}}$

$$\sqrt{\frac{9}{16} + \frac{25}{16} + \frac{7}{2}} = \sqrt{\frac{9+25+56}{16}} = \frac{3\sqrt{10}}{4}$$

Solution :

$h^2 - 4h + 13 - 25 = 0$

$\Rightarrow h^2 - 4h - 12 = 0$

$\Rightarrow h^2 - 6h + 2h - 12 = 0$

$\Rightarrow (h - 6)(h + 2) = 0$

$\Rightarrow h - 6 = 0$ or $h + 2 = 0$

$\Rightarrow h = 6$ or -2

$\therefore$ Centre is $(6, 0)$ or $(-2, 0)$

Hence, equation of circle by using

$(x - h)^2 + (h - k)^2 = r^2$

When $(h, k) = (6, 0)$ $r = 5$, is

$(x - 6)^2 + (y - 0)^2 = 5^2$

$\Rightarrow x^2 + 36 - 12x + y2 = 25$

$\Rightarrow x^2 + y^2 - 12x + 11 = 0$

and when $(h, k) = (-2, 0)$ and $r = 5$, is

$\Rightarrow (x + 2)^2 + (y - 0)^2 = 5^2$

[Q $(x - h)^2 + (y - k)^2 = r^2$]

$\Rightarrow x^2 + 4 + 4x + y^2 = 25$

$\Rightarrow x^2 + y^2 + 4x - 21 = 0$

Correct Answer: B

Question 161 : What conic does
13x2 – 18xy + 37y2 + 2x + 14y – 2 = 0 represent?

(A) Circle

(B) Ellipse

(C) Parabola

(D) Hyperbola

Solution :

Given, $13x^2 - 18xy + 37y^2 + 2x + 14y - 2 = 0$

On comparing the given equation with

$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$

$\therefore\ a = 13,\ h = -9,\ b = 37,\ g = 1,\ f = 7,\ c = -2$

Then, $\Delta = abc + 2fgh - af^2 - bg^2 - ch^2$

$= (13)(37)(-2) + 2(7)(1)(-9) - 13(7)^2 - 37(1)^2 + 2(-9)^2$

$= -962 - 126 - 637 - 37 + 162 = -1600 \neq 0$

and also $h^2 = (-9)^2 = 81$ and $ab = 13 \times 37 = 481$

Here, $ab - h^2 = 400 > 0$

So, we have $ab - h^2 > 0$ and $\Delta \neq 0$

Hence, the given equation represents and ellipse.

Correct Answer: B

Question 162 : Find the equation of parabola having focus at (–1, –2) and directrix x – 2y + 3 = 0

(A) $4x^2 + y^2 + 4xy + 2x + 32y - 16 = 0$

(B) $4x^2 + y^2 + 4xy + 4x + 32y + 16 = 0$

(C) $x^2 + 4y^2 + 4xy + 4x + 32y + 16 = 0$

(D) $4x^2 + y^2 + 4xy - 4x + 32y + 16 = 0$

By definition of parabola, if P is any point on the parabola, S is the focus and M is a point on directrix.
Use SP = PM.
Given, S = (–1, –2) and P = (x,y)

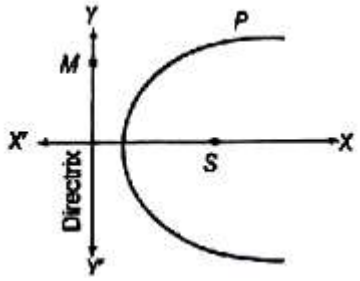
i.e. $\sqrt{(x+1)^2+(y+2)^2} = \frac{x-2y+3}{\sqrt{1+4}}$

[by distance formula]

$\Rightarrow (x+1)^2+(y+2)^2 = \frac{(x-2y+3)^2}{5}$

[Squaring both sides]

Solution :



$\Rightarrow 5x^2+5+10x+5y^2+20+20y$
$= x^2+4y^2+9-4xy-12y+6x$
$\Rightarrow 4x^2+y^2+4xy+4x+32y+16=0$

Correct Answer: B

If $\lambda(3\hat{i}+2\hat{j}-2\hat{k})$ is a unit vector, then the values of

Question 163 : λ are

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

(B) ± 7

(C) $\pm\sqrt{43}$

(D) $\pm\frac{1}{\sqrt{43}}$

Now, $|(3\hat{i}+2\hat{j}-6\hat{k})| = \sqrt{3^2+2^2+(-6)^2} = 7$

Since, (3i+2j+6k) is a unit vector.

Solution : $\therefore \lambda = \pm\frac{1}{|3\hat{i}+2\hat{i}-6\hat{k}|} = \pm\frac{1}{7}$

Correct Answer: A

Question 164 : If position vectors of four points A, B, C and D are i + j + k, 2i + 3j, 3j + 5j – 2k and k – j respectively, then AB and CD are related as

(A) perpendicular

(B) parallel

(C) independent

(D) None of the above

Solution : AB = i + 2j – k
CD = –3(i + 2j – k) = –3AB
Therefore, AB and CD are parallel.

Correct Answer: B

Question 165 : If a vector magnitude 50 is collinear wtih the vector $b = 6\hat{i}-8\hat{j}-\frac{15}{2}\hat{k}$ and makes an acute angle with the positive direction Z-axis, then the vector **a** is equal to

(A) $24\hat{i}-32\hat{j}-30\hat{k}$

(B) $-24\hat{i}+32\hat{j}+30\hat{k}$

(C) $16\hat{i}-16\hat{j}-15\hat{k}$

(D) $-12\hat{i}+16\hat{j}-30\hat{k}$

Let $\hat{a}=x\hat{i}+y\hat{j}+z\hat{k}$

$\Rightarrow |a|=|x\hat{i}+y\hat{j}+z\hat{k}|$

$\Rightarrow 50=\sqrt{x^2+y^2+z^2}$

Since, **a** and **b** are collinear.

$\therefore a=\lambda b$

$\Rightarrow x\hat{i}+y\hat{j}+z\hat{k}=\lambda\left(6\hat{i}-8\hat{j}-\frac{15}{2}\hat{k}\right)$

$\Rightarrow x^2+y^2+z^2=\lambda^2\left[6^2+8^2+\left(\frac{15}{2}\right)^2\right]$

$\therefore \lambda=\pm 4$

Since, a makes an acute angle with the positive direction of Z-axis, this is possible with $\lambda=-4$.

$\therefore \hat{a}=-4\left(6\hat{i}-8\hat{j}-\frac{15}{2}\hat{k}\right)$

Solution : $=-24\hat{i}+32\hat{j}+30\hat{k}$

Correct Answer: B

Question 166 : If (1, –2, –2) and (0, 2,1) are direction ratios of two lines, then the direction cosines of a perpendicular to both the lines are

(A) $\left(\frac{1}{3},-\frac{1}{3},\frac{2}{3}\right)$

(B) $\left(\frac{2}{3},-\frac{1}{3},\frac{2}{3}\right)$

(C) $\left(-\frac{2}{3},-\frac{1}{3},\frac{2}{3}\right)$

(D) $\left(\frac{2}{\sqrt{14}},-\frac{1}{\sqrt{14}},\frac{3}{\sqrt{14}}\right)$

Solution :

If (a_1, b_1, c_1) and (a_2, b_2, c_2) are direction ratios of two lines, then DC's of a perpendicular to both the lines are

$$\frac{b_1c_2 - b_2c_1}{\sqrt{(b_1c_2 - b_2c_1)^2 + (a_2c_1 - a_1c_2)^2 + (a_1b_2 - a_2b_1)^2}}$$

$$\frac{a_2c_1 - a_1c_2}{\sqrt{(b_1c_2 - b_2c_1)^2 + (a_2c_1 - a_1c_2)^2 + (a_1b_2 - a_2b_1)^2}}$$

and $$\frac{a_1b_2 - a_2b_1}{\sqrt{(b_1c_2 - b_2c_1)^2 + (a_2c_1 - a_1c_2)^2} \sqrt{+(b_1c_2 - b_2c_1)^2 + (a_2c_1 - a_1c_2)^2}}$$

Putting the values of a_1, b_1, c_1 and a_2, b_2, c_2, we get

$$\frac{2}{3}, -\frac{1}{3}, \frac{2}{3}$$

Correct Answer: B

Question 167 : Let O be the origin and P be the point at a distance 3 units from origin. If direction ratios of OP are (1, –2, –2), then coordinates of P is given by

(A) (1, –2, –2)

(B) (3, –6, –6)

(C) (1/3, –2/3, –2/3)

(D) (1/9, –2/9, –2/9)

Solution : Q Direction cosines of OP are $\left(\frac{1}{3}, \frac{-2}{3}, \frac{-2}{3}\right)$

also OP = r = 3.

NOw, point P is given by P(*l*r, mr, nr) i.e.

P(x, y, z)

$= P\left[\frac{1}{3}(3), -\left(\frac{2}{3}\right)3, \left(-\frac{2}{3}\right)3\right]$

$= P(1, -2, -2)$

Correct Answer: A

Question 168 : If the lines

$$\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k} \text{ and } \frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$$

are coplanar, then k can have

(A) any value

(B) exactly one value

(C) exactly two values

(D) exactly three values

Solution : Condition for coplanar,

$$k\begin{vmatrix} 2-1 & 3-4 & 4-5 \\ 1 & 1 & -k \\ k & 2 & 1 \end{vmatrix} = 0$$

$\Rightarrow k^2 + 3k = 0$

$\therefore k = 0, -3$

Correct Answer: C

Question 169 : The mean of n items is . If each item is successively increased by 3, 32 ,33,.., 3n, then mean will be

(A) $\bar{x}+\frac{3^{n+1}}{2n}$

(B) $\bar{x}+\frac{3(3^n-1)}{3n}$

(C) $\bar{x}+\frac{3^n}{3n}$

(D) $\bar{x}+\frac{3(3^n-1)}{2n}$

Solution :

Let $x_1, x_2, x_3, \ldots, x_n$ be n items. Then, new items are $x_1+3, x_2+3^2, \ldots, x_n+3^n$.

$$\therefore \text{ New mean} = \frac{(x_1+3)+(x_2+3^2)+\ldots+(x_n+3^n)}{n}$$

$$= \frac{(x_1+x_2+\ldots+x_n)}{n}+\frac{3^1+3^2+\ldots+3^n}{n}$$

$$= \bar{x}+\frac{3(3^n-1)}{2n}$$

Correct Answer: D

Question 170 : The arithmetic mean of the marks from the following table is Marks 0-10 10-20 20-30 30-40 40-50 50-60 Number 12 18 27 20 17 6 of Students

(A) 20

(B) 28

(C) 2800

(D) 100

Marks	Class marks(x)	f	fx
0-10	5	12	60
10-20	15	18	270
20-30	25	27	675
30-40	35	20	700
40-50	45	17	765
50-60	55	6	330
		$\Sigma f = 100$	$\Sigma fx = 2800$

Solution : $\therefore \ \bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{2800}{100} = 28$

Correct Answer: B

Question 171 : The weighted mean of the first n natural numbers, the weights being the corresponding numbers, is

(A) $\frac{n+1}{2}$

(B) $\frac{n+2}{2}$

(C) $\frac{2n+1}{3}$

(D) None of these

Solution : First n natural numbers are 1, 2, 3,..., n; whose corresponding weights are 1, 2, 3,...., n respectively.

$\therefore$ Weight mean

$$= \frac{1\times1+2\times2+.....+n\times n}{1+2+.....+n}$$

$$= \frac{1^2+2^2+.....+n^2}{1+2+.....+n}$$

$$= \frac{n(n+1)(2n+1)}{\frac{6n(n+1)}{2}} = \frac{2n+1}{3}$$

Correct Answer: C

Question 172 : There are two children in a family. The probability that both of them are boys, is

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

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

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

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

Solution : Let S be the sample space and E be the event that the family have two boys.
Clearly, S = {BB, BG, GB, GG) and E = {BB}

$$P(\text{both boys}) = \frac{n(E)}{n(S)} = \frac{1}{4}$$

Correct Answer: C

Question 173 : Five persons A. B, C, D and E are in queue of a shop. The probability that A and E are always together, is

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

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

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

(D) $\frac{3}{5}$

Solution : Total number of ways = 5!
and favourable number of ways = 2.4!
$\therefore$ Required probability = $\frac{2.4!}{5!} = \frac{2}{5}$

Correct Answer: A

Question 174 : One mapping (function) is selected at random from all the mappings of the set A = {1, 2, 3...n} into itself. The probability that the mapping selected is one-one, is

(A) $\frac{n!}{n^{n-1}}$

(B) $\frac{n!}{n^n}$

(C) $\frac{n!}{2n^n}$

(D) None of these

Solution : Total number of mappings from a set A into itself is n^n.
And the total nubmer of one-one mapping is n!
$\therefore$ Required probability = $\frac{n\ !}{n^{\ n}}$

Correct Answer: B

Question 175 : Let V be a vector space over a field and $a \in F$ and $u \in v$. Which of the following statement is not correct?

(A) $au = \theta \Rightarrow$ either $\alpha = 0$ or $u = \theta$

(B) $|-1u| = |-1|u$ for all $u \in v$

(C) $\alpha\theta = \theta$

(D) $0u = \theta$

Solution : $|-1u| = |-1|u, \forall u \in V$ is false statement.

Correct Answer: B

Question 176 : Let **R** be the set of all real number and $\mathbf{R}_2 = \{(x_1, x_2): x_1 \in \mathbf{R}, x_2 \in \mathbf{R}\}$. Then, which one of the following is a subspace of $\mathbf{R}^2$ over **R**?

(A) $\{(x_1, x_2): x_1 > 0, x_2 > 0\}$

(B) $\{(x_1, x_2): x_1 \in \mathbf{R}, x_2 > 0\}$

(C) $\{(x_1, x_2): x_1 < 0, x_2 < 0\}$

(D) $\{(x_1, 0): x_1 \in \mathbf{R}\}$

Solution : Here, R is the set of real numbers and
$R^2 = \{(x_1, x_2): x_1 \in R, x_2 \in R\}$
$\Rightarrow a = \{(x_1, 0): x_1 \in R\}$
$b = \{(y_1, 0): y_1 \in R\}$
Hence, $\alpha a + \beta b = \{ax_1, b_1y_1, 0: x, y \in R\}$

Correct Answer: D

Question 177 : Let **R** be the field of real numbers andQ be the field of rational numbers and show that $W = \{(x, y, z): x, y, z \in Q\}$

(A) W is a subspace of $V_3(R)$

(B) W is not a subspace of $V_3(R)$

(C) W is closed under multiplication

(D) W is not closed under multiplication

Solution :

Let $\alpha = \left(\frac{1}{2}, \frac{3}{5}, 7\right)$

and $a = \sqrt{3}$, a real number

Then, $a\alpha = \sqrt{3}\left(\frac{1}{2}, \frac{3}{5}, 7\right)$

$= \left(\frac{\sqrt{3}}{2}, \frac{3\sqrt{3}}{5}, 7\sqrt{3}\right) \notin W$

Since, $\frac{\sqrt{3}}{2}, \frac{3\sqrt{3}}{5}, 7\sqrt{3}$ are not rational numbers.

Hence, W is not cloed under scalar multiplication, consequently it does not form a vector space of $V_3(R)$.

Correct Answer: B

Question 178 : The value of f(x) = x + |x| is continuous for

(A) $x \in (-\infty, \infty)$

(B) $x \in (-\infty, \infty) - \{0\}$

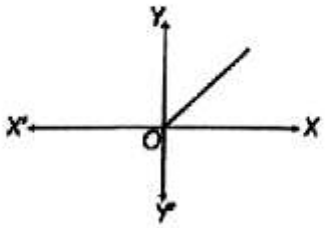
(C) only $x > 0$

(D) No value of x

Solution :

Given, $f(x) = x + |x|$

$\therefore\ f(x) = \begin{cases} 2x, & x \geq 0 \\ 0, & x < 0 \end{cases}$



It is clear from graph that f(x) is continuous for every value of x.

Correct Answer: A

Question 179 :

Let fbe the function defined on R as follows

$$f(x) = \begin{cases} 1-2x, & \text{when } x < 0 \\ 0, & \text{when } x = 0 \\ 1+3x, & \text{when } x > 0 \end{cases}$$

(A) f is continuous at 0

(B) f is discontinuous at 0

(C) f is nowhere continuous

(D) f is everywhere discontinuouus

Case I: Let $x < 0$. Given $\varepsilon > 0$,

$|f(x) - 1| = |-2x| = -2x < \varepsilon$ iff $x > -\frac{\varepsilon}{2}$

Now, taking $\delta = \frac{\varepsilon}{2}$, we find that

$|f(x) - 1| < \varepsilon$, whernever $-\delta < x < 0$.

$\Rightarrow \lim_{x \to 0} f(x) = 1$

Case II: Let $x > 0$. Given, $\varepsilon > 0$,

$|f(x) - 1| = |3x| = 3x < \varepsilon$ iff $x < \frac{\varepsilon}{3}$

Now, taking $\delta = \frac{\varepsilon}{3}$, we find that

$|f(x) - 1| < \varepsilon$, whenever $0 < x < \delta$

$\Rightarrow \lim_{x \to 0} f(x) = 1$

Hence, f is continuous at 0 and hence continuous

Solution : everywhere.

Correct Answer: A

Question 180 : Function $f(x) = x^2$ is

(A) not uniformly continuous on $[0, \infty[$

(B) not uniformly continuous on $[-\infty, \infty]$

(C) uniformly continuous on $[0, \infty]$

(D) None of the above

Solution :

Suppose, $\varepsilon = 1/2$ and δ be any positive number, then we can choose a positive integer n such that

$$n > \frac{1}{4\delta^2}$$

$$\Rightarrow \frac{1}{4n} < \delta^2 \qquad \text{.....(i)}$$

Let $x_1 = \sqrt{n}$

and $x_2 = \sqrt{n+1} \in [0, \infty[$, then

$|f(x_2) - f(x_1)| = |x_2^2 - x_1^2|$

$= |(n+1) - n| = 1 > \varepsilon,$

and $|x_2 - x_1| = |\sqrt{n+1} - \sqrt{n}|$

$$= \left|\frac{(\sqrt{n+1} - \sqrt{n})(\sqrt{n+1} + \sqrt{n})}{(\sqrt{n+1} + \sqrt{n})}\right|$$

$$= \frac{n+1-n}{\sqrt{n+1} + \sqrt{n}}$$

$$= \frac{1}{\sqrt{n+1} + \sqrt{n}} < \frac{1}{2\sqrt{n}} < \delta \quad \text{[Using eq. (i)]}$$

$Q\ (\sqrt{n+1} + \sqrt{n}) > \sqrt{n} + \sqrt{n} = 2\sqrt{n}$

$\Rightarrow |f(x_2) - f(x_1)| > \varepsilon$

When $|x_2 - x_1| < \delta$

Therefore, f is not uniformly continuous on $[0, \infty[$.

Correct Answer: A