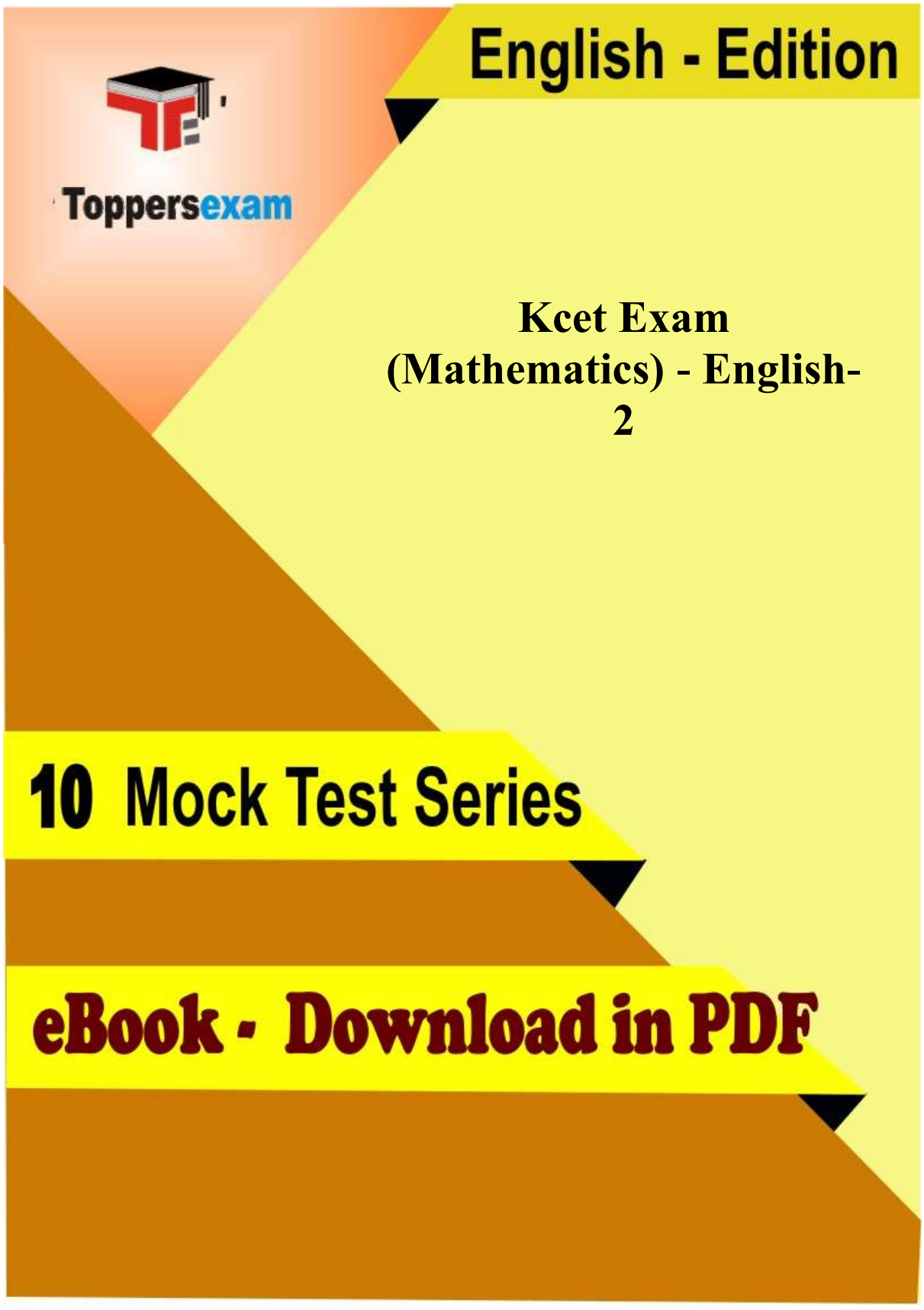

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Kcet Exam (Mathematics) - English-2

Paper Questions

SUBJECT: Physics

Question 1 : Which of the following is the infrared wavelength?

(A) 10^{-4} cm

(B) 10^{-5} cm

(C) 10^{-6} cm

(D) 10^{-7} cm

Correct Answer: A

Question 2 : Chromatic aberration of lens can be corrected by

(A) providing different suitable curvature to its two surfaces

(B) proper polishing of its two surfacesx

(C) suitably toffihining it with another lens

(D) reducing its aperture

Correct Answer: C

Question 3 : The forward voltage in a diode increased the width of the depletion region:

(A) Does not change

(B) Decreases

(C) Increases

(D) None of these

Correct Answer: B

Question 4 : Time-period of a pendulum on a satellite, orbiting around the earth, is

(B) ∞

(C) $1/\pi$

(D) π

Correct Answer: B

Question 5 : A magnet dropped into a coil of conducting wire along its axis will fall with an acceleration:

(A) More than g

(B) Equal to g

(C) Less than g

(D) None of these

Correct Answer: C

Question 6 : A charged hollow sphere does not produce an electric field at any

(A) inner point

(B) outer point

(C) beyond 2 metres

(D) beyond 10 metres

Correct Answer: A

Question 7 : An astronaut on a strange planet finds that acceleration due to gravity is twice as that on the surface of earth. Which of the following could explain this?

(A) Both the mass and radius of the planet are half as that of earth

(B) Radius of the planet is half as that of earth, but the mass is the same as that of earth

(C) Both the mass and radius of the planet are twice as that of earth

(D) Mass of the planet is half as that of earth, but radius is same as that of earth

Correct Answer: A

Question 8 : A small object is placed 10 cm in front of a plane mirror. If you stand behind the object 30 cm from the mirror and look at its image, the distance foccused for your eye will be:

(A) 60 cm

(B) 20 cm

(C) 40 cm

(D) 80 cm

Correct Answer: C

Question 9 : A milliameter of range 10 mA has a coil of resistance 1 Ω.. To use it as voltmeter of range 10 volt, the resistance that must be connected in series with it, will be:

(A) 999 Ω

(B) 99 Ω

(C) 1000 Ω

(D) None of these

Correct Answer: A

Question 10 : While a capacitor remains connected to a battery and dielectric slab is applied between the plates, then:

(A) Potential difference between the plates is changed

(B) Charge flows from the battery to the capacitor

(C) Electric field between the plates increases

(D) Energy store in the capacitor decreases

Correct Answer: B

Question 11 : There are two electric bulbs of 40 volt and 60 volt. The ratio of their resistance will be:

(A) 5 : 4

(B) 4 : 3

(C) 3 : 2

(D) 2 : 3

Correct Answer: C

Question 12 : A beam of light in air enters into the water. Which of the following characteristics of light will not change?

(A) colour

(B) velocity

(C) amplitude

(D) frequency

Correct Answer: D

Question 13 : If a ball is thrown vertically upwards, assuming the air resistance to be constant and considerable, then :

(A) Time of ascent $\geq$ time of descent

(B) Time of ascent = time of descent

(C) Time of ascent < time of descent

(D) Time of ascent > time of descent

Correct Answer: B

Question 14 : The work function for aluminium is 4.125 eV. The cutoff wavelength for photoelectric effect for aluminium will be:

(A) 420 nm

(B) 350 nm

(C) 300 nm

(D) 200 nm

Correct Answer: C

Question 15 : A bus is moving with a velocity of 5 m/s towards a huge well. The driver sounds a horn of frequency 165 Hz. If the speed of sound in air is 355 m/s, the number of beats heard per second by a passenger on the bus will be:

(A) 6

(B) 5

(C) 3

(D) 4

Correct Answer: B

Question 16 : If the critical angle for total internal reflection from a medium to vacuume is 30^{0} then velocity of light in the medium is:

(A) 1.5×10^{8} m/s

(B) 3×10^{8} m/s

(C) 0.75 m/s

(D) 6×10^{8} m/s

Correct Answer: A

Question 17 : In a stationary wave all particles of the medium cross the mean position with:

(A) Different velocities at different instants

(B) Different velocities at same instants

(C) Same speed at all instants

(D) Different speed al all instants

Correct Answer: B

Question 18 : A cylinder of 5 litre capacity, filled with air at N.T.P. is connected with another evacuated cylinder of 30 litres of capacity the resultant air pressure in both the cylinders will be :

(A) 38.85 cm of Hg

(B) 21.85 cm of Hg

(C) 10.85 cm of Hg

(D) 14.85 cm of Hg

Correct Answer: C

Question 19 : As the intensity of incident light increases then:

(A) K.E. of photoelectron decreases

(B) K.E. of photoelectron increases

(C) Photoelectric current increases

(D) Photoelectric current decreases

Correct Answer: C

Question 20 : When one of the slits of Young's experiment is covered with a transparent sheet of thickness 4.8 mm, the central shifts to a position originally occupies by the 30^{th} bright fringe. What should be the thickness of the sheet if the

central fringe has to shift to the position occupied by 20^{th} bright fringe?

(A) 1.6 mm

(B) 3.8 mm

(C)

3.2 mm

(D) 7.6 mm

Correct Answer: C

Question 21 : Pick out the statement which is not true:

(A) Shortest wavelength UV radiation are beneficial to living tissue while longer wavelength are harmful

(B) UV radiation have wavelength extending from 200 nm to 400 nm

(C) UV radiation are used for sterlisation of water

(D) Sun is natural source of UV radiation

Correct Answer: A

Question 22 :

Which of the following substances has the highest elasticity?

(A) Sponge

(B) Steel

(C) Rubber

(D) Copper

Correct Answer: B

Question 23 : What happens, when we multiply a vector by –2 ?

(A) direction reverses and unit changes

(B) direction reverses and magnitude is doubled

(C) direction remains unchanged but unit changes

(D) neither direction reverses nor unit changes but the magnitude is doubled

Correct Answer: B

Question 24 : A train is moving towards north with a speed of 180 km/hr. If the vertical component of the earth's magnetic field is 0.2×10^{-4} T, e.m.f. induced, in the axle 1.5 m long, is:

(A) 1.5 m V

(B) 15 m V

(C) 5.4 m V

(D) 54 m V

Correct Answer: A

Question 25 : When a ceiling fan is switched off its angular velocity radius 50% while its makes 36 rotations. How many more rotation will it make before coming to rest (assume uniform angular retardation) :

(A) 18

(B) 12

(C) 36

(D) 48

Correct Answer: B

Question 26 : At sea level, the value of g is minimum at

(A) the poles

(B) the equator

(C) 45° south latitude

(D) 45° north longitude

Correct Answer: B

Question 27 : When there are no external forces, the shape of a small liquid drop is determined by

(A) surface tension of the liquid

(B) density of the liquid

(C) viscosity of air

(D) temperature of air

Correct Answer: A

Question 28 : A gas at the temperature 250 K is contained in a closed vessel. If the gas is heated through 1 K, then the percentage increase in its pressure will be:

(A) 0.4%

(B) 0.2%

(C) 0.1%

(D) 0.8%

Correct Answer: A

Question 29 : Whenever stationary waves are set up, in any medium, then

(A) condensations occur at nodes

(B) refractions occur at antinodes

(C) maximum strain is experienced at the nodes

(D) no strain is experienced at the antinodes

Correct Answer: D

Question 30 : A block of mass 1kg slides down a rough inclined plane of inclination 60^{0} starting from its top. If coefficient of kinetic friction is 0.5 and length of the plane d=1 m then work done against friction is:

(A) 2.45 J

(B) 4.9 J

(C) 9.8 J

(D) 19.6 J

Correct Answer: A

Question 31 : A bar magnet of magnetic moment M is cut into two parts of equal length. The

magnetic moment of each part will be

(A) 12 M

(B) M

(C) 0.5 M

(D) Zero

Correct Answer: C

Question 32 : A body thrown upwards with some velocity, reaches the maximum height of 20 m. Another body with double the mass thrown up, with double initial velocity will reach a maximum height of:

(A) 200 m

(B) 16 am

(C) 80 m

(D) 40 m

Correct Answer: C

Question 33 : A particle having charge 100 times that of an electron is revolving in a circular path of radius 0.8 m with one rotation per second. Magnetic field produced at the centre of particle will be:

(A) $10^{-17}\,\mu_0$

(B) $10^{-11}\,\mu_0$

(C) $10^{-7}\,\mu_0$

(D) $10^{-3}\,\mu_0$

Correct Answer: A

Question 34 :

If the linear momentum of a body is increased by 50%, then the kinetic energy of that body increases by

(A) 100%

(B) 125%

(C) 225%

(D) 25%

Correct Answer: B

Question 35 : There is a uniform magnetic field directed perpendicular and into the plane of the paper. An irregular shaped conducting loop is slowly changing into a circular loop in the plane of the paper. Then

(A) current is induced in the loop in the anticlockwise direction

(B) current is induced in the loop in the clockwise direction

(C) AC is induced in the loop

(D) no current is induced in the loop

Correct Answer: A

Question 36 : The energy of hydrogen atom in its ground state is -13.6 eV. The energy of the level corresponding to the quantum number n is equal 5 is:

(A) -5.40 eV

(B) -2.72 eV

(C) -0.85 eV

(D) -0.54 eV

Correct Answer: D

Question 37 : Water is in streamline flows along a horizontal pipe with non-uniform cross-section. At a point in the pipe where the area of cross-section is 10 cm^2, the velocity of water is 1 ms^{-1} and the pressure is
2000 Pa. The pressure at another point where the cross-sectional area is 5 cm^2 is

(A) 4000 Pa

(B) 2000 Pa

(C) 1000 Pa

(D) 500 Pa

Correct Answer: D

Question 38 : Magnetic fields at two points on the axis of a circular coil at a distance of 0.05 m and 0.2 m from the centre are in the ratio 8 : 1 The radius of the coil is:

(A) 1.0 m

(B) 0.1 m

(C) 0.15 m

(D) 0.2 m

Correct Answer: B

Question 39 : A balloon starts rising from the ground with an acceleration of 1.25 m/s^2 after 8s, a

stone is released from the balloon. The store will (g = 10 m/s^2):

(A) Reach the ground in 4 second

(B) Begin to move down after being released

(C) Have a displacements of 50 m

(D) Cover a distance of 40 m in reaching the ground

Correct Answer: A

Question 40 : If a while light is used in Young's double slit experiments then a very large number of coloured fringes can be seen:

(A) With first order violet fringes being closer to the central white fringes

(B) First order red fringes being closer to the central white fringes

(C) With a central white fringe

(D) With a central black fringe

Correct Answer: C

Question 41 : In the experiment of diffraction at a single slit, if the slit width is decreased, the width of the central maximum:

(A) Decreases in Fresnel's diffraction but increases in Fraun hofer diffraction

(B) Increases in Fresnel's diffraction but decreases in Fraun hofer diffraction

(C) Decreases in both Fresnel and Fraun hofer diffraction

(D) Increases in both Fresnel and Fraun hofer diffraction

Correct Answer: D

Question 42 : A satellite with kinetic energy E_k is revolving round the earth in a circular orbit. How much more kinetic energy should be given to it so that it may just escape into outer space

(A) E_k

(B) $2E_k$

(C) $7E_k$

(D) $3E_k$

Correct Answer: A

Question 43 : The ionisation potential of hydrogen is 13.6 eV. Then the energy released when an electron jumps from n = 3 to n = 2 orbit, is:

(A) 2.89 eV

(B) 1.89 eV

(C) 3.89 eV

(D) 4.89 eV

Correct Answer: B

Question 44 : In an X-ray tube electrons bombarding the target produce X-rays of minimum wavelength 1 Å. What must be the energy of bombarding electrons:

(A) 13375 eV

(B) 12375 eV

(C) 14375 eV

(D) 15375 eV

Correct Answer: B

Question 45 : Conservation of linear momentum is equivalent to

(A) Newton's law of gravityx

(B) Newton's first law of motion

(C) Newton's second law of motion

(D) Newton's third law of motion

Correct Answer: B

Question 46 : The frequency of a tuning fork is 384 per second and velocity of sound in air is 352 m/s. How far the sound has traversed while fork completes 36 vibration?

(A) 3 m

(B) 13 m

(C) 23 m

(D) 33 m

Correct Answer: D

Question 47 : In Lenz's law, there is a conversion of

(A) charge

(B) energy

(C) current

(D) momentum

Correct Answer: B

Question 48 : When one of the slits of Young's experiment is covered with a transparent sheet of thickness 4.8 mm, the central shifts to a position originally occupies by the 30^{th} bright fringe. What should be the thickness of the sheet if the central fringe has to shift to the position occupied by 20^{th} bright fringe?

(A) 1.6 mm

(B) 3.8 mm

(C) 3.2 mm

(D) 7.6 mm

Correct Answer: C

Question 49 : Light passes successively through two polarimeter tubes each of length 0.29m. the first tube contains dextro rotatory solution of concentration 60 kg m^{-3} and specific rotation 0.01 rad m^2 kg^{-1}. The second tube contains laevo rotatory solution of concentration 30 kg m^{-5} and specific rotation 0.02 rad m^2 kg^{-1}. The net rotation produced is:

(A) 0^0

(B) 15^0

(C) 10^0

(D) 20^0

Correct Answer: A

Question 50 :

A motorboat covers a given distance in 6 h moving downstream on a river. It covers the same distance in 10 h moving upstream. The time it takes to cover the same distance in still water is

(A) 9 h

(B) 7.5 h

(C) 6.5 h

(D) 8 h

Correct Answer: B

Question 51 : The spectrum of an oil flame is an example for

(A) line emission spectrum

(B) continuous emission spectrum

(C) line absorption spectrum

(D) band emission spectrum

Correct Answer: B

Question 52 : The de – Broglie wavelength of an electron in the first Bohr orbit is:

(A) Equal to half the circumference of the first orbit

(B) Equal to one fourth the circumference to the first orbit

(C) Equal to the circumference of the first orbit

(D) Equal to twice the circumference of the first orbit

Correct Answer: C

Question 53 : Out of the following statements which is not true?

(A) Infrared radiations arise due to minor electron transitions in atoms

(B) Infrared radiations are used for long distance photography

(C) Sun is the natural source of infrared radiation

(D) Infrared radiation are detected by using a bolometer.

Correct Answer: A

Question 54 : In nuclear fission the percentage of mass converted into energy is about:

(A) 0.01%

(B) 10%

(C) 1%

(D) 0.1%

Correct Answer: D

Question 55 : If l_1, l_2, l_3 are the lengths of the emitter, base and collector of a transistor, then:

(A) $l_3 < l_2 < l_1$

(B) $l_1 = l_2 = l_3$

(C) $l_3 < l_1 < l_2$

(D) $l_3 < l_1 < l_2$

Correct Answer: C

Question 56 : When the conductivity of a semiconductor is only due to breaking of covalent bonds, the semiconductor is called:

(A) intrinsic

(B) extrinsic

(C) p-type

(D) n-type

Correct Answer: A

Question 57 : A very large number of balls are thrown vertically upwards in quick successions in such a way that the next ball is thrown when the previous one is at the maximum height. If the maximum height is 5 m, the number of balls thrown per minute is:(take g = 10 m/s^2)

(A) 80

(B) 120

(C) 40

(D) 60

Correct Answer: D

Question 58 : The light reflected by a plane mirror may form a real image:

(A) If the rays incident on the mirror are converging

(B) If the rays incident on the mirror are diverging

(C) Under no circumstances

(D) If the object is placed very close to the mirror

Correct Answer: A

Question 59 : The temperature of the sun is measured with

(A) pyrometer

(B) gas thermometer

(C) platinum resistance thermometer

(D) vapour pressure thermometer

Correct Answer: A

Question 60 : Light appears to travel in straight lines because:

(A) Light consists of very small particles

(B) The frequency of lights is very small

(C) The velocity of light is different for different colours

(D) The wavelength of light is very small

Correct Answer: D

SUBJECT: Chemistry

Question 61 : 5 moles of SO_2 and 5 moles of O_2 are allowed to react to form SO_3 in a closed vessel.

At the equilibrium stage 60% of SO_2 is used up. The total number of mole of SO_2, O_2 and SO_3 in the vessel now is:

(A) 10.0

(B) 8.5

(C) 10.5

(D) 3.9

Correct Answer: B

Question 62 : A base, as defined by Bronsted theory, is a substance which can

(A) accept protons

(B) donate protons

(C) lose a pair of electrons

(D) gain a pair of electrons

Correct Answer: A

Question 63 : In the case of small cuts bleeding is stopped by applying potash alum. Here alum acts as:

(A) Fungicide

(B) Disinfectant

(C) Germicide

(D) Coagulating agent

Correct Answer: D

Question 64 : "It is impossible to determine simultaneously the position and velocity of small particles such as electron". It is a statement of

(A) Hund's rule

(B) Aufbau's principle

(C) Pauli's rule

(D) Heisenberg's uncertainty principle

Correct Answer: D

Question 65 : The percentage of N_2 in urea is about:

(A) 28

(B) 18

(C) 85

(D) 46

Correct Answer: D

Question 66 : When salicyclic acid is distilled with zinc dust, the product obtained is:

(A) Zinc salicylate

(B) Salicylaldehyde

(C) Phenol

(D) Benzoic acid

Correct Answer: D

Question 67 : On heating ethanol with excess of conc. H_2SO_4 at 170° C, the product obtained is:

(A) Ethene

(B) Ethoxy ethane

(C) Ethyne

(D) Ethane

Correct Answer: A

Question 68 : To calculate the amount of work done in joules during reversible isothermal expansion of an ideal gas, the volume must be expressed in:

(A) Dm^3 only

(B) M^3 only

(C) Any unit

(D) Cm^3 unit

Correct Answer: C

Question 69 : The quantity of electricity required to liberate 112 cm^3 of hydrogen at STP from acidified water is:

(A) 965 coulombs

(B) 1 faraday

(C) 0.1 faraday

(D) 96500 coulombs

Correct Answer: A

Question 70 : Hydrogen ion concentration of an aqueous solution is 1×10^{-4} M. The solution is diluted with equal volume of water. Hydroxyl ion concentration of the resultant solution in terms of mol dm^{-3} is:

(A) 1×10^{-8}

(B) 1×10^{-6}

(C) 2×10^{-10}

(D) 0.5×10^{-10}

Correct Answer: C

Question 71 : The shape of cuprammonium ion is:

(A) Trigonal

(B) Tetrahedral

(C) Octahedral

(D) Square planar

Correct Answer: D

Question 72 : The enthalpy of combustion of C_6H_6 (*l*) is -3250 kJ. When 0.39 g of benzene is burnt in excess of oxygen in an open vessel, the amount of heat liberated is:

(A) 16.25 J

(B) 16.25 kJ

(C) 32.5 J

(D) 32.5 kJ

Correct Answer: B

Question 73 :

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 74 : The solubility product of a binary weak electrolyte is 4×10^{-10} at 298 K. Its solubility in mol dm^{-3} at the same temperature is:

(A) 4×10^{-5}

(B) 2×10^{-5}

(C) 8×10^{-10}

(D) 16×10^{-20}

Correct Answer: B

Question 75 : Propane is the product obtained by dehydrogenation of:

(A) 2 v- propanol

(B) 1 – propanol

(C) Propanol

(D) N – propyl alcohol

Correct Answer: A

Question 76 : To get DDT chlorobenzene has to react with the following compound in the pressure of concentrated sulphric acid:

(A) Trichloro ethane

(B) Dichloro acetone

(C) Dichloro acetaldehyde

(D) Trichloro acetaldehyde

Correct Answer: D

Question 77 : Glacial acetic acid is obtained by:

(A) Chemically separating acetic acid

(B) Treating vinegar with dehydrating agents

(C) Crystallising, separating and melting acetic acid

(D) Distilling vinegar

Correct Answer: D

Question 78 : An organic acid without a carboxylic acid group is:

(A) Picric acid

(B) Oxalic acid

(C) Vinegar

(D) Ascorbic acid

Correct Answer: A

Question 79 : An ester used as medicine is:

(A) Ethyl benzoate

(B) Methyl salicylate

(C) Methyl acetate

(D) Ethyl acetate

Correct Answer: B

Question 80 : Reaction of aniline with benzaldehyde is:

(A) Polymerisation

(B) Condensation

(C) Addition

(D) Substitution

Correct Answer: B

Question 81 : Halo alkane in the presence of alcoholic KOH undergoes:

(A) Elimination

(B) Polymerisation

(C) Dimerization

(D) Substitution

Correct Answer: A

Question 82 : The simplest way to check whether a system is colloidal is by

(A) Electrodialysis

(B) Finding out particle size

(C) Tyndall effect

(D) Brownian movement

Correct Answer: C

Question 83 : An example for a strong electrolyte is:

(A) Urea

(B) Ammonium hydroxide

(C) Sugar

(D) Sodium acetate

Correct Answer: D

Question 84 : An example of a salt that will not hydrolyse is

(A) CH_3COONH_4

(B) CH_3COOK

(C) NH_4CI

(D) KCI

Correct Answer: D

Question 85 : C^{14} is

(A) A natural non – radioactive isotope

(B) An artificial non – radioactive isotope

(C) An artificial radioactive isotope

(D) A natural radioactive isotope

Correct Answer: D

Question 86 : A cuprous ore among the following is

(A) Cuprite

(B) Malachite

(C) Chalcopyrites

(D) Azurite

Correct Answer: A

Question 87 : Smallest among these species is:

(A) Lithium

(B) Lithium ion

(C) Hydrogen

(D) Helium

Correct Answer: C

Question 88 : Sodium chloride is an ionic compound where as hydrogen chloride gas is mainly convalent because

(A) Electronegativity difference in the case of hydrogen in less than 2.1

(B) Hydrogen chloride is a gas

(C) Hydrogen is a non metal

(D) Sodium is reactive

Correct Answer: A

Question 89 : Convalent compounds have low melting point because

(A) Convalent molecules are held by weak van der waal's force of attraction

(B) Convalent bond is less exothermic

(C) Convalent bond is weaker than ionic bond

(D) Convalent molecules have definite shape

Correct Answer: A

Question 90 : Which of the following is an alloy of aluminium?

(A) magnalium

(B) duralumin

(C) brass

(D) both ‘a’ and ‘b’

Correct Answer: D

Question 91 : A neutral fertilizer among these compounds is

(A) Ammonium nitrate

(B) Urea

(C) CAN

(D) Ammonium sulphate

Correct Answer: A

Question 92 : A condensation polymer among the following polymers is

(A) Teflon

(B) Polysterene

(C) PVC

(D) Decron

Correct Answer: D

Question 93 : A compound that undergoes bromination easily is:

(A) Toluene

(B) Benzoic acid

(C) Phenol

(D) Benzene

Correct Answer: C

Question 94 : A sugar that is not a disaccharide among the following is

(A) Galactose

(B) Lactose

(C) Maltose

(D) Sucrose

Correct Answer: A

Question 95 : Drying soil invariably contains

(A) Butyric acid

(B) Stearic acid

(C) Lauric acid

(D) Linoleic acid

Correct Answer: D

Question 96 : Hetrocyclic amino acid among these compound is

(A) Lysine

(B) Tyrosine

(C) Proline

(D) Serine

Correct Answer: C

Question 97 : Aluminium oxide is not reduced by chemical reactions since

(A) Reducing agent contaminate

(B) The process pollute the environment

(C) Aluminium oxide is highly stable

(D) Aluminium oxide is reactive

Correct Answer: C

Question 98 : Iron loses magnetic property at

(A) Melting point

(B) 1000 K

(C) Curie point

(D) Boiling point

Correct Answer: C

Question 99 : An example for a double salt is

(A) Potassium ferricyanide

(B) Cobalt hexamine chloride

(C) Cuprous sulphate

(D) Mohr's salt

Correct Answer: D

Question 100 : The set of compounds in which the reactivity of halogen atom in the ascending order is

(A) Viny1 chloride, chloroethane, chlorobenzene

(B) Viny1 chloride, chlorobenzene, chloroethane

(C) chloroethane, chlorobenzene, Viny1 chloride

(D) chlorobenzene, Viny1 chloride, chloroethane

Correct Answer: D

Question 101 : methanol is

(A) CH_3CHO

(B) CH_3COCH_3

(C) CH_2OH

(D) HCHO

Correct Answer: D

Question 102 : In the case of auto catalysis

(A) Product catalysis

(B) Solvent catalysis

(C) Reactant catalysis

(D) Heat produced in the reaction catalysis

Correct Answer: A

Question 103 :

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 104 : Order to reaction is decided by

(A) Molecularity

(B) Pressure

(C) Temperature

(D) Mechanism of reaction as well as relative concentration of reactants

Correct Answer: D

Question 105 : Half-life of a reaction is found to be inversely proportional to the cube of initial concentration. The order of reaction is

(A) 5

(B) 2

(C) 4

(D) 3

Correct Answer: C

Question 106 : Which among the following statement is false?

(A) The adsorption may be monolayered or multilayered

(B) Particle size of adsorbent will not affect the amount of adsorption

(C) Increase of pressure increases amount of adsorption

(D) Increase of temperature may decrease the amount of adsorption

Correct Answer: B

Question 107 : Purine derivative among the following bases is

(A) Cytosine

(B) Guanine

(C) Uracil

(D) Thymine

Correct Answer: B

Question 108 : A drug that is antipyretic as well as analgesic is

(A) Penicillin

(B) Chloroquin

(C) Para acetamidophenol

(D) Chloropromazine hydrochloride

Correct Answer: C

Question 109 : For a f – orbital the values of m_1 are

(A) – 1, 0 + 1

(B) 0, +1, + 2, + 3

(C) – 2, - 1, 0, + 1, + 2

(D) – 3, - 2, - 1, 0, + 1, + 2, + 3

Correct Answer: C

Question 110 : Chloride ion and potassium ion are isoelectronic. Then

(A) Potassium ion is relatively bigger

(B) Depends on the other cation and anion

(C) Their size are same

(D) Chloride ion is bigger than potassium ion

Correct Answer: D

Question 111 : In a reversible reaction a catalyst will affect

(A) The rate of forward reaction and reverse reaction

(B) Neither the forward reaction nor the rate of reverse reaction

(C) The rate of forward reaction

(D) The rate of reverse reaction

Correct Answer: A

Question 112 : Pentavalence in phosphorous is more stable when compared to that of nitrogen even through they belong to same group is due to

(A) Reactivity of phosphorous

(B) Inert nature of nitrogen

(C) Dissimilar electronic configuration

(D) Larger size of phosphorous atom

Correct Answer: C

Question 113 : Aqueous solutions of hydrogen sulphide and sulphurdioxide when mixed together, yield

(A) Sulphur trioxide and water

(B) Hydrogen and sulphurous acid

(C) Sulphur and water

(D) Hydrogen peroxide and sulphur

Correct Answer: C

Question 114 : A salt producing hydrocarbon among these compounds is

(A) Ethane

(B) Methane

(C) Ethene

(D) Ethyne

Correct Answer: D

Question 115 : Octane number is zero for

(A) N – octane

(B) Iso – octane

(C) N – heptane

(D) Iso – heptane

Correct Answer: C

Question 116 : The intensive property among these quantities is

(A) Enthalpy

(B) Mass/volume

(C) Mass

(D) Volume

Correct Answer: B

Question 117 : 30g of Mg and 30g of oxygen are reacted and the residual mixture contains

(A) 45g of MgO and 15 g of O_2

(B) 50g of MgO and 10 g of O_2

(C) 60g of MgO only

(D) 40g of MgO and 20 g of O_2

Correct Answer: B

Question 118 : 3 g of oxide of a metal is converted to chloride completely and it yielded 5 g of chloride. The equivalent weight of metal is

(A) 12

(B) 20

(C) 33.25

(D) 2.325

Correct Answer: C

Question 119 : 20 ml of 0.25 N strong acid and 30 ml 0.2 N of strong base are mixed; the resulting solution is

(A) 0.02 N acidic

(B) 0.025 N basic

(C) 0.02 N basic

(D) 0.025 N acidic

Correct Answer: C

Question 120 : The rate of forward reaction is two times that of reverse reaction at a given temperature and identical concentration. Kequilibrium is

(A) 2.5

(B) 2.0

(C) 0.5

(D) 1.5

Correct Answer: B

SUBJECT: Mathematics

Question 121 :

If Y = {x : x is a positive factor of the number 2p – 1(2p – 1), where 2p – 1 is a prime number}, then Y can be represent in roster form as

(A) {2}

(B) {1, 2}

(C) {1, 2, 22, ..., 2p – 1}

(D) {1, 2, 22, 23,.... 2p – 1, (2p – 1)}

Solution :

The factors of 2p – 1(2p – 1), where 2p – 1 is a prime number, are 1, 2, 22, 23, ..., 2p – 1 and (2p – 1).

So, the roster form of given set is

{1, 2, 22, 23, ..., 2p – 1, (2p – 1)}.

Correct Answer: D

Question 122 :

The set {x : x is a positive integer less than 6 and 3x – 1 is an even number} in roster form is

(A) {1, 2, 3, 4, 5}

(B) {1, 2, 3, 4, 5, 6}

(C) {2, 4, 6}

(D) {1, 3, 5}

Correct Answer: D

Question 123 : Let A and B are two sets having 3 elements in common. If n(A) = 5 and n(B) = 4, then n[(A × B) $\cap$ (B × A)] is equal to

(A) 20

(B) 25

(C) 16

(D) 9

Solution : If A and B have n common elements, then A × B and B × A will have n^2 common

elements.

Correct Answer: D

Question 124 : If n(A) = 3, n(B) = 4 then, n(A × A × B) is equal to

(A) 36

(B) 12

(C) 108

(D) None of these

Solution :

Clearly,

$n(A \times A \times B) = n(A) \times n(A) \times n(B)$

$= 3 \times 3 \times 4 = 3^6$

Correct Answer: A

Question 125 : If $\frac{(1+i)^2}{2-i} = x + iy$, then $x + y$ is equal to

(A) $-\frac{2}{5}$

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

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

(D) $-\frac{6}{5}$

Correct Answer: C

Question 126 : The multiplicative inverse of $\sqrt{5}+3i$ is

(A) $\frac{\sqrt{5}}{14}+\frac{3i}{14}$

(B) $\frac{\sqrt{5}}{14}-\frac{3i}{14}$

(C) $\frac{\sqrt{5}}{14}-\frac{3i}{14}$

(D) $\frac{\sqrt{5}}{13}+\frac{3i}{13}$

Solution :

Let $z=\sqrt{5}+3i$, then its multiplicative inverse is

$$\frac{1}{z}=\frac{1}{\sqrt{5}+3i}=\frac{1}{\sqrt{5}+3i}\times\frac{\sqrt{5}-3i}{\sqrt{5}-3i}$$

$$=\frac{\sqrt{5}-3i}{5-9i^2}\ [\because (a+b)(a-b)=a^2-b^2]$$

$$=\frac{\sqrt{5}-3i}{5+9}=\frac{\sqrt{5}-3i}{14}\ [\because i^2=-1]$$

$$=\frac{\sqrt{5}}{14}-\frac{3i}{14}$$

Correct Answer: B

Question 127 : What is the value of n sot that $\frac{a^{n+1}+b^{n+1}}{a^n+b^n}$ is the geometric mean between a and b? where $a \neq b$

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

(B) $n = \frac{-1}{2}$

(C) n = 2

(D) –2

Solution :

$Q\ \frac{a^{n+1}+b^{n+1}}{a^n+b^n}$ is GM between a and b.

$\therefore\ \frac{a^{n+1}+b^{n+1}}{a^n+b^n} = a^{1/2}.b^{1/2}$

$\Rightarrow (a^{n+1}+b^{n+1}) = (a^n+b^n)a^{1/2}.b^{1/2}$

$\Rightarrow (a^{n+1}+b^{n+1}) = a^{\left(n+\frac{1}{2}\right)}b^{1/2}+a^{1/2}.b^{\left(n+\frac{1}{2}\right)}$

$\Rightarrow \left\{a^{n+1}-a^{\left(n+\frac{1}{2}\right)}b^{1/2}\right\} = a^{1/2}.b^{\left(n+\frac{1}{2}\right)}-b^{n+1}$

$\Rightarrow a^{\left(n+\frac{1}{2}\right)}\left(a^{\frac{1}{2}}-b^{\frac{1}{2}}\right) = b^{\left(n+\frac{1}{2}\right)}\left(a^{\frac{1}{2}}-b^{\frac{1}{2}}\right)$

$\Rightarrow a^{\left(n+\frac{1}{2}\right)} = b^{\left(n+\frac{1}{2}\right)}\ \left[Q\ a^{1/2}-b^{1/2} \neq 0, as\ a \neq b\right]$

$\Rightarrow \left(\frac{a}{b}\right)^{\left(n+\frac{1}{2}\right)} = 1$

$$\Rightarrow \left(\frac{a}{b}\right)^{\left(n+\frac{1}{2}\right)} = \left(\frac{a}{b}\right)^{0}$$

$$\Rightarrow n+\frac{1}{2}=0 \Rightarrow n=\frac{-1}{2}$$

Correct Answer: B

Question 128 : If logax, logbx, logex be in HP, then a, b, c are in

(A) AP

(B) HP

(C) GP

(D) None of these

Solution :

since, logax, logbx, logex are in HP.

$\therefore \frac{\log x}{\log a}, \frac{\log x}{\log b}, \frac{\log x}{\log c}$ are in HP

$\Rightarrow \frac{\log a}{\log x}, \frac{\log b}{\log x}, \frac{\log c}{\log x}$ are in AP

$\Rightarrow \log_x a, \log_x b, \log_x c$ are in AP

$\therefore$ a, b and c are in GP.

Correct Answer: C

Question 129 : The number of integers less than 720 and prime to it

(A) 144

(B) 192

(C) 216

(D) 36

Solution :

We have to find $\phi(720)$.

We shall first express 720 in canonical form

We have,

$720 = 2^4 \times 3^2 \times 5^1$

$\therefore \phi(720) = \phi(2^4 \times 3^2 \times 5^1) = \phi(2^4).\phi(3^2).\phi(5)$

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

$= 720 \times \frac{1}{2} \times \frac{2}{3} \times \frac{4}{5} = 192$

Correct Answer: B

Question 130 : The number of ways in which N = 2,778,300 can be resolved into the two factors prime to each other

(A) 10

(B) 9

(C) 8

(D) 7

Solution :

Correct Answer: C

Question 131 : How many 10-digit numbers can be written by using the digits 1 and 2?

(A)

(B) 2^{10}

(C) $^{10}C_2$

(D) $10!$

Solution : Each digit can be placed in 2 ways.
Required number of ways = 2^{10}

Correct Answer: B

Question 132 : The number of ways in which a team of eleven players can be selected from 22 players always including 2 of them and excluding 4 of them is

(A) $^{16}C_{11}$

(B) $^{16}C_5$

(C) $^{16}C_9$

(D) $^{20}C_9$

Solution : Required number of ways
$= 22 - 4 - {}^2C_{11} - 2 = {}^{16}C_9$

Correct Answer: C

Question 133 : If in the expansion of $(1 + x)^m (1 - x)^n$, the coefficient of x and x^2 and 3 and –6, respectively, then m is

(A) 6

(B) 9

(C) 12

(D) 24

Solution :

Correct Answer: C

Question 134 : The middle term in the expansion of $\left(x+\frac{1}{2x}\right)^{2n}$ is

(A) $\frac{1.3.5.....(2n-3)}{n!}$

(B) $\frac{1.3.5.....(2n-1)}{n!}$

(C)

(D) None of the above

Solution :

Given expression is $\left(x+\frac{1}{2x}\right)^{2n}$

$\therefore$ Middle term = ${}^{2n}C_n(x)^n\left(\frac{1}{2x}\right)^n$

$= \frac{2n!}{n!n!2^n} = \frac{1.3.5.....(2n-1)}{n!}$

Correct Answer: B

Question 136 : If the sum of the squares of the roots of the equation $x^2 - (a - 2)x - (a + 1) = 0$ is least, then the value of a is

(A) –1

(B) 1

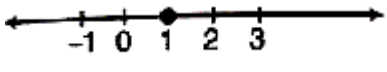
(C) 2

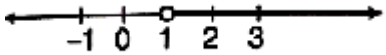
(D) –2

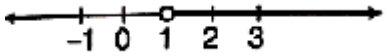
Solution :

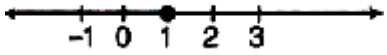
Correct Answer: B

Question 137 : The graph of the solutions of inequaltiy $\frac{3x-4}{2} \geq \frac{x+1}{4} - 1$ on number line is

(A) 

(B) 

(C) 

(D) 

Solution :

We have, $\frac{3x-4}{2} \geq \frac{x+1}{4} - 1$

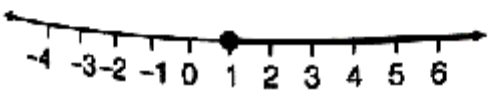
or $\frac{3x-4}{2} \geq \frac{x-3}{4}$

or $2(3x-4) \geq (x-3)$

or $6x - 8 \geq x - 3$

or $5x \geq 5$ or $x \geq 1$

The graphical representation of solutions is given in figure.



Correct Answer: A

Question 138 : The solution set of the inequality $4x + 3 < 6x + 7$ is

(A) $[-2, \infty)$

(B) $(-\infty, -2)$

(C) $(-2, \infty)$

(D) None of the above

Solution :

We have, $4x + 3 < 6x + 7$
or $4x + 3 - 6x - 3 < 6x + 7 - 6x - 3$
or $-2x < 4$ or $x > -2$
i.e. all the real numbers which are greater than -2, are the solutions of the given inequality. Hence, the solution set is $(-2, \infty)$.

Correct Answer: C

Question 139 : If A is square matrix such that $A^2 = A$, then $(A + I_3)$ is equal to

(A) A + 1

(B) 7A + I

(C) 3A + I

(D) A – I

Solution :

Given that, $A^2 = A$ ....(i)
Now, we have
$(I + A)^3 = (I)^3 + (A)^3 + 3I.A(I + A)$
$= I + A2.A + 3A(I + A)$ [Q $I^3 = I$, $I.A = A$]
$= I + A.A + 3A(I + A)$ [Q $A^2 = A$]
$= I + A^2 + 3(A.I + A^2)$
$= I + A + 3(A + A)$ [Q $A^2 = A$]
$= I + A + 3(A)$
$= I + A + 6A$
$= 7A + I$

Correct Answer: B

If $A=\begin{bmatrix} 0 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 0 \end{bmatrix}$ and I is the identity matrix

Question 140 : of order 2, then $(I-A)\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ is equal to

(A) A

(B) I

(C) I + A

(D) None of these

Solution :

Here, $A=\begin{bmatrix} 0 & -t \\ t & 0 \end{bmatrix}$, where $t=\tan\left(\frac{\alpha}{2}\right)$

$$\text{Now, } \cos\alpha = \frac{1-\tan^2\left(\frac{\alpha}{2}\right)}{1+\tan^2\left(\frac{\alpha}{2}\right)} = \frac{1-t^2}{1+t^2}$$

$$\text{and } \sin\alpha = \frac{2\tan^2\left(\frac{\alpha}{2}\right)}{1+\tan^2\left(\frac{\alpha}{2}\right)} = \frac{2t}{1+t^2}$$

Now, we have

$$(I-A)\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$$

$$= \left[\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - \begin{pmatrix} 0 & -t \\ t & 0 \end{pmatrix}\right]\begin{bmatrix} \frac{1-t^2}{1+t^2} & \frac{-2t}{1+t^2} \\ \frac{2t}{1+t^2} & \frac{1-t^2}{1+t^2} \end{bmatrix}$$

$$= \begin{bmatrix} 1 & t \\ -t & 1 \end{bmatrix} \begin{bmatrix} \frac{1-t^2}{1+t^2} & \frac{-2t}{1+t^2} \\ \frac{2t}{1+t^2} & \frac{1-t^2}{1+t^2} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1-t^2+2t^2}{1+t^2} & \frac{-2t+t(1-t^2)}{1+t^2} \\ \frac{-t(1-t^2)+2t}{1+t^2} & \frac{2t^2+1-t^2}{1+t^2} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1+t^2}{1+t^2} & \frac{-2t+t-t^3}{1+t^2} \\ \frac{-t+t^3+2t}{1+t^2} & \frac{2t^2+1-t^2}{1+t^2} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1+t^2}{1+t^2} & \frac{-(1+t^2)}{1+t^2} \\ \frac{t(1+t^2)}{1+t^2} & \frac{1+t^2}{1+t^2} \end{bmatrix} = \begin{bmatrix} 1 & -t \\ t & 1 \end{bmatrix} \quad \ldots\ldots(i)$$

$$\text{Now, } I + A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 0 & -t \\ t & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 0+1 & -t+0 \\ t+0 & 0+1 \end{bmatrix} = \begin{bmatrix} 1 & -t \\ t & 1 \end{bmatrix} \quad \ldots\ldots(ii)$$

On putting the value of t in both equations, we get

$$\begin{bmatrix} 1 & -\tan\left(\frac{\alpha}{2}\right) \\ \tan\left(\frac{\alpha}{2}\right) & 1 \end{bmatrix} = \begin{bmatrix} 1 & -\tan\left(\frac{\alpha}{2}\right) \\ \tan\left(\frac{\alpha}{2}\right) & 1 \end{bmatrix}$$

$$\therefore (I - A) \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix} = I + A$$

Correct Answer: C

Question 141 : If $\begin{vmatrix} a & b & 0 \\ 0 & a & b \\ b & 0 & a \end{vmatrix} = 0$, then

(A) a is one of the cube roots to unity

(B) b is one of the cube roots of unity

(C) $\left(\frac{a}{b}\right)$ is one of the cube roots of unity

(D) $\left(\frac{a}{b}\right)$ is one of the cube roots of –1

Solution :

We have, $\Delta = \begin{vmatrix} a & b & 0 \\ 0 & a & b \\ b & 0 & a \end{vmatrix} = 0$

$\Rightarrow \Delta = a(a^2 - 0) - b(0 - b^2)$

$= a^3 + b^3$

$\Rightarrow a^3 + b^3 = 0$

$\Rightarrow \left(\frac{a}{b}\right)^3 = -1$

$\therefore \left(\frac{a}{b}\right)$ is one of the cube roots of – 1

Correct Answer: D

Question 142 : If $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{bmatrix}$, then

(A) |3A| = 3 |A|

(B) |3A| = 9 |A|

(C) |3A| = 27 |A|

(D) None of these

Given. $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{bmatrix}$

It can be observed that in the first column, two entries are zero. Thus, we expand the matrix A along the first column (C_1) for finding |A|.

$\therefore |A| = 1 \begin{vmatrix} 1 & 2 \\ 0 & 4 \end{vmatrix} - 0 \begin{vmatrix} 0 & 1 \\ 0 & 4 \end{vmatrix} + 0 \begin{vmatrix} 0 & 1 \\ 1 & 2 \end{vmatrix}$

$= 1\,(1 \times 4 - 0 \times 2) = 4$

$\therefore 27\,|A| = 27 \times 4 = 108$ .....(i)

Now, $3A = 3 \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 0 & 3 \\ 0 & 3 & 6 \\ 0 & 0 & 12 \end{bmatrix}$

$\therefore |3A| = \begin{bmatrix} 3 & 0 & 3 \\ 0 & 3 & 6 \\ 0 & 0 & 12 \end{bmatrix}$

$|3A| = 3 \begin{vmatrix} 3 & 6 \\ 0 & 12 \end{vmatrix} - 0 \begin{vmatrix} 0 & 3 \\ 0 & 12 \end{vmatrix} + 0 \begin{vmatrix} 0 & 3 \\ 3 & 6 \end{vmatrix}$

Solution :

$= 3\,(3 \times 12 - 0 \times 6)$

$\Rightarrow |3A| = 3(36) = 108$ ..... (ii)

From Eqs. (i) and (ii), we get

$|3A| = 27\,|A|$

Note If A is a square matrix or order n, then $|kA| = k^n\,|A|$.

Correct Answer: C

The value of

$$\left(1+\cos\frac{\pi}{6}\right)\left(1+\cos\frac{\pi}{3}\right)\left(1+\cos\frac{2\pi}{3}\right)\left(1+\cos\frac{7\pi}{6}\right)$$

Question 143 : is

(A) $\frac{3}{16}$

(B) $\frac{3}{8}$

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

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

Solution :

$$\left(1+\cos\frac{\pi}{6}\right)\left(1+\cos\frac{\pi}{3}\right)\left(1+\cos\frac{2\pi}{3}\right)\left(1+\cos\frac{7\pi}{6}\right)$$

$$=\left(1+\frac{\sqrt{3}}{2}\right)\left(1+\frac{1}{2}\right)\left(1-\frac{1}{2}\right)\left(1-\frac{\sqrt{3}}{2}\right)$$

$$=\left(1+\frac{3}{4}\right)\left(1-\frac{1}{4}\right)$$

$$=\frac{1}{4}\times\frac{3}{4}=\frac{3}{16}$$

Correct Answer: A

Question 144 : If $\sec\theta = m$ and $\tan\theta = n$, then $\frac{1}{m}\left[(m+n)+\frac{1}{(m+n)}\right]$ is equal to

(A) 2

(B) 2m

(C) 2n

(D) mn

$$\frac{1}{m}\left[(m+n)+\frac{1}{(m+n)}\right]$$

$$=\frac{1}{\sec\theta}\left[(\sec\theta+\tan\theta)+\frac{1}{\sec\theta+\tan\theta}\right]$$

$$=\frac{\left[\sec^2\theta+\tan^2\theta+2\sec\theta\tan\theta+1\right]}{\sec\theta(\sec\theta+\tan\theta)}$$

Solution : $=\frac{2\sec^2\theta+2\sec\theta\tan\theta}{\sec\theta(\sec\theta+\tan\theta)}=2$

Correct Answer: A

Question 145 : Range of $\tan^{-1}\left(\frac{2x}{1+x^2}\right)$ is

(A) $\left[-\frac{\pi}{4},\frac{\pi}{4}\right]$

(B) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$

(C) $\left[-\frac{\pi}{2},\frac{\pi}{4}\right]$

(D) $\left[\frac{\pi}{2},\frac{\pi}{4}\right]$

$(1+x^2)\geq 2|x|$

$$\Rightarrow \frac{2|x|}{1+x^2}\leq 1 \Rightarrow -1\leq\frac{2x}{1+x^2}\leq 1$$

Solution : $\Rightarrow \tan^{-1}\left(\frac{2x}{1+x^2}\right)\in\left[-\frac{\pi}{4},\frac{\pi}{4}\right]$

Correct Answer: A

Question 146 : If f(x) = $\sec^{-1}x + \tan^{-1}x$, then f(x) is real for

(A) $x \in [-1, 1]$

(B) $x \notin [-1, 1]$

(C) $x \in [-\infty, -1] \cup [1, \infty]$

(D) $x \in [-\infty, -1] \cup [1, -\infty]$

Solution :

Given, $f(x) = \sec^{-1} + \tan^{-1}x$

Here, domain of $\sec^{-1}x = R$

and domain of $\tan^{-1}x = (-\infty, -1] \cup [1, \infty]$

$\therefore$ $D\{f(x)\} = D(\sec^{-1}x) \cap D(\tan^{-1}x)$

$= \{(-\infty, -1] \cup [1, \infty)\} \cap R$

$= (-\infty, -1)] \cup [1, \infty)$

Correct Answer: C

Question 147 : $\lim_{x \to \tan^{-1}3} \left(\frac{\tan^2 x - 2\tan x - 3}{\tan^2 x + 4\tan x + 3}\right)$ equal

(A) 1

(B) 2

(C) ZERO

(D) 3

$$\lim_{x \to \tan^{-1}3} \left(\frac{\tan^2 x - 2\tan x - 3}{\tan^2 x + 4\tan x + 3}\right)$$

Solution : $$I = \frac{lim}{tanx \to 3} \frac{\tan x + 1}{tanx - 1} = \frac{3+1}{3-1} = \frac{4}{2} = 2$$

Correct Answer: B

Question 148 : $\lim_{x\to 0}\frac{e^{\sin x}-1}{x}$ is equal to

(A) ZERO

(B) e

(C) 1

(D) does not exist

$$\lim_{x\to 0}\frac{e^{\sin x}-1}{x}$$

$$=\lim_{x\to 0}\frac{\left(e^{\sin x}-1\right)}{\sin x}\times\frac{\sin x}{x}$$

Solution : $=1\times 1=1$

Correct Answer: C

Question 149 : Derivative of $\sqrt{e^{\sqrt{x}}}$ with respect to x is

(A) $\frac{e^{\sqrt{x}}}{2\sqrt{xe^{\sqrt{x}}}}$

(B) $\frac{4e^{\sqrt{x}}}{2\sqrt{xe^{\sqrt{x}}}}$

(C) $\frac{e^{\sqrt{x}}}{4\sqrt{xe^{\sqrt{x}}}}$

(D) $\frac{e^{\sqrt{x}}}{\sqrt{e^{\sqrt{x}}}}$

Solution :

Let $y = (e^{\sqrt{x}})^{1/2}$

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

$$\frac{dy}{dx} = \frac{1}{2}(e^{\sqrt{x}})^{\frac{1}{2}-1}\frac{d}{dx}e^{\sqrt{x}}$$

$$\Rightarrow \frac{dy}{dx} = \frac{1}{2}(e^{\sqrt{x}})^{-\frac{1}{2}}.e^{\sqrt{x}}.\frac{d}{d}(\sqrt{x})$$

$$\Rightarrow \frac{dy}{dx} = \frac{1}{2}\frac{e^{\sqrt{x}}}{\sqrt{e^{\sqrt{x}}}} \times \frac{1}{2\sqrt{x}} = \frac{e^{\sqrt{x}}}{4\sqrt{x}\sqrt{e^{\sqrt{x}}}} = \frac{e^{\sqrt{x}}}{4\sqrt{xe^{\sqrt{x}}}}$$

Correct Answer: C

Question 150 : Find $\frac{dy}{dx}$, when $x = \frac{3at}{1+t^3}$ and $y = \frac{3at^2}{1+t^3}$.

(A) $\frac{t^3-4}{1-2t^2}$

(B) $\frac{t(2-t^3)}{1-2t^3}$

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

(D) None of these

$$x = 3a.\frac{t}{1+t^3}$$

$$\therefore \frac{dx}{dt} = 3a.\frac{(1+t^3)\frac{d}{dt}t - t.\frac{d}{dt}(1+t^3)}{(1+t^3)^2}$$

$$= 3a.\frac{(1+t^3).1 - t.3t^2}{(1+t^3)^2} = 3a.\frac{1-2t^3}{(1+t^3)^2}$$

Again, $y = 3a.\frac{t^2}{1+t^3}$

$$\therefore \frac{dy}{dt} = 3.a\frac{(1+t^3)\frac{d}{dt}t^2 - t^2\frac{d}{dt}(1+t^2)}{(1+t^3)^2}$$

$$= 3a.\frac{(1+t^3).2t - t^2.3t^2}{(1+t^3)^2}$$

$$= 3a.\frac{t(2-t^3)}{(1+t^3)^2}$$

Solution :

$$\therefore \frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{3at(2-t^3)}{(1+t^3)^2} \times \frac{(1+t^3)^2}{3a(1-2t^3)} = \frac{t(2-t^3)}{1-2t^3}$$

Correct Answer: B

Question 151 : The approximate value of $\sqrt{36.6}$ is

(A) 6.02

(B) 6.04

(C) 6.05

(D) 6.06

Solution :

Let $y = \sqrt{x}$, $x = 36$ and $\Delta x = 0.6$

Then, $\Delta y = \sqrt{x + \Delta x} - \sqrt{x}$

$= \sqrt{36.6} - \sqrt{36} = \sqrt{36.6} - 6$

$\Rightarrow \sqrt{36.6} = 6 + \Delta y$

Now, $\Delta y \cong \left(\frac{dy}{dx}\right)\Delta x = \frac{1}{2\sqrt{x}}.\Delta x$

$= \frac{1}{2\sqrt{36}} \times 0.6 = 0.05$

$\therefore$ Approximately value of $\sqrt{36.6} = 6 + 0.05 = 6.05$

Correct Answer: C

Question 152 : Find the equation of the tangent to the curve $y = \frac{x-7}{(x-2)(x-3)}$ at the point, where it cuts the

(A) x + 20y + 7 = 0

(B) 20y + x – 7 = 0

(C) 20y – x + 7 = 0

(D) 20x – y – 7 = 0

Solution :

Put y = 0 (for X-axis) in the given equation

$y = \frac{x-7}{(x-2)(x-3)}$, we get the point (7, 0).

Now, $\frac{dy}{dx} = \frac{d}{dx}\left[\frac{5}{x-2} - \frac{4}{x-3}\right]$ [by partial fraction]

$\Rightarrow \frac{dy}{dx} - \frac{5}{(x-2)^2} + \frac{4}{(x-3)^2}$

$\Rightarrow \left(\frac{dy}{dx}\right)_{(7,0)} - \frac{5}{25} + \frac{4}{16} = \frac{1}{20}$

$\therefore$ Required equation of tangent is

$y - 0 = \frac{1}{20}(x-7)$

$\Rightarrow 20y - x + 7 = 0$

Correct Answer: C

Question 153 : $\int \frac{\sin x + \cos x}{\sqrt{1+\sin 2x}} dx$ is equal to

(A) log (sinx + cosx) + C

(B) x + C

(C) log(1 + sin 2x) + C

(D) sinx + cos x + C

Solution :

We have, $I = \int \frac{\sin x + \cos x}{\sqrt{1+\sin 2x}} dx$

$= \int \frac{\sin x + \cos x}{\sqrt{\sin^2 x + \cos^2 + 2 \sin x \cos x}} dx$

$= \int \frac{\sin x + \cos x}{\sin x + \cos x} dx = \int 1 \, dx = x + C$

Correct Answer: B

Question 154 : $\int \sin^3 x \cos x \, dx$ is euqal to

(A) $\frac{\cos^4 x}{4} + C$

(B) $\sin^4 x + C$

(C) $\frac{\sin^4 x}{4} + C$

(D) $\frac{\sin 4x}{4} + C$

Solution : We have, $I = \int \sin^3 x \cos x \, dx$

Put $\sin x = t \Rightarrow \cos x \, dx = dt$

$\therefore I = \int t^3 \, dt = \frac{t^4}{4} + C = \frac{1}{4}\sin^4 x + C$

Correct Answer: C

Question 155 : The solution of $e^{-y} dy = e^x dx$ at (1,0) is

(A) $x = e^y - 1$

(B) $-e^{-y} = e^x - e - 1$

(C) $y = e^x - 1$

(D) None of these

Solution :

We have, $e^{-y}dy = e^x\,dx$

On integrating both sides, we get

$\Rightarrow -e^{-y} = e^x + C$

At(1, 0), we get

$-e^{-0} = e^1 + C \Rightarrow C = -e - 1$

$\therefore\ -e^{-y} = e^x - e - 1$

Correct Answer: B

Question 156 : The solution of $\frac{dy}{dx} = e^{x-y} + x^2e^{-y}$ is

(A) $e^{-y} = e^x + \frac{x^3}{3} + C$

(B) $e^{y} = e^x + \frac{x^3}{3} + C$

(C) $e^{-y} = e^{-x} + \frac{x^3}{3} + C$

(D) None of these

Solution :

Given differential equation is

$\frac{dy}{dx} = e^{x-y} + x^2e^{-y}$

$\Rightarrow \frac{dy}{dx} = e^{-y}(e^x + x^2)$

$\Rightarrow \frac{1}{e^{-y}}\,dy = (e^x + x^2)\,dx$

On integrating both sides, we get

$\int e^y dy = \int (e^x + x^2)dx$

$\Rightarrow e^y = e^x + \frac{x^3}{3} + C$

Correct Answer: B

Question 157 : If a DABC has vertices (0, 0), (11, 60) and (91, 0). If the line y = kx cuts the triangle into two triangles of equal area, then k is equal to

(A) $\frac{30}{51}$

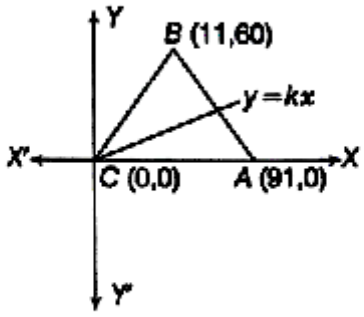
(B) $\frac{4}{7}$

(C) $\frac{7}{4}$

(D) $\frac{30}{91}$

Solution :

As the line divides the ΔABC in equal area. Mid-point of AB (51, 30) which lies on y = kx.



$\therefore$ 30 = 51 $\Rightarrow$ k = $\frac{30}{51}$

Correct Answer: A

Question 158 : The circumcentre of the triangle with vertices (8, 6), (8, –2) and (2, –2) is at the point

(A) (2, –1)

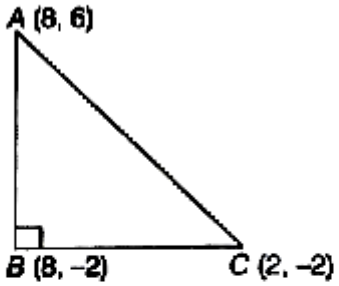
(B) (1, –2)

(C) (5, 2)

(D) (2, 5)

Solution :

Let the vertices of a triangle are A(8,6), B(8, –2) and C (2, –2).



Now, $AB = \sqrt{(8-8)^2+(6+2)^2} = \sqrt{0+8^2} = 8$

$BC = \sqrt{(2-8)^2+(-2+2)^2} = \sqrt{36+0} = 6$

and $CA = \sqrt{(8-2)^2+(6+2)^2} = \sqrt{6^2+8^2}$

$= \sqrt{36+64} = \sqrt{100} = 10$

Now, $AB^2 + BC^2 = (8)^2 + (6)^2 = 64 + 36 = 100 = AC^2$

So, ABC is a right angled triangle and right angled at B.

Correct Answer: C

Question 159 : The equation of the circle, the end points of whose diameter are the centres of the circles
$x^2 + y^2 + 6x – 14y = 1$ and $x^2 + y^2 – 4x + 10y = 2$, is

(A) $x^2 + y^2 – 2x + y – 41 = 0$

(B) $x^2 + y^2 – 2x – y – 41 = 0$

(C) $x^2 + y^2 + x – 2y – 41 = 0$

(D) $x^2 + y^2 + x – 2y + 41 = 0$

Clearly, centres of the circles
$x^2 + y^2 + 6x - 14y = 1$ and $x^2 + y^2 - 4x + 10y = 2$
are $(-3, 7)$ and $(2, -5)$ respectively.
As per question $(-3, 7)$ and $(2, -5)$ are the extremities of the diameter of the required circle.
$\therefore$ Equation of the requirec circle is
$(x + 3)(x - 2) + (y - 7)(y + 5) = 0$

Solution : $\Rightarrow x^2 + y^2 + x - 2y - 41 = 0$

Correct Answer: C

Question 160 : If $(2 + 4\cos\theta, -1 + 4\sin\theta)$ are parametric coodinates of the circle, then its cartesian equation is

(A) $(x + 2)^2 + (y + 1)^2 = 16$

(B) $(x - 2)^2 + (y - 1)^2 = 16$

(C) $(x + 2)^2 + (y - 1)^2 = 16$

(D) $(x - 2)^2 + (y + 1)^2 = 16$

From the given condition, we have
$x = 2 + 4\cos\theta$
$\Rightarrow x - 2 = 4\cos\theta$ .....(i)
and $y = -1 + 4\sin\theta$
$\Rightarrow y + 1 = 4\sin\theta$ .....(ii)
On squaring and adding eqs. (i) and (ii), we get

Solution : $(x - 2)^2 + (y + 1)^2 = 16$

Correct Answer: D

Question 161 : Vertex and Focus of the parabola $y^2 - 4y - 2x - 8 = 0$ are respectively

(A) $(-6,2)\left(\frac{-11}{2},2\right)$

(B) $(-5,2)\left(\frac{-11}{2},2\right)$

(C) $\left(\frac{-11}{2},2\right),(-6,2)$

(D) None of these

Solution :

Given equation of parabolais

$y^2 - 4y - 2x - 8 = 0$

$y^2 - 4y + 4 = 2x + 8 + 4$

or $(y-2)^2 = 2(x+6)$ .....(i)

This is of the form $Y^2 = 4aX$,

where $X = x + 6$, $Y = y - 2$, $4a = 2$

$\Rightarrow a = \frac{1}{2}$

Q Vertex is given by $X = 0$, $Y = 0$

$\therefore x + 6 = 0$, $y - 2 = 0$

$\Rightarrow x = -6$, $y = 2$

$\therefore$ Vertex $\equiv (-6, 2)$

and Focus is given by $X = a$, $Y = 0$

$\therefore x + 6 = \frac{1}{2}$, $y - 2 = 0$

$\therefore x = \frac{-11}{2}$, $y = 2$

$\therefore$ Focus $\equiv \left(\frac{-11}{2},2\right)$

Correct Answer: A

Question 162 : Parametric equatio of parabola $y^2 = 12x$ is

(A) $x = 6t^2$, $y = 3t$

(B) $x = t^2$, $y = t$

(C) $x = 3t^2$, $y = 6t$

(D) $x = 12t^2$, $y =$

Given, $y^2 = 12x$

Here, $4a = 12$

$\Rightarrow a = 3$

Q Parametric equation of parabola

$y^2 = 4ax$ are $x = at^2$, $y = 2at$

$\therefore$ Parametic equation of given parabola are

Solution : $x = 3t^2$ and $y = 6t$

Correct Answer: C

Question 163 : If $\mathbf{a}$ and $\mathbf{b}$ are two unit vectors inclined at an angle $\pi/3$, then the value of $|\mathbf{a} + \mathbf{b}|$ is

(A) equal to

(B) greater than 1

(C) equal to 0

(D) less than 1

Given, $|\mathbf{a}| = |\mathbf{b}| = 1$ and $\theta = \pi/3$

Now, $|\mathbf{a} + \mathbf{b}|^2 = |\mathbf{a}|^2 + |\mathbf{b}|^2 = 2|\mathbf{a}|\,|\mathbf{b}|\cos\theta$

$$= 1^2 + 1^2 + 2 \times 1 \times 1 \times \cos\frac{\pi}{3}$$

Solution : $\Rightarrow |\mathbf{a}+\mathbf{b}| = \sqrt{3} > 1$

Correct Answer: B

Question 164 : If $\hat{i}+\hat{j}$, $\hat{j}+\hat{k}$ and $\hat{i}+\hat{k}$ are the position vectors of the vertices of a ΔABC taken in order, then $\angle A$ is equal to

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

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

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

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

Solution :

Let position vector of the vertices be

$\mathbf{OA} = \hat{i}+\hat{j}$, $\mathbf{OB} = \hat{j}+\hat{k}$ and $\mathbf{OC} = \hat{i}+\hat{k}$

Now, $\mathbf{AB} = -\hat{i}+\hat{k}$ AC and $\hat{k}-\hat{j}$

$$\therefore \cos\theta = \frac{(\mathbf{AB}).(\mathbf{AC})}{|\mathbf{AB}||\mathbf{AC}|}$$

$$= \frac{(-\hat{i}+\hat{k}).(\hat{k}-\hat{j})}{\sqrt{1^2+1^2}\sqrt{1^2+1^2}}$$

$$= \frac{(\hat{k})^2}{\sqrt{2}\sqrt{2}} = \frac{1}{2} \Rightarrow \theta = \frac{\pi}{3}$$

Correct Answer: D

Question 165 : Let u, v and w be vectors such that u + v + w = 0. If |u| = 3, |v| = –1 and |w| = 5, then u.v + v.w + w.u is equal to

(A) ZERO

(B) –25

(C) 25

(D) 50

Solution :

Given, $|\mathbf{u}| = 3$, $|\mathbf{v}| = 4$ and $|\mathbf{w}| = 5$

Also, $\mathbf{u} + \mathbf{v} + \mathbf{w} = 0$

On squaring both sides, we get

$|\mathbf{u}|^2 + |\mathbf{v}|^2 + |\mathbf{w}|^2 + 2(\mathbf{u}.\mathbf{v} + \mathbf{v}.\mathbf{w} + \mathbf{w}.\mathbf{u}) = 0$

$\Rightarrow 3^2 + 4^2 + 5^2 + 2(\mathbf{u}.\mathbf{v} + \mathbf{v}.\mathbf{w} + \mathbf{w}.\mathbf{u}) = 0$

$\therefore \mathbf{u}.\mathbf{v} + \mathbf{v}.\mathbf{w} + \mathbf{w}.\mathbf{u} = -\frac{50}{2} = -25$

Correct Answer: B

Question 166 : If the line passing through the points (5, 1, a) and (3, b, 1) crosses the YZ-plane at the point $\left(0, \frac{17}{2}, -\frac{13}{2}\right)$, then

(A) a = 8, b = 2

(B) a = 2, b = 8

(C) a = 4,b = 6

(D) a = 6, b = 4

Solution :

Equation of line passing through (5, 1, a) and (3, b, 1) is

$$\frac{x-3}{5-3} = \frac{y-b}{1-b} = \frac{z-1}{a-1} \quad \ldots..(i)$$

Also, point $\left(0, \frac{17}{2}, -\frac{13}{2}\right)$ satisfies Eq. (i), we get

$$-\frac{3}{2} = \frac{\frac{17}{2}-b}{1-b} = \frac{-\frac{13}{2}-1}{a-1}$$

On solving I, III and I, II separately we get a = 6 and b = 4

Correct Answer: D

Two lines, whose equations are

$$\frac{x-3}{2}=\frac{y-2}{3}=\frac{z-1}{\lambda} \text{ and } \frac{x-2}{3}=\frac{y-3}{2}=\frac{z-2}{3}$$

lie in the same plane. Then, the value of $\sin^{-1}\sin\lambda$ is equal to

Question 167 :

(A) 3

(B) $\pi-3$

(C) 4

(D) $\pi-4$

Given lines lie in the same plane. So, both are coplanar.

$$\therefore \begin{vmatrix} 2 & 3 & \lambda \\ 3 & 2 & 3 \\ 1 & -1 & -1 \end{vmatrix} = 0 \Rightarrow 5\lambda = 20 \Rightarrow \lambda = 4$$

Solution : $\therefore \sin^{-1}\sin\lambda = \sin^{-1}\sin 4 = \sin^{-1}\sin(\pi-4) = \pi-4$

Correct Answer: B

Question 168 : The equation of the plane passing through the point (–2, –2, 2) and containing the line joining the points (1, 1, 1) and (1, –1, 2) is

(A) x + 2y – 3z + 4 = 0

(B) 3x – 4y + 1= 0

(C) 5x + 2y – 3z – 17 =0

(D) x – 3y – 62 + 8 = 0

Solution : Equation of a plane through (–2, –2, 2) is given by
$a(x + 2) + b(y + 2) + c(z - 2) = 0$
It contains the line joining the points (1, 1, 1) and B(1, –1, 2), so these points also lie in the plane.
$\therefore\ 3a + 3b - c = 0$ and $3a + b + 0.c = 0$

$$\Rightarrow \frac{a}{1} = \frac{b}{-3} = \frac{c}{-6} = r \quad \text{[say]}$$

$c = -6r$
So, equation of the plane is
$x - 3y - 6z + 8 = 0.$

Correct Answer: D

Question 169 : The average salary of male employees in a firm was Rs. 5200 and that of females was Rs. 4200. The mean salary of all the employees was Rs. 5000. The percentage of male and female employees are respectively

(A) 80, 20

(B) 20, 80

(C) 60, 40

(D) 52, 48

Solution : Let x_1 = Rs. 5200, x_2 = Rs. 4200, $\bar{x}$ = Rs. 5000

Also, we know that $\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$

$$\Rightarrow 5000(n_1 + n_2) = 5200n_1 + 4200n_2 \Rightarrow \frac{n_1}{n_2} = \frac{4}{1}$$

$\therefore$ The percentage of male employees in the firm

$$= \frac{4}{4+1} \times 100 = 80\%$$

and the percentage of female employees in the firm

$$= \frac{1}{4+1} \times 100 = 20\%$$

Correct Answer: A

Question 170 : The geometric mean of the numbers 3, 32, 33,....3n is

(A) $3^{2/n}$

(B) $3^{(n-1)/2}$

(C) $3^{n/2}$

(D) $3^{(n+1)/2}$

Solution : $\therefore GM = (3.3^2 \ldots . 3^n)^1$

$= 3^{\frac{1+2+\ldots+n}{n}}$

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

Correct Answer: D

Question 171 : The mean of n terms is . If the first term is increased by 1, second by 2 and so on, then the new mean is

(A) $\bar{x} + n$

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

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

(D) None of the above

Solution :

Let the observations be $x_1, x_2, x_3, \ldots, x_n$.

Now, mean $(\bar{x}) = \frac{x_1 + x_2 + \ldots + x_n}{n}$

When first term is increaeed by 1, second term is increased by 2 and so on, then the observation will be

$(x_1 + 1), (x_2 + 2), (x_3 + 3), \ldots, (x_n + n)$.

Then, new mean

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

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

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

Correct Answer: C

Question 172 : Ram is visiting a friend. Ram knows that his friend has 2 children and 1 of them is a boy. Assuming that a child is equally likely to be a boy or a girl, then the probability that the other child is a girl is

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

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

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

(D) $\frac{7}{10}$

Solution :

Total sample space = $\{B_1B_2, B_1G_1, G_1B_2\}$

Favourable ways = $\{B_1G_1, G_1B_2\}$

$\therefore$ Required prabability = $\frac{2}{3}$

Correct Answer: C

Question 173 : Three of the six vertices of a regular hexagon are chosen at random. The probability that the triangle with three vertices is equilateral equals

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

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

(C) $\frac{1}{10}$

(D) $\frac{1}{20}$

Solution :

In a regular hexagon, there are two equilateral triangles are possible.

$\therefore$ Required probability $= \frac{2}{{}^{6}C_{3}}$

$= \frac{2}{\frac{6\times5\times4}{3\times2}} = \frac{2}{20} = \frac{1}{10}$

Correct Answer: C

Question 174 : In a hurdle race, a runner has probability p of jumping over a specific hurdle. Given that in 9 trials, the runner succeeded 3 times, the conditionals probability that the runner had succeeded in the first trial, is

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

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

(C) $\frac{1}{5}$

(D) None of these

Solution :

Let A and B denote the event that the runner succeeds exactly 3 times out of 5 times and event that the runner succeds on the first trial.

$\therefore P\left(\frac{B}{A}\right) = \frac{P(B \cap A)}{P(A)}$

$\therefore P(B \cap A) = {}^4C_2 p^2(1-p)^2 = 6p^3(1-p)^2$

$P(A) = {}^5C_3 P^3(1-p)^2 = 10p^3(1-p)^2$

$\therefore P\left(\frac{B}{A}\right) = \frac{6p^3(1-p)^2}{10p^3(1-p)^2} = \frac{3}{5}$

Correct Answer: A

Question 175 : If $W_1 = \{(0, x_2, x_3, x_4, x_5) : x_2, x_3, x_4, x_5 \in \mathbf{R}\}$ and $W_2 = \{(x_1, 0, x_3, x_4, x_5): x_1, x_3, x_4, x_5, \in \mathbf{R}\}$ be subspace of R^5, then dim $(W_1 \cap W_2)$ is equal to

(A) 5

(B) 4

(C) 3

(D) 2

Solution :

Here, it is given that

$W_1 = \{(0, x_2, x_3, x_4, x_5): x_2, x_3, x_4, x_5 \in R\}$

and $W_2 = \{(x_1, 0, x_3, x_4, x_5): x_1, x_3, x_4, x_5 \in R\}$

which is subspace of R_5

Hence, $W_1 \cap W_2$ will be equal to 2.

Correct Answer: D

Question 176 : Which of the following statements is / are true?

(A) The intersection of any two subspaces of a vector space V(F) is again a subspace of V(F)

(B) The intersection of any two subspaces of a vector space V(F) is not a subspace of V(F)

(C) V(F) is the subspace of intersection of any two subspace of V(F)

(D) If V_1 and V_2 are two subspace of V, then $v_1 \in V_1$ and $v_2 \in V_2$, then $v_1 + v_2 \notin V_1 \cap V_2$

Solution :

Let V_1, V_2 be two subspace of the vector space V over a field F.

Let $v_1, v_2 \in V_1 \cap V_2$, a, b $\in$ F

Then, $v_1 \in V_1 \cap V_2 \cup v_1 \in V_1$

and $v_1 \in V_2$

$v_2 \in V_1 \cap V_2$

$\Rightarrow v_2 \in V_1$ and $v_2 \cap V_2$

$v_1, v_2 \in V_1$

$av_1 + bv_2 \in V_1$ (since, V_1 is a subspace)

and $v_1, v_2 \in V_2$

$\Rightarrow av_1 + bv_2 \in V_2$ (since, V_1 is a subspace)

As, $av_1 + bv_2 \in V_1$ and $av_1 + bv_2 \in V_2$

$\Rightarrow av_1 + bv_2 \in V_1 \cap V_2$

Thus, $V_1 \cap V_2$ is subspace of a vector space V over a field F.

Correct Answer: A

Question 177 : Which of the following(s) is/are linearly dependent set of vectors in R3?

(A) {(1, 0, 0), (1, 1, 0), (1,1, 1)}

(B) {(1, 1, 1), (–1, 0, 1), (0, –2, 1)}

(C) (1, 0, 0), (0, 1, 0), (1, 1, 1), (–1, 1, –1)

(D) All of the above

Solution :

(1) Let a, b, c ∈ R such that

$a(1,0,0) + b(1,1,0) + c(1,1,1) = (0,0,0)$

$\Rightarrow a + b + c = 0,\ b + c = 0,\ c = 0$

$\Rightarrow a = 0,\ b = 0,\ c = 0$

Hence, {(1, 0, 0), (1, 1, 0), (1, 1, 1)} is linearly independent set of vectors.

(2) Let a, b, c ∈ R such that

$a(1,1,1) + b(-1,0,1) + c(0,-2,1) = (0,0,0)$

$\Rightarrow a - b = 0,\ a - 2c = 0,\ a + b + c = 0$

$\Rightarrow a = b,\ c = \frac{1}{2}b,\ b + b + \frac{1}{2}b = 0$

$\Rightarrow b = 0,\ a = 0,\ c = 0.$

Hence, {(1, 1, 1), (–1, 0, 1), (0, –2, 1)} is linearly independent set of vectors.

(3) Let a, b, c, d ∈ R such that

$a(1,0,0) + b(0,1,0) + c(1,1,1) + d(-1,1,-1) = (0,0,0)$

$\Rightarrow a + c - d = 0,\ b + c + d = 0,\ c - d = 0$

$\Rightarrow c = b,\ b = -2d,\ a = 0$

taking d = 1, we get

$a = 0,\ b = -2,\ c = 1,\ d = 1$

Hence, {(1, 0, 0), (0, 1, 0), (1,1, 1), (–1, 1, –1)}

Correct Answer: C

Question 178 : The sequence of real-valued function $f_n(x) = x^n$ $x \in [0,1] \cup \{2\}$ is

(A) pointwise convergent

(B) uniformly convergent

(C) does not uniformly convergent

(D) pointwise limit is $f(x) = \begin{cases} 0, & x = 0 \\ 1, & x \neq 0 \end{cases}$

Solution :

Let $\alpha \in [0, 1] \cup \{2\}$, then

Case I: If $\alpha = 0$, then

$$f(x) = \lim_{n\to\infty} f_n(\alpha) = \lim_{n\to\infty} f_n(0)$$

$$= \lim_{n\to\infty} 0 = 0$$

Case II: If $\alpha = 1$, then

$$f(x) = \lim_{n\to\infty} f_n(\alpha) = \lim_{n\to\infty} f_n(1)$$

$$\lim_{n\to\infty} 1 = 1$$

Case III: If $0 < \alpha < 1$, then

$$f(\alpha) = \lim_{n\to\infty} f_n(\alpha) = \lim_{n\to\infty} \alpha^n = 0 \quad [\because 0 < \infty < 1]$$

Case IV: If $\alpha = 2$. Then,

$$f(\alpha) = \lim_{n\to\infty} f_n(\alpha) = \lim_{n\to\infty} f_n(2) = \lim_{n\to\infty} 2^n$$

= does not exist.

Hence, fn(x) is not pointwise convergent.

$\Rightarrow f_n(x)$ is not uniformly convergent.

Correct Answer: C

Question 179 : The power series $\sum_{n=0}^{\infty} 2^{-n} \cdot z^{2n}$ converges, if

(A) radius of convergence is $\sqrt{2}$

(B) radius of convergence is $\sqrt{3}$

(C) radius of convergence is $\sqrt{5}$

(D) None of the above

Solution :

Here, $u_n = 2^{-n}.z^{2n}$ and $u_{n+1} = 2^{-(n+1)}.z^{2(n+1)}$

$$\lim_{n\to\infty}\left|\frac{u_{n+1}}{u_n}\right| = \left|\lim_{n\to\infty}\frac{2^{-n(n+1)}.z^{2(n+1)}}{2^{-n}.z^{2n}}\right| = \left|\frac{z^2}{2}\right|$$

The series Σu_n converges absolutely, if

$$\left|\frac{z^2}{2}\right| < 1 \Rightarrow |z|^2 < 2 \Rightarrow |z| < \sqrt{2}$$

Here, radius of convergence is $\sqrt{2}$ and centre of convergence is 0.

Correct Answer: A

Question 180 : Which one of the following is true?

(A) A constant function is Riemann integrable

(B) Constant function is not Riemann integrable

(C) A constant function may or may not be Riemann integrable

(D) None of the above

Let a function f be defined on [a, b], by

$f(x) = c, \forall x \in [a, b]$

where c is a constant.

Let P be a partition of [a, b] given by

$P = \{a = x_0, x_1, x_2, \ldots, x_r, \ldots, x_n = b\}$

Let its sub-intervals be given by

$I_r = [x_{r-1}, x_r]$ for $r = 1, 2, \ldots, n$

If δ_r be the length of this interval I_r, then

$\delta_r = x_r - x_{r-1}$

Also, if M_r and m_r be the lub and glb of the function f in I_r respectively, then

$M_r = c, m_r = c$, as $f(x) = c, \forall x \in (a, b)$

Hence, $U(P, f) = \sum_{r=1}^{n} M_r \delta_r$

Solution : $= \sum_{r=1}^{n} c(x_r - x_{r-1}) = \sum_{r=1}^{n} (x_r - x_{r-1})$

$= c[(x_1 - x_0) + (x_2 - x_1) + \ldots + (x_n - x_{n-1})]$

$= c(x_n - x_0) = c(b - a)$

$= \text{constant}$

and $L(P, f) = \sum_{r=1}^{n} m_r \delta_r = \sum_{r=1}^{n} c(x_r - x_{r-1})$

$= c(b - a)$, as above

$= \text{constant}$

Hence, $\int_a^b f(x)\,dx = \text{glb}\{U(P,f)\}$

$= \text{glb}\{c(b - a)\}$

$= c(b - a)$ .....(i)

and $\int_a^b f(x)\,dx = \text{lub}\{L(P - f)\} = \text{lub}\{c(b - a)\}$

$= c(b - a)$ .....(ii)

Correct Answer: A