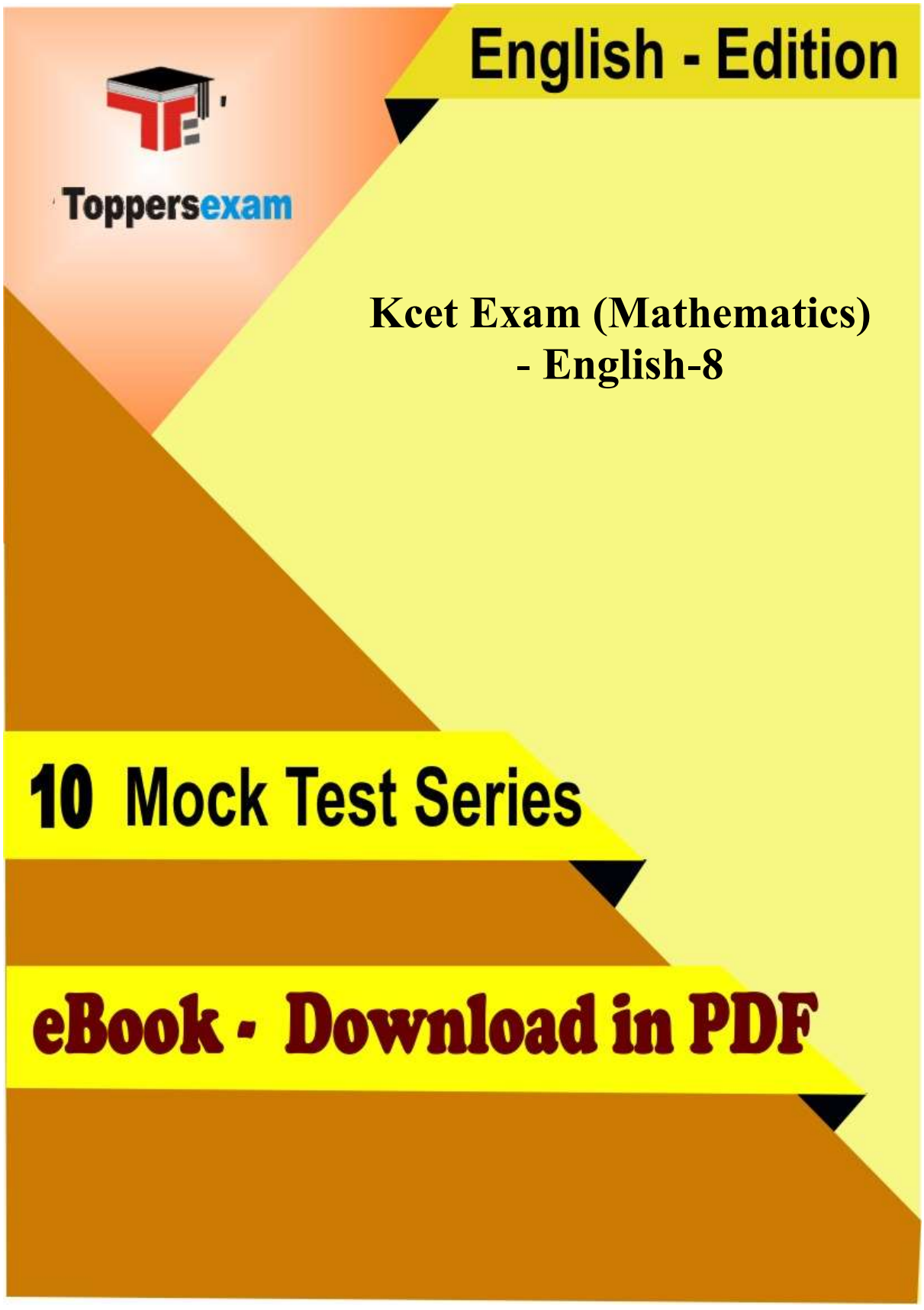

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Kcet Exam (Mathematics) - English-8

Paper Questions

SUBJECT: Physics

Question 1 : From the top of a tower of two stones, whose masses are in the ratio 1 : 2 are thrown on straight up with an initial speed u and the second straight down with the same speed u. then neglecting air resistance :

(A) the heavier stone hits the ground with a higher speed

(B) the lighter stone hits the ground with a higher speed

(C) both the stones will have the same speed when they hit the ground

(D) the speed can't be determined with the given

Correct Answer: C

Question 2 : Infrared radiation was discovered in 1800 by :

(A) William wollaston

(B) William Herschel

(C) Wilhelm roentgen

(D) Thomas young

Correct Answer: B

Question 3 : A particle on the through of a wave at any instant will come to the mean position after a time (T = time period)

(A) T/2

(B) T/4

(C) T

(D) 2T

Correct Answer: B

Question 4 : The disc of a siren containing 60 holes rotates at a constant speed of 360 rpm. The emitted sound is in unison with a tuning fork of frequency :

(A) 10 HZ

(B) 360 HZ

(C) 216 HZ

(D) 60 HZ

Correct Answer: B

Question 5 : The ratio of velocity of sound in hydrogen and oxygen at STP is :

(A) 16 : 1

(B) 8 : 1

(C) 4 : 1

(D) 2 : 1

Correct Answer: C

Question 6 : In an experiment with sonometer a tuning fork of frequency 256HZ resonates with a length of 25 cm and another tuning fork resonates with a length of 16 cm. Tension of the string remaining constant the frequency of the second tuning fork is :

(A) 163.84 Hz

(B) 400 Hz

(C) 320 Hz

(D) 204.8 Hz

Correct Answer: B

Question 7 : The apparent frequency of a note is 200 Hz, when a listener is moving with a velocity of 40 ms^{-1} towards a stationary source. When he moves away from the same source with the same speed, the apparent frequency of the same note is 160 Hz. The velocity of sound in air in m/s is :

(A) 340

(B) 330

(C) 360

(D) 320

Correct Answer: C

Question 8 : The wave theory of light, in its original form, was first postulates by :

(A) Isaac Newton

(B) Christian Huygens

(C) Thomas Young

(D) Augustin Jean fresnel

Correct Answer: B

Question 9 : If a liquid dose not wet glass, its angle of contact is :

(A) zero

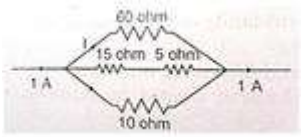
(B) acute

(C) obtuse

(D) right angle

Correct Answer: C

Question 10 : The magnetic of *I* in ampere is :



(A) 0.1

(B) 0.3

(C) 0.6

(D) none of these

Correct Answer: A

Question 11 : Electron of mass *m* and charge q is travelling with a speed *v*along a circular path of radius r at right angles to a uniform magnetic field of intensity B, If the speed of the electron is double and the magnetic field is halved the resulting path would have a radius :

(A) 2r

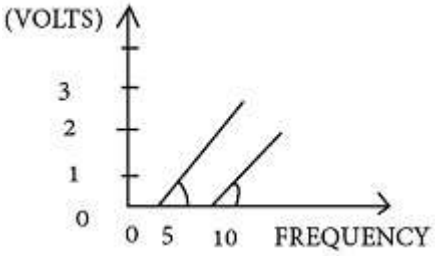
(B) 4r

(C) r/4

(D) r/2

Correct Answer: B

Question 12 : From the figure describing photoelectric effect we may infer correctly that :



(A) Na and Al both have the same threshold frequency

(B) maximum kinetic energy for both the metals depend linearly on the frequency

(C) the stopping potentials are different for Na and Al for the same change in frequency

(D) Na & Al have different work functions

Correct Answer: B

Question 13 : Two coherent light beams of intensity I and 4l are superposed. The maximum and minimum possible intensities in the resulting beam are :

(A) 9 *I* and *I*

(B) 9 *I* and 3 I

(C) 5 *I* and *I*

(D) 5 *I* and 3 *I*

Correct Answer: A

Question 14 : The electron in a hydrogen atom makes a transition from $n = n_1$ to $n = n_2$ state. The time period of the electron in the initial state (n_1) is eight times that in the final state (n_2). The possible values of n_1 and n_2 are :

(A) $n_1 = 8, n_2 = 1$

(B) $n_1 = 4, n_2 = 2$

(C) $n_1 = 2, n_2 = 4$

(D) $n_1 = 1, n_2 = 8$

Correct Answer: B

Question 15 : If the forward voltage in a diode is increased, the width of the depletion region :

(A) increases

(B) decreases

(C) fluctuates

(D) no change

Correct Answer: B

Question 16 : Two nucleons are at a separatons of one Fermi. Protons have a charge of $+ 1.6 \times 10^{-19}$ C. the net nuclear force between them is F_1, if both are neutrons, F_2 if both are protons and F_3 if one is proton and the other is neutron. Then :

(A) $F_1 = F_2 > F_3$

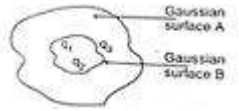
(B) $F_1 = F_2 = F_3$

(C) $F_1 < F_2 < F_3$

(D) $F_1 > F_2 > F_3$

Correct Answer: B

Question 17 : The electric flux for Gaussian surface A that enclose the charged particles in free space is (given q_1 =- 14nC, q_2 = 78.85nC, q_3 = - 56nC)



(A) $10^3 Nm^2C^{-1}$

(B) $10^3 CN^{-1}m^{-2}$

(C) $6.32 \times 10^3 Nm^2C^{-1}$

(D) $6.32 \times 10^3 CN^{-1}m^{-2}$

Correct Answer: A

Question 18 : Four metal conductors having different shapes
1. a sphere 2. Cylinder
3. pear 4. Lightning conductor
Are mounted on insulating stands and charged. The one which is best suited to retain the charges for a longer time is :

(A) 1

(B) 2

(C) 3

(D) 4

Correct Answer: A

Question 19 : The potential to which a conductor is raised, depends on :

(A) the amount of charge

(B) geometry and size of the conductor

(C) both (a) and (b)

(D) only on (a)

Correct Answer: C

Question 20 : The work done in carrying a charge q once round a circle od radius r with a charge Q at the centre is :

(A) $\frac{qQ}{4\pi\varepsilon Er}$

(B) $\frac{qQ}{4\pi\varepsilon 2Er2}$

(C) $\frac{qQ}{4\pi\varepsilon Er2}$

(D) none of these

Correct Answer: D

Question 21 : An air filled parallel plate condenser has a capacity of 2 pF. The separation of the plates is doubled and the interspace between the plates is filled with wax. If the capacity is increased to 6 pF. The dielectric constant of wax is :

(A) 2

(B) 3

(C) 4

(D) 6

Correct Answer: D

Question 22 : The energy that should be added to an electron to reduce its de-Broglie wavelength from 1 nm to 0.5 nm is :

(A) four times the initial energy

(B) equal to the initial energy

(C) twice the initial energy

(D) thrice the initial energy

Correct Answer: D

Question 23 : Mean life of a radioactive sample is 100 seconds. Then its half-life (in minutes) is :

(A) 0.693

(B) 1

(C) 10^{-4}

(D) 1.155

Correct Answer: D

Question 24 : Consider two nuclei of the same radioactive nuclide. One of the nuclei was created in a supernova explosion 5 billion years ago. The other ws created in a nucler reactor 5 minutes ago. The probability of decay during the next time is :

(A) different for each nuclei

(B) nuclei created in explosion decays

(C) nuclei created in the reactor decays

(D) independent of the time of creation

Correct Answer: D

Question 25 : Bohr's atom model assumes :

(A) the nucles is of infinite mass and is at rest

(B) electrons in a quantized orbit will not radiate energy

(C) mass of electron remains

(D) all the above conditions

Correct Answer: D

Question 26 : Identify the property which is not characteristic for a semiconductor ?

(A) at a very low temperatures, it behave like an insulator

(B) At higher emperatures two years of charge carries will cause conductivity

(C) the charge carries are electrons and holes in the valence band at higher temperatures

(D) the semiconductor is electrically neutral

Correct Answer: C

Question 27 : identify the wrong statement in the following. Coulomb's law correctly describe the electric force that :

(A) binds the electrons of an atom to its nucles

(B) binds the protons and neutrons in the nucles of an atom

(C) binds atoms together to form molecules

(D) binds atoms and molecules to form solids

Correct Answer: B

Question 28 : A single slit of width d is illuminated by violet light of wavelength 400 nm and the width of the diffraction pattern is measured as y. when half of the slit width is covered and illuminated by yellow light of wavelength 600 nm, the width of the diffraction pattern is :

(A) the pattern vanishes and the width is zero

(B) y/3

(C) 3y

(D) none of these

Correct Answer: B

Question 29 : At kavalur in India, the astronomers using a telescope whose objective had a diameter of one metre started using telescope of diameter 2.54 m. this resulted in :

(A) the increase in the resolving power by 2.54 times for the same ג

(B) the increase in the limiting angle by 2.54 times for the same ג

(C) decrease in the resolving power

(D) no effect on the limiting angle

Correct Answer: A

Question 30 : When unpolarised light beam is incident from air onto glass (n= 1.5) at the polarizing angle:

(A) reflected beam is polarized 100 percent

(B) reflected and refracted beams are partially polarized

(C) the reason for (a) is that almost all the light is reflected

(D) all of the above

Correct Answer: A

Question 31 : Select the rightoption in the following :

(A) Christian Huygens, a contemporary of newton established the wave theory of light by assuming that light waves were transverse.

(B) Maxwell provided the theoretical evidence that light is transverse wave

(C) Thomas young experimentally proved the wave behavior of light and Huygens assumptios

(D) All the statements given above, correctly answers the questions “what is light?”

Correct Answer: B

Question 32 : In blast furnace, iron oxide is reduced by :

(A) hot blast of air

(B) carbon monoxide

(C) carbon

(D) silica

Correct Answer: B

Question 33 : Solar spectrum is an example for

(A) line emission spectrum

(B) continuous emission spectrum

(C) band absorption spectrum

(D) line absorption spectrum

Correct Answer: D

Question 34 : When a piece of metal is illuminated by a monochromatic light of wavelength λ, then stopping potential is 3Vs. When same surfaces illuminated by light of wavelength 2 λ, then stopping potential becomes Vs. The value of threshold wavelength for photoelectric emission will be

(A) 4λ

(B) 8λ

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

(D) 6 λ

Correct Answer: A

Question 35 : The maximum kinetic energy of emitted electrons in a photoelectric effect does not

depend upon

(A) Wavelength

(B) frequency

(C) Intensity

(D) work function

Correct Answer: C

Question 36 : The ratio of minimum wavelengths of Lyman and Balmer series will be

(A) 1.25

(B) 0.25

(C) 5

(D) 10

Correct Answer: B

Question 37 : Hydrogen atom does not emit X-rays because

(A) it contains only a single electron

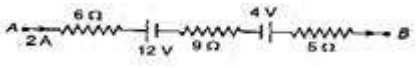
(B) energy levels in it are far apart

(C) its size is very small

(D) energy levels in it are very close to each other

Correct Answer: D

Question 38 : The potential difference between A and B in the following figure is



(A) 32 V

(B) 24 V

(C) 48 V

(D) 14 V

Correct Answer: B

Question 39 : The magnetic field at the centre of a circular current carrying conductor of radius r is B_c. The magnetic field on its axis at a distance r from the centre is B_a. The value of $B_c : B_a$ will be

(A) 1 : $\sqrt{2}$

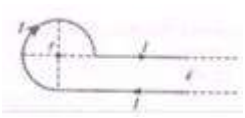
(B) 1 :2$\sqrt{2}$

(C) 2$\sqrt{2}$: 1

(D) $\sqrt{2}$: 1

Correct Answer: C

Question 40 : Current I is flowing in conductor shaped asshown in the figure. The radius of the curved part is r and the length of straight portion is very large. The value of the magnetic field at the centre 0 will be



(A) $\frac{\mu_0 i}{4\pi r}\left(\frac{3\pi}{2}+1\right)$

(B) $\frac{\mu_0 i}{4\pi r}\left(\frac{3\pi}{2}-1\right)$

(C) $\frac{\mu_0 i}{4\pi r}\left(\frac{\pi}{2}+1\right)$

(D) $\frac{\mu_0 i}{4\pi r}\left(\frac{\pi}{2}-1\right)$

Correct Answer: A

Question 41 : Two tangent galvanometers A and B are identical except in their number of turns.They are connected in series. On passing a current through them, deflections of 60° and 30° are produced. The ratio of the number of turns in A and B is

(A) 1 : 3

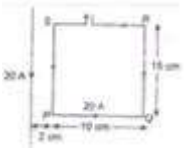
(B) 3 : 1

(C) 1 : 2

(D) 2:1

Correct Answer: B

Question 42 : The resultant force on the current loop PQRS due to a long current carrying conductor will be



(A) 10^{-4}N

(B) 3.6 x 10^{-4} N

(C) 1.8 x 10^{-4} N

(D) 5 x 10^{-4} N

Correct Answer: D

Question 43 : How many 6 µf, 200 V condensers are needed to make a condenser of 18 µF, 600 V?

(A) 9

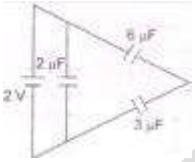
(B) 18

(C) 3

(D) 27

Correct Answer: D

Question 44 : The total energy stored in the condenser system shown in the figure will be



(A) 2µJ

(B) 4µJ

(C) 8 µJ

(D) 16 µJ

Correct Answer: C

Question 45 : A metal wire is subjected to a constant potential difference. When the temperature of

the metal wire increases, the drift velocity of the electron in it

(A) increases, thermal velocity of the electron decreases

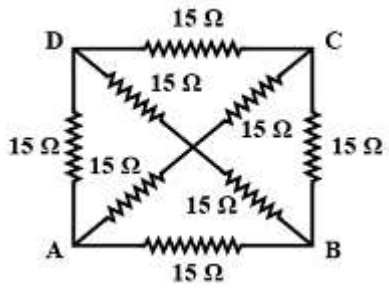
(B) decreases, thermal velocity of the electron decreases

(C) increases, thermal velocity of the electron increases

(D) decreases, thermal velocity of the electron increases

Correct Answer: D

Question 46 : The equivalent resistance between the points A and B will be (each resistance is 15Ω)



(A) 30Ω

(B) 8Ω

(C) 10Ω

(D) 40Ω

Correct Answer: B

Question 47 : In the Bohr model of hydrogen-atom, the electron is pictured to rotate in a circular orbit of radius 5 x 10^{-11} m, at a speed 2.2 x 10^{6} m/ s. What is the current associated with electron motion?

(A) 1.12 mA

(B) 3 mA

(C) 0.75 mA

(D) 2.25 mA

Correct Answer: A

Question 48 : A certain current on passing through a galvanometer produces a deflection of 100 divisions. When a shunt of one ohm is connected, the deflection reduces to 1 division. The galvanometer resistance is

(A) 100 Ω

(B) 99Ω

(C) 10Ω

(D) 9.9Ω

Correct Answer: B

Question 49 : Two similar circular loops carry equal currents in the same direction. On moving coils further apart, the electric current will

(A) increase in both

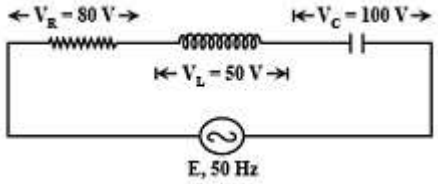
(B) decrease in both

(C) remain unaltered

(D) increases in one and decreases in the second

Correct Answer: A

Question 50 : The value of alternating emf E in the given circuit will be



(A) 220 V

(B) 140 V

(C) 100 V

(D) 20 V

Correct Answer: C

Question 51 : A current of 5 A is flowing at 220 V in the primary coil of a transformer. If the voltage produced in the secondary coil is 2200 V and 50% of power is lost, then the current in secondary will be

(A) 2.5 A

(B) 5 A

(C) 0.25 A

(D) 0.5 A

Correct Answer: C

Question 52 : For a series LCR circuit at resonance, the statement which is not true is

(A) Peak energy stored by a capacitor = peak energy stored by an inductor.

(B) Average power = apparent power.

(C) Wattless current is zero.

(D) Power factor is zero.

Correct Answer: D

Question 53 : 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: A

Question 54 : In Young's double slit experiment, a third slit is made in between the double slits. Then

(A) intensity of fringes totally disappears

(B) only bright light is observed on the screen

(C) fringes of unequal width are formed

(D) contrast between bright and dark fringes is reduced

Correct Answer: D

Question 55 : In a two slit experiment with monochromatic light fringes are obtained on a screen placed at some distance from the slits. If the screen is moved by 5×10^{-2} m towards the slits, the change in fringe width is 3×10^{-5}m. If separation between the slits is 10^{-3}m, the wavelength of light used is

(A) 6000 Å

(B) 5000 Å

(C) 3000 Å

(D) 4500 Å

Correct Answer: A

Question 56 : In a Fraunhofer diffraction experiment at a single slit using a light of wavelength 400 nm, the first minimum is formed at an angle of 30°. The direction θ of the first secondary maximum is given by

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

(B) $\sin^{-1}\left(\frac{3}{4}\right)$

(C) $\sin^{-1}\left(\frac{1}{4}\right)$

(D) $\sin^{-1}\left(\frac{2}{3}\right)$

Correct Answer: B

Question 57 : Maximum diffraction takes place in a given slit for

(A) γ-rays

(B) ultraviolet light

(C) infrared light

(D) radio waves

Correct Answer: D

Question 58 : If an electron and a proton have the same de-Broglie wavelength, then the kinetic energy of the electron is

(A) zero

(B) less than that of a proton

(C) more than that of a proton

(D) equal to that of a proton

Correct Answer: C

Question 59 : Two protons are kept at a separation of 40 Å. F_n is the nuclear force and F_e is the electrostatic force between them. Then

(A) $F_n >> F_e$

(B) $F_n = F_e$

(C) $F_n << F_e$

(D) $F_n \approx F_e$

Correct Answer: C

Question 60 : Blue colour of sea water is due to

(A) interference of sunlight reflected from the water surface

(B) scattering of sunlight by the water molecules

(C) image of sky in water

(D) refraction of sunlight

Correct Answer: B

SUBJECT: Chemistry

Question 61 : A compound A has a molecular formula C_2CI_3OH. It reduces fehling's solution and on oxidation, gives a monocarboxylic acid B. A can be obtained by the action of chlorine on ethyl alcohol A is :

(A) chloroform

(B) chloral

(C) methyl chloride

(D) monochloroacetic acid

Correct Answer: B

Question 62 : Which of the followings haloalkanes is most reactive ?

(A) 1-chloropropane

(B) 1-bromopropane

(C) 2-chloropropane

(D) 2-bromopropane

Correct Answer: D

Question 63 : The reaction in which phenol differs from alcohol is :

(A) it undergoes esterification with carboxylic acid

(B) it reacts with ammonia

(C) it forms yellow crystals of iodoform

(D) it liberates H_2 with Na metal.

Correct Answer: C

Question 64 : An organic compound A containing C, H and O has a pleasant odour with boiling point of 78^0C. on boiling A with concentrated H_2SO_4, a colourless gas is produced which decolourises bromine water and alkaline $KMnO_4$. The organic liquid A is :

(A) C_2H_5CI

(B) $C_2H_5COOCH_3$

(C) C_2H_5OH

(D) C_2H_6

Correct Answer: C

Question 65 : Which of the following is an amphoteric acid ?

(A) Glycine

(B) salicylic acid

(C) Benzoic acid

(D) Citric acid

Correct Answer: A

Question 66 : Gold is extracted by hydrometallurgical process, based on its property :

(A) of being electropositive

(B) of being less reactive

(C) to form salts which are water soluble

(D) to form salts which are water soluble

Correct Answer: C

Question 67 : Which of the following pairs of elements cannot form an alloy ?

(A) Zn, Cu

(B) Fe, Hg

(C) Fe, C

(D) Hg,Na

Correct Answer: B

Question 68 : Which compound is zero valent metal complex ?

(A) $[Cu(NH_3)_4]SO_4$

(B) $[Pt(NH_3)_2CI_2]$

(C) $[Ni(CO)_4]$

(D) $K_3[Fe_9CN0_6]$

Correct Answer: C

Question 69 : Alum is a water purifier because it :

(A) coagulates the impurities

(B) softens hard water

(C) gives taste

(D) destroys the pathogenic bacteria

Correct Answer: A

Question 70 : For the reaction $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g),}$ the value of K_c at 800^0C is 0.1. when the equilibrium concentration of both the reactants is 0.5 mol, what is the value of K_p at the same temperature ?

(A) 0.5

(B) 0.1

(C) 0.01

(D) 0.025

Correct Answer: B

Question 71 : The extent of adsorption of a gas on a solid depends on :

(A) nature of the gas

(B) pressure of the gas

(C) temperature of the gas

(D) all of the above

Correct Answer: D

Question 72 : A emulsifier is a substance which :

(A) stabilises the emulsion

(B) homogenizes the emulsion

(C) coagulates the emulsion

(D) accelerates the dispersion of liquid in liquid

Correct Answer: A

Question 73 : Which of the following types of metals form the most efficient catalysts?

(A) Alkali metals

(B) Alkaline earth metals

(C) Transition metals

(D) All of the above

Correct Answer: C

Question 74 : The species among the following which can act as an acid and a base is :

(A) HSO_4^-

(B) SO^{2-}_4

(C) H_3O^+

(D) CI^-

Correct Answer: A

Question 75 : Benzyl alchol and sodium benzoate is obtained by the action of sodium hydroxide on benzaldehyde. This reaction is known as, :

(A) Perkin's reaction

(B) Cannizaro's reaction

(C) Sandmeyer's reaction

(D) Claisen condensation

Correct Answer: B

Question 76 : Ethyl chloride on heating with AgCN forms a compound X. the functional isomer of X is :

(A) C_2H_5NC

(B) $C_2H_5NH_2$

(C) C_2H_5CN

(D) none of these

Correct Answer: C

Question 77 : A compound, containing only carbon hydrogen And oxtgen has a molecular weight of 44. On complete oxidation it is converted into a compound of molecular weight 60. The original compound is:

(A) an aldehyde

(B) an acid

(C) an alcohol

(D) an either

Correct Answer: A

Question 78 : Grignard reagent adds to :

(A) > C = O

(B) -C≡ N

(C) > C = S

(D) all of these

Correct Answer: D

Question 79 : Which of the following biomolceules contain non-transition metal ion ?

(A) Vitamin B_{12}

(B) Chlorophyll

(C) Haemoglobin

(D) Insulin

Correct Answer: B

Question 80 : A mixture of two moles of carbon monoxide and one mole of oxygen, in a closed vessel is ignited to convert the carbon monoxide to carbon dioxide. If ΔH is the enthalphy change and ΔE is the change in internal energy, then:

(A) $\Delta H > \Delta E$

(B) $\Delta H < \Delta E$

(C) $\Delta H = \Delta E$

(D) the relationship depends on the capacity of vessel

Correct Answer: B

Question 81 : The cooling in refrigerator is due to :

(A) reaction of the refrigerator gas

(B) expansion of ice

(C) the expansion of the gas in the refrigerator

(D) the work of the compressor

Correct Answer: C

Question 82 : For a system in equilibrium, $\Delta G = 0$/ under conditions of constant …..

(A) temperature and pressure

(B) temperature and volume

(C) pressure and volume

(D) energy and volume

Correct Answer: A

Question 83 : Molar heat of vaporization of a liquid is 6 kJ mol^{-1}. If the entropy change is 16J $mol^{-1}K^{-1,}$ the boiling point of the liquid is :

(A) 375^0C

(B) 375 K

(C) 273 K

(D) 102^0C

Correct Answer: B

Question 84 : The temperature of the system decreases in an :

(A) adiabatic compression

(B) isothermal compression

(C) isothermal expansion

(D) adiabatic expansion

Correct Answer: D

Question 85 : A buffer solution has equal volumes of 0.2 M NH_4OH and 0.02 m NH_4Cl. The pK_b of the base is 5. The pH is :

(A) 10

(B) 9

(C) 4

(D) 7

Correct Answer: A

Question 86 : The hydrogen electrode is dipped in a solution of pH 3 at 25^0C the potential would be

(the value of 2.303 RT/F is 0.059 V) :

(A) 0.177 v

(B) 0.087 V

(C) 0.059 V

(D) -0.177 V

Correct Answer: D

Question 87 : 20 ml of 0.5 N HCL and 35 mL of 0.1 N NaOH are mixed. The resulting solution will:

(A) be neutral

(B) be basic

(C) turn phenolphthalein solution pink

(D) turn methyl orange red

Correct Answer: C

Question 88 : Corrosion of iron is essentially an electrochemical phenomenon where the cell reaction are :

(A) Fe is oxidized to Fe^{2+} and dissolved oxygen in water is reduced to OH^-

(B) Fe is oxidized to Fe^{3+} and H_2O is reduced to O_2^{2-}

(C) Fe is oxidized to Fe^{2+} and H_2O is reduced to O_2^-

(D) Fe is oxidized to Fe^{2+} and H_2O is reduced to O_2

Correct Answer: A

Question 89 : The standard electrode potential is measured by :

(A) electrometer

(B) voltmeter

(C) pyrometer

(D) galvanometer

Correct Answer: B

Question 90 : A precipitate of AgCl is formed when equal volumes of the following are mixed :[K_{sp} for AgCl = 10^{-10}]

(A) 10^{-4} M $AgNO_3$ and 10^{-7} M HCI

(B) 10^{-5} M $AgNO_3$ and 10^{-6} M HCI

(C) 10^{-5} M $AgNO_3$ and 10^{-4} M HCI

(D) 10^{-6} M $AgNO_3$ and 10^{-6} M HCI

Correct Answer: C

Question 91 : Which one of the following defects in the crystals lower its density ?

(A) Frenked defect

(B) Schottky defect

(C) F-centres

(D) Interstitial defect

Correct Answer: B

Question 92 : A radioactive isotope has a half-life of 10 days. If today 125 mg is left over, what was its original weight 40 days earlier ?

(A) 2 g

(B) 600mg

(C) 1 g

(D) 1.5 g

Correct Answer: A

Question 93 : Which of the following nuclear reaction neutrons is emitted ?

(A) α – particle

(B) β – partical

(C) protons

(D) Neutrons

Correct Answer: D

Question 94 :

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 95 : Molarity of 0.2 N H_2SO_4 is :

(A) 0.2

(B) 0.4

(C) 0.6

(D) 0.1

Correct Answer: D

Question 96 : In the equation of state of an ideal gas PV = nRT, the value of the universal gas constant would depend only on :

(A) the nature of the gas

(B) the pressure of the gas

(C) the units of the measurement

(D) none of the above

Correct Answer: C

Question 97 : A commercial sample of hydrogen peroxide is labeled as 10 volume. Is percentage strength is nearly :

(A) 1%

(B) 3%

(C) 10%

(D) 90%

Correct Answer: B

Question 98 : Activated charcoal is used to remove colouring matter from pure substance. It works by :

(A) oxidation

(B) reduction

(C) bleaching

(D) adsorption

Correct Answer: D

Question 99 : When plants and animals decay, the organic nitrogen is converted into inorganic nitrogen. The inorganic nitrogen is in the form of:

(A) ammonia

(B) elements of nitrogen

(C) nitrates

(D) nitrides

Correct Answer: A

Question 100 : Three dimensional molecules with cross links are formed in the case of a :

(A) thermoplastic

(B) thermosetting plastic

(C) both (a) & (b)

(D) none of the above

Correct Answer: B

Question 101 : Sucrose molecule is made up of :

(A) a gluco pyranose and a fructo pyranose

(B) a gluco pyranose and a fructo furanose

(C) a gluco furanose and a fructo pyranose

(D) a gluco furanose and a fructo furanose

Correct Answer: B

Question 102 : Water insoluble component of starch is :

(A) amylopectin

(B) amylase

(C) cellulose

(D) none of these

Correct Answer: A

Question 103 : An example for a saturated fatty acid, present in nature is :

(A) oleic acid

(B) linoleic acid

(C) linolenic acid

(D) palmitic acid

Correct Answer: D

Question 104 : A nanopeptide contains….. peptide linkages :

(A) 10

(B) 8

(C) 9

(D) 18

Correct Answer: B

Question 105 : A gas decolourised bu $KMnO_4$ solution but gives no precipitate with ammoniacal curprous chloride is :

(A) ethane

(B) methane

(C) ethane

(D) acetylene

Correct Answer: C

Question 106 : $H_3C-\underset{\underset{CI}{|}}{C}=CH-\underset{\underset{CH_3}{|}}{CH}-CH_3$

(A) 2-chloro-4-methyl-2pentene

(B) 4-chloro-2-methyl-3-pentene

(C) 4-methyl-2-chloro-2pentene

(D) 2-chloro-4,4-dimethyl-2-butene

Correct Answer: A

Question 107 : Amongst the following the compound that can most readily get sulphonated is :

(A) benzene

(B) toluene

(C) nitrobenzene

(D) chlorobenzene

Correct Answer: B

Question 108 : Household gaseous fuel (LPG) mainly contains :

(A) CH_4

(B) C_2H_2

(C) C_2H_4

(D) C_4H_{10}

Correct Answer: D

Question 109 : Use of chlorofluoro carbons is not encouraged because :

(A) they are harmful to the eyes of people that use it

(B) they damage the refrigerators and air conditioners

(C) they eat away the ozone in the atmosphere

(D) they destroy the oxygen layer

Correct Answer: C

Question 110 : An example of a sulphur containing amino acid is :

(A) lysine

(B) serine

(C) cysteine

(D) tyrosine

Correct Answer: D

Question 111 : Which of the following is not present in a nucleotide ?

(A) Cytosine

(B) Guanine

(C) Adenine

(D) Tyrosine

Correct Answer: D

Question 112 : Antiseptic chloroxylenol is :

(A) 4-chloro-3,5-dimethyl phenol

(B) 3-chloro-4,5-dimethyl phenol

(C) 4-chloro-2,5-dimethyl phenol

(D) 5-chloro-3,4-dimethyl phenol

Correct Answer: A

Question 113 : An atom of an element A has three electrons in its outermost orbit and that of B has six electrons in its outermost orbit. The formula of the compound between these two will be :

(A) A_3B_6

(B) A_2B_3

(C) A_3B_2

(D) A_2B

Correct Answer: B

Question 114 : Among Na^+ ,Na, Mg and Mg^{2+} , the largest particle is :

(A) Mg^{2+}

(B) Mg

(C) Na

(D) Na^+

Correct Answer: C

Question 115 : The number of nodal planes present in σ* s antibonding orbitals is

(A) 1

(B) 2

(C) 0

(D) 3

Correct Answer: A

Question 116 : Which of the following electrolytic solutions has the least specific conductance?

(A) 0.02 N

(B) 0.2 N

(C) 2 N

(D) 0.002 N

Correct Answer: D

Question 117 : The overlapping of orbitals in benzene is of the type

(A) sp-sp

(B) p-p

(C) sp^2- sp^2

(D) sp^3- sp^3

Correct Answer: C

Question 118 : The calculated bond order of superoxide ion (0^-_2) is

(A) 2.5

(B) 2

(C) 1.5

(D) 1

Correct Answer: C

Question 119 : Which of the following can be measured by the Ostwald-Walker dynamic method?

(A) Relative lowering of vapour pressure

(B) Lowering of vapour pressure

(C) Vapour pressure of the solvent

(D) All of the above

Correct Answer: D

Question 120 : Mesomeric effect involves delocalisation of

(A) pi electrons

(B) sigma electrons

(C) protons

(D) None of these

Correct Answer: A

SUBJECT: Mathematics

Question 121 :

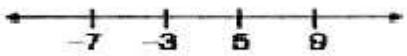
If A = (–3, 5) and B = [–7, 9], then

(A) A = B

(B) A $\subset$ B

(C) B $\subset$ A

(D) None of these



Solution :

Correct Answer: B

Question 122 :

Two finite sets have m and n elements, respectively. The total number of subsets of first set is 56 more than the total number of subsets of the second set. The value of m and n respectively are

(A) 7, 6

(B) 5, 1

(C) 6, 3

(D) 8, 7

Solution :

Let sets A and B are such that n(A) = m and n(B) = n, then

Total number of subsets of A = 2^m

Total number of subsets of B = 2_n

So, $2^m - 2^n = 56$

$\Rightarrow 2n(2m - n - 1) = 56 = 8 \times 7$

$\Rightarrow 2n(2m - n - 1) = 23 \times (23 - 1)$

$\Rightarrow n = 3, m - n = 3$

$\Rightarrow m = n + 3 = 6$

Correct Answer: C

Let A = {1, 2, 3, 4, 5} and R be a relation defined by
R = {(x, y): x, y ∈ A, x + y = 5}.
Then, R is

Question 123 :

(A) reflexive and transitive

(B) an equivalence relation

(C) symmetric but neither reflexive nor transitive

(D) neither reflexive nor symmetic but transitive

Correct Answer: C

Question 124 : The relation ' has the same father as ' over the set of children is

(A) Only reflexive

(B) Only symmetric

(C) Only transitive

(D) an equivalence relation

Solution :

R = {x : x is a set of all children of a same father}

Reflexive clearly, pRp, as p has same father as p. Hence, R is reflexive.

Symmetry Let p and q be the children of same father. Then, q and p be the children of same father.

Hence, R is symmetric.

Transitive Let p and q be the children of same father. And q and r be the children of same father.

Then, p and r be the children of same father.

Hence, R is transitive.

Since, R have all three properties reflexivity, symmetricity and transitivity, so R is an equivalence relation.

Correct Answer: D

Question 125 : If z is a complex number such that Re(z) = Im(z), then

(A) $Re(z^2) = 0$

(B) $Im(z^2) = 0$

(C) $Re(z^2) = Im(z^2)$

(D) $Re(z^2) = -Im(z^2)$

Solution :

Let $z = x + ix = x(1 + i)$

$\Rightarrow z^2 = 2ix \Rightarrow Re(z^2) = 0$

Correct Answer: A

Question 126 : If $2a = -1 - i$ and $2b = -1 + i$ then

5a4 + 5b4 + 7a–1b–1 is equal to

(A) –1

(B) –2

(C) Zero

(D) 2

Solution :

Given, $2\alpha = -1 - i\sqrt{3}$ and $2\beta = -1 + i\sqrt{3}$

$\therefore \alpha + \beta = -1$ and $\alpha\beta = 1$

Now, $5\alpha^4 + 5\beta^4 + \frac{7}{\alpha\beta}$

$= 5[\{(\alpha + \beta)^2 - 2\alpha\beta\}^2 - 2(\alpha\beta)^2] + \frac{7}{\alpha\beta}$

$= 5[\{(-1)^2 - 2 \times 1\}^2 - 2(1)^2] + \frac{7}{1}$

$= 5[(1 - 2)2 - 2] + 7 = 2$

Correct Answer: D

Question 127 : If log 2, log $(2^n - 1)$ and log $(2^n + 3)$ are in AP, then n is is equal to

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

(B) $\log_2 5$

(C) $\log_3 5$

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

Solution :

Since, log 2, log$(2^n - 1)$ and log$(2^n + 3)$ are in AP.

$\therefore 2\log(2^n - 1) = \log 2 + \log(2^n + 3)$

$\Rightarrow (2^n - 1)2 = 2(2^n + 3)$

$\Rightarrow (2^n - 5)(2^n + 1) = 0$

As 2^n cannot be negative hence,

$2^n - 5 = 0$

$\Rightarrow 2^n = 5 \Rightarrow n = \log_2 5$

Correct Answer: B

Question 128 :

In a cricket tournament 16 school terms participated. A sum of Rs,8000 is to be awarded among themselves as prize money. If the last placed team is awarded `Rs 275 in prize money and the award increases by the same amount for successive finishing places, amount will be first place team received is

(A) Rs 720

(B) Rs 725

(C) Rs`735

(D) Rs 780

Solution :

Here, $n = 16, S_n = 8000$ and $l = 275$

$\because S_n = \frac{n}{2}[a + l]$

$\therefore 8000 = \frac{16}{2}[a + 275]$

$\Rightarrow 1000 = (a + 275]$

$\Rightarrow A = 725$

$\therefore$ The first place team will get the prize of `725

Correct Answer: B

Question 129 : What is the largest number that divides 245 and 1029, leaving remainder 5 in each case?

(A) 15

(B) 16

(C) 9

(D) 5

Solution : Required number = HCF{(245 – 5},
(1029 – 5} = HCF
(240, 1024) = 16

Correct Answer: B

Question 130 : What is the largest number that divides each one of 1152 and 1664 exactly?

(A) 32

(B) 64

(C) 128

(D) 256

Solution : Required number = HCF{1152, 1664} = 128

Correct Answer: C

Question 131 : In a football championship, there were played 153 matches. Every team played one match with each other. The number of teams participating in the championship is

(A) 17

(B) 18

(C) 9

(D) 13

Solution :

Let there are n teams.
Each team play to every other team in ${}^nC_2$ ways
$\therefore {}^nC_2 = 153$ [Given]
$\Rightarrow n^2 - n - 306 = 0$
$\Rightarrow (n - 18)(n + 17) = 0$
$\Rightarrow n = 18$ [Q n is never negative]

Correct Answer: B

Question 132 : There are four balls of different colours and four boxes of colours same as those of the balls. The number of ways in which the balls, one in each box, could be placed such that a ball does not. go to box of its own colour, is

(A) 8

(B) 7

(C) 9

(D) None of these

Solution :

The number of ways in which four different balls can be placed in four different boxes
$= {}^4C_1 + {}^3C_1 + {}^2C_1 + {}^1C_1$
$= 4 + 3 + 2 + 1 = 10$
$\therefore$ Required number of ways

Correct Answer: C

Question 134 : If the binomial coefficients of $(3r)^{th}$ and $(r + 2)^{th}$ terms in the binomial expansion of $(1 + x)^{2n}$ are equal, then

(A) n = r

(B) n = r + 1

(C) n = 2r

(D) n = 2r - 1

Solution : Given expansion is $(1 + x)^{2n}$.
According to the given condition.
$^{2n}C_{3r-1} = {}^{2n}C_{r+1}$
$\Rightarrow (2n - 3r + 1) = (r + 1)$
$\Rightarrow 2n = 4r \Rightarrow n = 2r$

Correct Answer: C

Question 136 : For all x, $x^2 + 2ax + (10 - 3a) > 0$, then the interval in which a lies, is

(A) a < –5

(B) –5 < a < 2

(C) a > 5

(D) 2 < a < 5

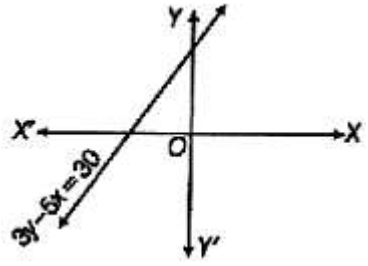
Solution : As we know, $ax^2 + bx + c > 0$ for all $x \in R$, iff a > 0 and D < 0.
$\therefore\ x^2 + 2ax + (10 - 3a) > 0, \forall x \in R$
$\Rightarrow D < 0$
$\Rightarrow 4a^2 - 4(10 - 3a) < 0$
$\Rightarrow (a + 5)(a - 2) < 0$
Using number line rule

$a \in (-5, 2)$

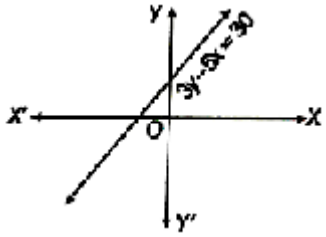
Correct Answer: B

Question 137 : The solution of 3y – 5x < 30 is represented by the graph

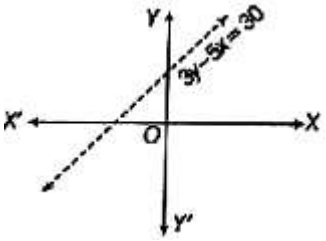
(A)



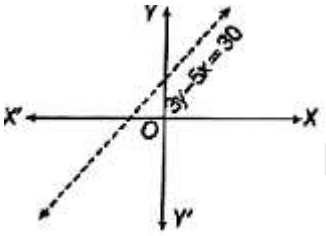
(B)



(C)



(D)



The given inequation is

$3y - 5x < 30$ .....(i)

Step I: Consider the inequation as a strict equation i.e. $3y - 5x = 30$

Step II: Find the points on the X-axis and Y-axis i.e.

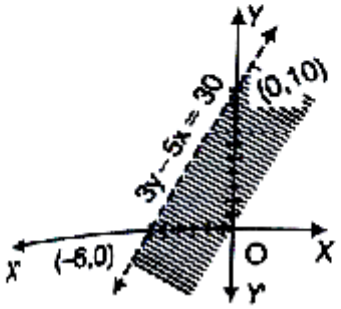
x	0	−6
y	10	0

Step III: Plot the graph using the above table.

Step IV: Take a point (0, 0) and put it in the given inequation (i), we get

$0 - 0 < 30 \Rightarrow 0 < 30$

which is true, so the shaded region will be towards the origin.



Solution : Thus, shaded region shows the inequality.

Correct Answer: C

Question 138 : The region represented by the solution of system of inequalities $5x + 4y \leq 40$, $x \geq 2$, $y \geq 3$ is

(A) bounded

(B) nbounded

(C)

Does not exist

(D) None of these

Solution :

We first draw the graph of the lines 5x + 4y = 40,

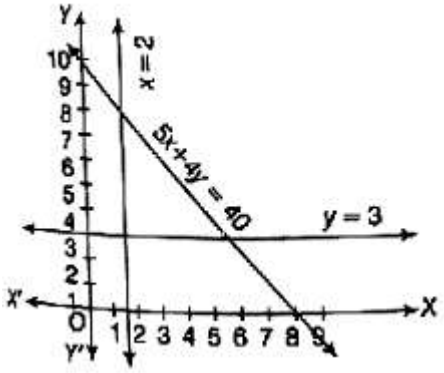
x = 2 and y = 3

Then, we note that the inequality (i) represents shaded region below the line 5x + 4y = 40 and

inequality (ii) represents the shaded region right of line = 2 but inequality (iii) represents the shaded region above the line y = 3 Hence, shaded region in figure) including all the point on the lines are also the solution of the given system of the linear inequalities.

In many practical situations involving system of inequalities the variable x and y often represent quantities that cannot have negative values, for example, number of units produced, number of articles purchased, number of hours worked, etc. Clearly, in such cases, x ³ 0, y ³ 0 and the solution region lies only in the first quadrant.

Since, the region is enclosed, so it is bounded.



Correct Answer: A

Question 139 : If $A=\begin{bmatrix}0 & -1\\ 1 & 0\end{bmatrix}$ and $B=\begin{bmatrix}0 & i\\ i & 0\end{bmatrix}$, then

(A) $A^2 = I$

(B) $A^2 = -A$

(C) $B^2 = -I$

(D) $B^2 = I$

$$A^2 = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$$

$$B^2 = \begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}\begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix} = \begin{bmatrix} i^2 & 0 \\ 0 & i^2 \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$$

Solution :

Correct Answer: C

If $\begin{bmatrix} 0 & a & b \\ -a & 0 & c \\ -b & -c & 0 \end{bmatrix}$, if $Q_1 = \frac{1}{2}(A + A')$ and $Q_2 = \frac{1}{2}(A - A')$, then Q_1, Q_2 is equal to

Question 140 :

(A) I^3

(B) O^3

(C) A

(D) A^2

$$A=\begin{bmatrix}0 & a & b\\ -a & 0 & c\\ -b & -c & 0\end{bmatrix}$$

$$A=\frac{1}{2}(A+A')+\frac{1}{2}(A-A')$$

$$Q_1=\frac{1}{2}\begin{bmatrix}0 & a & b\\ -a & 0 & c\\ -b & -c & 0\end{bmatrix}+\begin{bmatrix}0 & -a & -b\\ a & 0 & -c\\ b & c & 0\end{bmatrix}$$

$$=\frac{1}{2}\begin{bmatrix}0 & 0 & 0\\ 0 & 0 & 0\\ 0 & 0 & 0\end{bmatrix}+\begin{bmatrix}0 & 0 & 0\\ 0 & 0 & 0\\ 0 & 0 & 0\end{bmatrix}$$

Similarly,

$$Q_2=\frac{1}{2}(A-A')=\begin{bmatrix}0 & a & b\\ -a & 0 & c\\ -b & -c & 0\end{bmatrix}$$

Solution : $\therefore\ Q_1Q_2=O_3$

Correct Answer: A

If 5 and 7 are the roots of the equation

$$\begin{vmatrix}x & 4 & 5\\ 7 & x & 7\\ 5 & 8 & x\end{vmatrix}=0$$

Question 141 : then what is the third root?

(A) – 12

(B) 9

(C) 13

(D) 14

Solution :

Given determinant is,

$$\begin{vmatrix} x & 4 & 5 \\ 7 & x & 7 \\ 5 & 8 & x \end{vmatrix} = 0$$

Expanding along R_1,

$x(x^2 - 56) - 4(7x - 35) + 5(56 - 5x) = 0$

$\Rightarrow x^3 - 56x - 28x + 140 + 280 - 25x = 0$

$\Rightarrow x^3 - 109x + 420 = 0$

If (5, 7) are the roots of above equation, then

$x^2(x - 5) + 5x(x - 5) - 84(x - 5) = 0$

$\Rightarrow (x - 5)(x^2 + 5x - 84) = 0$

$\Rightarrow (x - 5)(x - 7)(x + 12) = 0$

$\Rightarrow x = 5, 7, -12$

Correct Answer: A

Question 142 :

The value of the determinant $\begin{vmatrix} x & x+y & x+2y \\ x+2y & x & x+y \\ x+y & x+2y & x \end{vmatrix}$ is

(A) $9x^2(x + y)$

(B) $9y^2(x + y)$

(C) $3y^2(x + y)$

(D) $7x^2(x + y)$

Solution :

$$\text{Let } \Delta = \begin{vmatrix} x & x+y & x+2y \\ x+2y & x & x+y \\ x+y & x+2y & x \end{vmatrix}$$

[using operation $R_1 \to R_1 + R_2 + R_3$]

$$\Delta = \begin{vmatrix} 3(x+y) & 3(x+y) & 3(x+y) \\ x+2y & x & x+y \\ x+y & x+2y & x \end{vmatrix}$$

$$\Delta = 3(x+y) \begin{vmatrix} 1 & 1 & 1 \\ x+2y & x & x+y \\ x+y & x+2y & x \end{vmatrix}$$

[using operation $C_2 \to C_2 - C_1$ and $C_3 \to C_3 - C_1$]

$$\Delta = 3(x+y) \begin{vmatrix} 1 & 0 & 0 \\ x+2y & -2y & -y \\ x+y & y & -y \end{vmatrix}$$

Expanding along R_1

$\Delta = 3(x + y)\{2y^2 + y^2\}$

$= 3(x + y)(3y^2)$

$\Delta = 9y^2(x + y)$

Correct Answer: B

Question 143 : The angles of elevation of the top of a tower at two points, which are at distances a and b from the foot in the same horizontal line and on the same side of the tower, are complementary. The height of the tower is

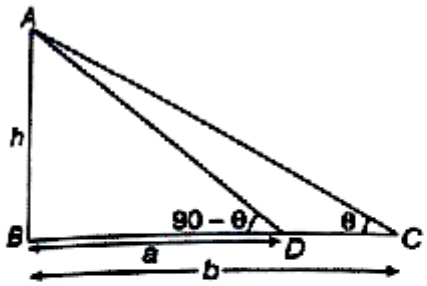
(A) ab

(B) $\sqrt{ab}$

(C) $\sqrt{\frac{a}{b}}$

(D) $\sqrt{\frac{b}{a}}$

In ΔABC, $\tan\theta = \frac{h}{a}$ .....(i)



In ΔABD, $\tan(90° - \theta) = \frac{h}{a}$

[since angles of elevation at and D are complement]

$\Rightarrow \cot\theta = \frac{h}{a}$

Solution : $\Rightarrow \tan\theta = \frac{a}{h}$ .....(ii)

On comparing Eqs. (i) and (ii), we get

$\frac{h}{a} = \frac{a}{h} \Rightarrow h^2 = ab$

$\therefore h = \sqrt{ab}$

Correct Answer: D

Question 144 : ABC is a triangular park with AB = AC = 100 m. A clock tower is situated at the mid-point of BC. The angle of elevation, if the top of the tower at A and B are $\cot^{-1} 3.2$ and $\text{cosec}^{-1} 2.6$, respectively. The height of the tower is

(A) 16 m

(B) 25 m

(C) 50 m

(D) None of these

Solution : Let OP be the clock tower standing at the mid-point O of side BC of DABC Let a = ÐPAO = cot–3.2

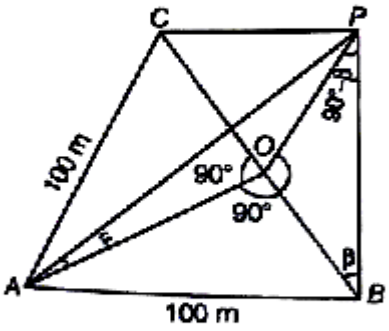
and $\beta = \angle PBO = \text{cosec}^{-1}\ 2.6$

Then, $\cot\alpha = 3.2$ and $\text{cosec}\ \beta = 2.6$

$\therefore\ \cos\beta = \sqrt{\text{cosec}^2\beta - 1}$

$= \sqrt{(2.6)^2 - 1} = 2.4$

In ΔPAO and ΔPBO, we have



$AO = h\ \cot\alpha = 3.2\ h$

and $BO = h\ \cot\beta = 2.4\ h$

In ΔABO, $AB^2 = OA^2 + OB^2$

$\Rightarrow 100^2 = (3.2\ h)^2 + (2.4\ h)^2$

$\Rightarrow 100^2 = 16h^2 \Rightarrow h^2 = 625$

$\Rightarrow h = 25$ m

Correct Answer: B

Question 145 : $\sum_{m=1}^{n} \tan^{-1}\left(\frac{2m}{m^4+m^2+2}\right)$ is equal to

(A) $\tan^{-1}\left(\frac{n^2+n}{n^2+n+2}\right)$

(B) $\tan^{-1}\left(\frac{n^2-n}{n^2-n+2}\right)$

(C) $\tan^{-1}\left(\frac{n^2+n+2}{n^2+n}\right)$

(D) None of these

We have, $\sum_{m=1}^{n} \tan^{-1}\left(\frac{2m}{m^4+m^2+2}\right)$

$= \sum_{m=1}^{n} \tan^{-1}\left\{\frac{2m}{1+(m^4+m^2+2)}\right\}$

$= \sum_{m=1}^{n} \tan^{-1}\left\{\frac{2m}{1+(m^2+1)^2-m^2}\right\}$

$= \sum_{m=1}^{n} \tan^{-1}\left[\frac{2m}{1+(m^2+m+1)(m^2-m+1)}\right]$

$= \sum_{m=1}^{n} \tan^{-1}\left[\frac{(m^2-m+1)}{1+(m^2+m+1)(m^2-m+1)}\right]$

Solution :

$= \sum_{m=1}^{n}\left\{\tan^{-1}(m^2+m+1)-\tan^{-1}(m^2-m+1)\right\}$

$= (\tan^{-1}3 - \tan^{-1}1) + (\tan^{-1}7 - \tan^{-1}3)$

$+ (\tan^{-1}3 + \tan^{-1}7) + \ldots +$

$\tan^{-1}(n^2+n+1) - \tan^{-1}(n^2-n+1)$

$= \tan^{-1}(n^2+n+1) - \tan^{-1}1$

$= \tan^{-1}\left[\frac{n^2+n+1-1}{1+(n^2+n+1).1}\right] = \tan^{-1}\frac{n^2+n}{2+n^2+n}$

Correct Answer: A

If $\sin^{-1}x + \sin^{-1}y + \sin^{-1}z =$, then the value of $\frac{3\pi}{2}$

$x^9 + y^9 + z^9 - \frac{1}{x^9+y^9+z^9}$ is

Question 146 :

(A) ZERO

(B) 1

(C) 2

(D) 3

We know that, $|\sin^{-1} x| \leq \frac{\pi}{2}$ From the given relation, we observe that each of $\sin^{-1} x$, $\sin^{-1} y$ and $\sin^{-1} z$ will be $\frac{\pi}{2}$.

$\Rightarrow x = y = z = \sin\frac{\pi}{2} = 1$

Solution : $\therefore \quad x^9 + y^9 + z^9 - \frac{1}{x^9 + y^9 + z^9}$

$= 1 + 1 + 1 - \frac{1}{1} = 3 - 1 = 2$

Correct Answer: C

Question 147 : Evaluate $\lim_{x \to 3} \frac{3 - x}{\sqrt{4 + x} - \sqrt{1 + 2x}}$

(A) ZERO

(B) $7\sqrt{2}$

(C) $4\sqrt{7}$

(D) $2\sqrt{7}$

$$\lim_{x\to 3}\frac{3-x}{\sqrt{4+x}-\sqrt{1+2x}}$$

$$=\lim_{x\to 3}\frac{(3-x)\left[\sqrt{4+x}-\sqrt{1+2x}\right]}{(3-x)}$$

$$=\lim_{x\to 3}\left[\sqrt{4+x}+\sqrt{1+2x}\right]$$

Solution : $=\sqrt{7}+\sqrt{7}=2\sqrt{7}$

Correct Answer: D

Question 148 : $\lim_{x\to\infty}\frac{\sin x}{x}$ is equal to

(A) ∞

(B) 1

(C) ZERO

(D) does not exist

It is fundamental concept of indeterminate

i.e. $\lim_{x\to\infty}\frac{\sin x}{x}=\frac{\sin\infty}{\infty}$

Solution : $= 0 \times \text{finite term} = 0$

Correct Answer: C

Question 149 : What is the differential coefficient of f(log x), where f(x) = logx?

(A) $\frac{x}{(\log x)}$

(B) $(x\log)^{-1}$

(C) $\frac{(\log x)}{x}$

(D) $f\left(\frac{1}{x}\right)$

Solution :

Given that $f(x) = \log x$

$\therefore f(\log x) = \log \log x$

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

$$f'(\log x) = \frac{1}{x \log x} = (x \log x)^{-1}$$

Correct Answer: B

Question 150 : If y = cost and x = sint, then what is the value of $\frac{dy}{dx}$?

(A) xy

(B) x/y

(C) –y/x

(D) –x/y

Solution :

Given that y = cost and x = sint

Then, $\frac{dy}{dt} = -\sin t$ and $\frac{dx}{dt} = \cos t$

Now, $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = -\frac{\sin t}{\cos t} = \frac{-x}{y}$

Correct Answer: D

Question 151 : The rate of change of the surface area of a sphere of radius r, when the radius is

increasing at the rate of 2 cm/s is proportional to

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

(B) $\frac{1}{r^2}$

(C) r

(D) r^2

Solution :

Surface area of sphere, $S = 4\pi r^2$ and $\frac{dr}{dt} = 2$

$\therefore \frac{dS}{dt} = 4\pi \times 2r\frac{dr}{dt} = 8\pi r \times 2 = 16\pi r$

$\Rightarrow \frac{dS}{dt} \propto r$

Correct Answer: C

Question 152 : The approximate value of f(5001), where $f(x) = x^3 - 7x^2 + 15$, is

(A) –34.995

(B) –33.995

(C) –33.335

(D) –35.993

Solution :

Firstly, break the number 5.001 as x = 5 and Δx = 0.001 and use the relation $f(x + \Delta x)$; $f(x) + \Delta x f'(x)$.

Consider $f(x) = x^3 - 7x^2 + 15$

$\Rightarrow f'(x) = 3x^2 - 14x$

Let $x = 5$ and $\Delta x = 0.001$

Also, $f(x + \Delta x)$; $f(x) + \Delta x\, f'(x)$

Therefore,

$f(x + \Delta x)$; $(x^3 - 7x^2 + 15) + \Delta x(3x^2 - 14x)$

$\Rightarrow f(5.001)$; $(5^3 - 7 \times 5^2 + 15)$

$+ (3 \times 5^2 - 14 \times 5)(0.001)$

$= 125 - 175 + 15 + (75 - 70)(0.001)$

$= -35 + (5)(0.001)$

$= -35 + 0.005 = -34.995$

Correct Answer: A

Question 153 : $\int \cos\left[2\cot^{-1}\sqrt{\frac{1-x}{1+x}}\right]dx$ is equal to

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

(B) $\frac{1}{2}\sin\left[2\cot^{-1}\sqrt{\frac{1-x}{1+x}}\right] + C$

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

(D) $\frac{1}{2}x^2 + C$

Solution :

$$\int \cos\left[2\cot^{-1}\sqrt{\frac{1-x}{1+x}}\right]dx$$

$$= \int \cos[\cos^{-1}(-x)]dx$$

$$= \int (-x)\,dx = -\frac{x^2}{2} + C$$

Correct Answer: C

Question 154 : $\int (x+1)(x+2)^7(x+3)\,dx$ is equal to

(A) $\frac{(x+2)^{10}}{10} - \frac{(x+2)^8}{8} + C$

(B) $\frac{(x+1)^2}{2} + \frac{(x+2)^8}{8} + \frac{(x+3)^2}{2} + C$

(C) $\frac{(x+2)^{10}}{10} + C$

(D) $\frac{(x+1)^2}{2} + \frac{(x+2)^8}{8} + \frac{(x+3)^2}{2} + C$

Solution : $\int (x+1)(x+2)^7(x+3)\,dx$

Let $(x+1)(x+3) = (x+2-1)(x+2+1)$

$= (x+2)^2 - 1$

$\therefore \int (x+1)(x+2)^7(x+3)\,dx$

$= \int \{(x+2)^9 - (x+2)^7\}\,dx$

$= \frac{(x+2)^{10}}{10} - \frac{(x+2)^8}{8} + C$

Correct Answer: A

Question 155 : The solution of $\frac{dy}{dx} = 1 + y + y^2 + x + xy + xy^2$ is

(A) $4\tan^{-1}\left(\frac{4y+1}{\sqrt{3}}\right) = \sqrt{3}(2x + x^2) + C$

(B) $\sqrt{3}\tan^{-1}\left(\frac{3y+1}{3}\right) = 4(1 + x + x^2) + C$

(C) $\tan^{-1}\left(\frac{2y+1}{3}\right) = 4(2x + x^2) + C$

(D) $4\tan^{-1}\left(\frac{2y+1}{3}\right) = \sqrt{3}(2x+x^2)+C$

Solution :

$$\text{Given, } \frac{dy}{1+y+y^2} = (1+x)dx$$

$$\Rightarrow \int \frac{dy}{\left(y+\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2} = \int (1+x)\,dx$$

$$\Rightarrow \frac{1}{\frac{\sqrt{3}}{2}}\tan^{-1}\left(\frac{y+\frac{1}{2}}{\frac{\sqrt{3}}{2}}\right) = x+\frac{x^2}{2}+\frac{C}{2}$$

$$\Rightarrow 4\tan^{-1}\left(\frac{2y+1}{\sqrt{3}}\right) = \sqrt{3}(2x+x^2)+C$$

Correct Answer: C

Question 156 : The solution of the differential equation $(x^2 + y^2)dx = 2xy\,dy$ is

(A) $x^2 + y^2 = Cy$

(B) $C(x^2 - y^2) = x$

(C) $x^2 - y^2 = Cy$

(D) $x^2 + y^2 = Cy$

Solution :

Given, $(x^2 + y^2)dx = 2xy\ dy \Rightarrow \frac{dy}{dx} = \frac{x^2 + y^2}{2xy}$

Put $y = vx \Rightarrow \frac{dy}{dx} = v + x\frac{dv}{dx}$

$\therefore\ v + x\frac{dv}{dx} = \frac{x^2 + v^2x^2}{2xvx} \Rightarrow x\frac{dv}{dx} = \frac{1 - v^2}{2v}$

$\Rightarrow \frac{2v}{1 - v^2}dv = \frac{dx}{x}$

$\Rightarrow -\log(1 - v^2) = \log x + \log C$

$\Rightarrow \log(1 - v^2)^{-1} = \log xC$

$\Rightarrow \left(\frac{x^2 - y^2}{x^2}\right)^{-1} = xC \Rightarrow \frac{x^2}{x^2 - y^2} = xC$

$\therefore\ x = C(x^2 - y^2)$

Correct Answer: B

Question 157 : If the equation 4x2 + hxy + y = 0 represents coincident lines, then h is equal to

(A) 1

(B) 3

(C) 2

(D) 4

Solution :

Given equations is $4x^2 + hxy + y^2 = 0$

Here, $a = 4, b = 1$

and $h = \frac{h}{2}$

The given equation represents coincident lines, if

$h^2 - ab = 0$

Given equations is $4x^2 + hxy + y^2 = 0$
Here, $a = 4, b = 1$

and $h = \frac{h}{2}$

The given equation represents coincident lines, if
$h^2 - ab = 0$

$\Rightarrow \left(\frac{h}{2}\right)^2 - 4.1 = 0 \Rightarrow h = \pm 4$

Correct Answer: D

Question 158 : If A (k, 2) and B (3, 5) are points. The point (t, t) divides AB from A's side in the ratio of k, then k = ...$k \in R - \{0, -1\}$.

(A) –4

(B) –2

(C) 4

(D) 2

Solution : Let P(t, t) divides AB in the ratio k : 1, then

$\frac{3k+k}{k+1} = t$ and $\frac{5k+2}{k+1} = t$

$\Rightarrow \frac{3k+k}{k+1} = \frac{5k+2}{k+1} \Rightarrow 4k - 5k = 2$

$\therefore k = -2$

Correct Answer: B

Question 159 : The equation of the three circles are given $x^2 + y^2 = 1$, $x^2 + y^2 - 8x + 15 = 0$, $x^2 + y^2 + 10y + 24 = 0$. Find the coordinates of the point P such that the tangents drawn from it to the circles are

equal in length.

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

(B) (6, 1)

(C) (2, 1/2)

(D) (4, 1)

Solution : We know that point from which lengths of tangents are equal in length in radical centre of the given three circles. Now, radical axis of the first two circles is

$(x^2 + y^2 - 1) - (x^2 + y^2 - 8x + 15) = 0$

i.e. $x - 2 = 0$ .....(i)

and radical axis of the second and third circles is

$(x^2 + y^2 - 8x + 15) - (x^2 + y^2 + 10y + 24) = 0$

i.e. $8x + 10y + 9 = 0$ .....(ii)

On solving eqs. (i) and (ii), the coordinates of the radical centre i.e. of point P are ((2, –5/2).

Correct Answer: A

Question 160 : The radical axis of coaxial system whose limiting points are (–1, 2) and (2, 3) is

(A) $x + 3y + 4 = 0$

(B) $3x + y - 4 = 0$

(C) $3x - y + 4 = 0$

(D) $x - 3y - 10 = 0$

Solution :

. Equation of circles with limiting points are (–1, 2) and (2, 3) are $(x + 1)^2 + (y – 2)^2 = 0$

$\Rightarrow x^2 + y^2 + 2x – 4y + 5 = 0$ .....(i)

and $(x – 2)^2 + (y – 3)^2 = 0$

$\Rightarrow x^2 + y^2 – 4x – 6y + 13 = 0$ .....(ii)

$\therefore$ Radical axis of circle (i) and (ii) is

$(x^2 + y^2 + 2x – 4y + 5) – (x^2 + y^2 – 4x – 6y + 13) = 0$

$\Rightarrow 3x + y – 4 = 0$

Correct Answer: B

Question 161 : he value of c, for which the line y = 2x + c,is tangent to the parabola y = 4a(x + a), is

(A) a

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

(C) 2a

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

Solution :

Since, the intersection of a line y = 2x + c and a parabola $y^2 = 4ax + 4a^2$ is

$(2x + c)^2 = 4ax + 4a^2$

$\Rightarrow 4x^2 + 4(c – a)x + (c^2 – 4a^2) = 0$

Since, it is a tangent line.

$\therefore 16(c – a)^2 – 4 \times 4(c^2 – 4a^2) = 0$

$\Rightarrow y = 0$ [Q D =0]

$\Rightarrow c^2 + a^2 – 2ac – c^2 + 4a^2 = 0$

$\therefore c = \frac{5a}{2}$

Correct Answer: D

Question 162 : The line x + y = 6 is a normal to the parabola $y^2 = 8x$ at the point

(A) (18, –12)

(B) (4, 2)

(C) (2, 4)

(D) (8, 8)

Solution : Here, a = 2, m = –1
Required point is (am2, –2am) = (2, 4)

Correct Answer: C

Question 163 : A, B and C are three non-zero vectors, no two of them are parallel. If A + B is collinear to C and B + C is collinear to A, then A + B + C is equal to

(A) A

(B) B

(C) C

(D) ZERO

Solution : Since, $\mathbf{A} + \mathbf{B}$ is collinear to $\mathbf{C}$ and $\mathbf{B} + \mathbf{C}$ is collinear to A.
$\therefore \mathbf{A} + \mathbf{B} = \lambda\mathbf{C}$ and $\mathbf{B} + \mathbf{C} = \mu\mathbf{A}$
where, λ and μ are scalars.
$\Rightarrow \mathbf{A} + \mathbf{B} + \mathbf{C} = (\lambda + 1)$
and $\mathbf{A} + \mathbf{B} + \mathbf{C} = (\mu + 1)\mathbf{A}$
$\Rightarrow (\lambda + 1)\mathbf{C} = (\mu + 1)\mathbf{A}$

If $\lambda \neq -1$, then $\mathbf{C} = \frac{\mu + 1}{\lambda + 1}\mathbf{A}$

$\Rightarrow \mathbf{C}$ and $\mathbf{A}$ are collinear.
This is a contradiction to the given condition.
$\Rightarrow \lambda = -1 \therefore \mathbf{A} + \mathbf{B} + \mathbf{C} = 0$

Correct Answer: D

Question 164 : If the points with position vectors $60\hat{i}+3j, 40\hat{i}-8\hat{j}$ and $a\hat{i}-52j$ are collinear, then a is equal to

(A) –40

(B) –20

(C) 20

(D) 40

Solution : Let $\mathbf{P}(60\hat{i}+3\hat{j}), \mathbf{Q}(40\hat{i}-8\hat{j})$ and $\mathbf{R}(a\hat{i}-52\hat{j})$ be the collinear points.

Then, $\mathbf{PQ} = \lambda\mathbf{QR}$ for some scalar λ.

$\Rightarrow (-20\hat{i}-11\hat{j}) = \lambda[(a-40)\hat{i}-44\hat{j}]$

$\Rightarrow \lambda = \frac{1}{4}$

$\Rightarrow \mathbf{a} - 40 = -20 \times 4 \Rightarrow \mathbf{a} = -40$

Correct Answer: A

Question 165 : The position vectors of the points A and B with respect to O are $2\hat{i}+2\hat{j}+\hat{k}$ and $2\hat{i}+4\hat{j}+4\hat{k}$. The length of the internal bisector of $\angle BOA$ of ΔAOB is

(A) $\frac{\sqrt{136}}{9}$

(B) $\frac{\sqrt{136}}{3}$

(C) $\frac{20}{3}$

(D) $\frac{\sqrt{217}}{9}$

Solution : $|\mathbf{OA}| = \sqrt{4+4+1} = 3$ and

$|\mathbf{OB}| = \sqrt{4+16+16} = 6$

$\therefore$ Requried vector $= \lambda(\mathbf{OA} + \mathbf{OB})$

$\therefore$ Length of vector $= \frac{\lambda}{3}\sqrt{9+16+9} = \frac{2}{3}\sqrt{34}$

Correct Answer: B

Question 166 : If a line makes angles α, β and γ with the coordinate axes, then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma$ is

(A) –1

(B) –2

(C) 2

(D) –3

Solution : We know that, $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$

$\Rightarrow \cos 2\alpha + \cos 2\beta + \cos 2\gamma = -1$

Correct Answer: A

Question 167 : The projection of the line segment joining the points (–1, 0, 3) and (2, 5, 1) on the line whose direction ratios are 6, 2 and 3, is

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

(B) $\frac{22}{7}$

(C) $\frac{18}{7}$

(D) None of these

Solution :

Projection

$$= [2-(-1)]\frac{6}{7} + [5-0]\frac{2}{7} + [1-3]\frac{3}{7}$$

$$= \frac{18+10-6}{7} = \frac{22}{7}$$

Correct Answer: B

Question 168 :

In ΔABC, the mid-points of the sides AB, BC and CA are respectively $(l, 0, 0)$, $(0, m, 0)$ and $(0, 0, n)$.

Then, $\frac{AB^2 + BC^2 + CA^2}{(l^2 + m^2 + n^2)}$ is equal to

(A) 2

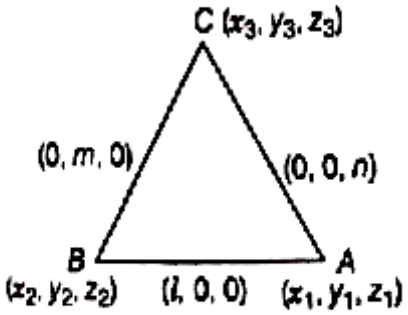
(B) 4

(C) 8

(D) 16

Solution :

From the figure,



$x_1 + x_2 = 2l$, $y_1 + y_2 = 0$, $z_1 + z_2 = 0$,
$x_2 + x_3 = 0$, $y_2 + y_3 = 2m$, $z_2 + z_3 = 0$
and $x_1 + x_3 = 0$, $y_1 + y_3 = 0$, $z_1 + z_3 = 2n$

On solving, we get the coordiantes are
A(*l*, –m,n), B(*l*, m, –n) and C(–*l*, m, n).

Correct Answer: C

Question 169 : The mean age of a combined group of men and women is 25 yr. If the mean age of the group of men is 26 and that of the group of women is 21, then the percentage of men and women in the group is

(A) 46, 60

(B) 80, 20

(C) 20, 80

(D) 60, 40

Solution :

Let n_1 and n_2 be the numbers of men and women in a group. According to the given combination,

$$\frac{n_1 \times 26 + n_2 \times 21}{n_1 + n_2} = 25$$

$$\Rightarrow n_1 = 4n_2 \Rightarrow \frac{n_1}{n_2} = \frac{4}{1}$$

$$\text{Percentage of men} = \frac{n_1}{n_1 + n_2} \times 100$$

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

$$\text{Percentage of women} = \frac{n_2}{n_1 + n_2} \times 100$$

$$= \frac{1}{5} \times 100 = 20\%$$

Correct Answer: B

Question 170 : The average marks of boys in a class is 52 and that of girls is 42. The average marks of boys and girls combined is 50. The percentage of boys in the class is

(A) 40%

(B) 20%

(C) 80%

(D) 60%

Solution :

Let the number of boys and girls be x and y, respectively.

$52x + 42y = 50(x + y)$

$\Rightarrow 2x = 8y \Rightarrow x = 4y$

So, total number of students in the class

$= x + y = 5y$ [□ $x = 4y$]

∴ Required percentage of boys

$= \frac{4y}{5y} \times 100\% = 80\%$

Correct Answer: C

Question 171 : The arithmetic mean of an AP and the mean of first and last term of an AP are

(A) equal

(B) unequal

(C) square of each other

(D) None of the above

Solution : Mean = (Mean of first and last term of the given AP)

Let a, a + d, a + 2d,..... a(n – 1)d be the n terms in AP.

$$\therefore \text{ Mean } = \frac{a+(a+d)+....+\{a+(n-1)d\}}{n}$$

$$\Rightarrow \text{Mean } = \frac{n}{2}\left\{\frac{2a+(n-1)d}{n}\right\}$$

$$\Rightarrow \text{Mean } = \frac{a+\{a+(n-1)d\}}{2}$$

Correct Answer: A

Question 172 : A die is rolled three times. The probability of getting a larger number than the previous number each time is

(A) $\frac{5}{72}$

(B) $\frac{5}{54}$

(C) $\frac{13}{216}$

(D) $\frac{1}{18}$

Solution : Total number of outeomes = 216
and number of favourable outcomes is equal to 20%, which are given below
(1, 2, 3), (1, 2, 4), (1, 2, 5), (1, 2, 6), (1, 3, 4), (1, 3, 5), (1, 3, 6), (1, 4, 6), (1, 4, 6), (1, 5, 6), (2, 3, 4), (2, 3, 5), (2, 3, 6), (2, 4, 5), (2, 4, 6), (2, 5, 6), (3, 4, 5), (3, 4, 6), (3, 5, 6), (4, 5, 6).
Therefore, the required probability

$$= \frac{20}{216} = \frac{5}{54}$$

Correct Answer: B

Question 173 : Let ω be a complex cube root of unity with $\omega \neq 1$. A fair die is thrown three times. If r_1, r_2 and r_3 are the numbers obtained on the die, then the probability that $\omega^{r_1} + \omega^{r_2} + \omega^{r_3} = 0$ is

(A) $\frac{1}{18}$

(B) $\frac{1}{9}$

(C) $\frac{2}{9}$

(D) $\frac{1}{36}$

Solution :

A dice is thrown thrice,

$n(S) = 6 \times 6 \times 6$

Favourable outcomes of

$\omega^{r_1} + \omega^{r_2} + \omega^{r_3} = 0$

i.e. (r_1, r_2, r_3) are ordered triplets which can take values,

(1,2,3), (1,5,3), (4,2,3), (4,5,3)
(1,2,6), (1,5,6), (4,2,6), (4,5,6)

9 ordered triplets and each can be arranged in 3! ways = 6

Let E is an event that

$\omega^{r_1} + \omega^{r_2} + \omega^{r_3} = 0$

$n(E) = 8 \times 6$

$\Rightarrow P(E) = \frac{8 \times 6}{6 \times 6 \times 6} = \frac{2}{9}$

Correct Answer: C

Question 174 : Two dice are tossed. The following two events A & B are A = {x, y) : x + y = 11}, B = {(x, y) : x ≠ 5} where (x, y) denotes a typical sample point.

(A) Not independent

(B) independent

(C) Mutually exclusive

(D) None of the above

Solution :

Let S be the sample space having 6 × 6 = 35 elements.

Given, $A = \{x,y: x + y = 11\}$

$\Rightarrow A = \{(5, 6), (6,5)\}$

So, $P(A) = \frac{n(A)}{n(S)} = \frac{2}{36} = \frac{1}{18}$

and $B = \{(x, y): x \neq 5\}$

$\Rightarrow B = S - \{(1, 5), (2, 5), (3, 5), (4, 5), (6, 5)\}$

$n(B) = 36 - 5 = 31$

$\therefore P(B) = \frac{n(B)}{n(S)} = \frac{31}{36}$

and $A \cap B = \{(x,y): x + y = 11, x \neq 5\} = \phi$

$\Rightarrow A \cap B = 0 \Rightarrow A \cap B = \frac{n(A \cap B)}{n(S)} = \frac{0}{36} = 0$

Clearly, $P(A).P(B) = \frac{1}{18} \times \frac{31}{36} \neq P(A \cap B)$

Hence, A and B are not independent events.

Correct Answer: B

If v is a non-zero vector in R^3. Consider the linear transformation $T : R^3 \to R^3$ defined by

$$T(w) = w - 2\frac{< w,v >}{< v,v >}v .$$

Question 175 : Which of the following is true?

(A) There is a non-zero vector w, such that T(w) = –w

(B) T(v) = v

(C) T(v) = –v

(D) There is a non-zero vector w, such that $T_w = w$

We have, $T(w) = w - \frac{\langle w,v \rangle v}{\langle v,v \rangle}$

$\therefore\ T(v) = v - \frac{2\langle v,v \rangle v}{\langle v,v \rangle}$

Solution : $= v - 2v = -v$

Correct Answer: C

Question 176 : If V is the vector space of all functions from R to R and W = {f : f(5) = 0}.

(A) W is a subspace of V

(B) W is not a subspace of V

(C) W is closed under multiplication

(D) W is not closed under multiplication

Let f, g ∈ W

f(5) = 0 and g(5) = 0 .....(i)

If a, b ∈ R, then

(af + bg)(5) = (af)(5) + (bg)(5)

= af(5) + bg(5)

= a.0 + b.0 [From eq. (i)]

= 0

⇒ af + bg ∈ W

i.e. f, g ∈ W and a, b ∈ R

⇒ af + bg ∈ W

Solution : Hence, W is a subspace of V.

Correct Answer: A

Question 177 : Let V = R^3, also W = {(x, y, 0): x, y ∈ **R**}

(A) W is a subspace of V

(B) W is not a subspace of V

(C) $\alpha\, \beta \in W \Rightarrow \alpha + \beta \notin W$

(D) $\alpha + 2\beta \in W \Rightarrow \alpha + 2\beta \in W$

Let $\alpha = (x_1, y_1, 0)$ and $\beta = (x_2, y_2, 0)$ belongs to W

If a, b ∈ ¡ , then

$a\alpha + b\beta = a(x_1, y_1, 0) + b(x_2, y_2, 0)$

$= (ax_1, ay_1, 0) + (bx_2, by_2, 0)$

$= (ax_1 + bx_2, ay_1 + by_2, 0 + 0) = (x', y', 0)$

where $x' = ax_1 + bx_2$

$y' = ay_1 + by_2 \in$ ¡ ∈ W

i.e. α, β ∈ W and a, b∈ ¡ ⇒ aα + bβ ∈ W

Solution : Hence, W is a subspace of V.

Correct Answer: D

If $f(x) = \begin{cases} x, & 0 < x < 1 \\ 3 - x, & 1 \le x \le 2 \end{cases}$, then

I. $\lim_{x \to 1} f(x) = 1$

II. $\lim_{x \to 1^-} f(x) = 2$

III. $\lim_{x \to 1} f(x) = 2$

Question 178 : Which of these statement(s) is / are correct?

(A) I and III are correct

(B) I, II and III are correct

(C) I and II are correct

(D) II alone is correct

Given that $f(x) = \begin{cases} x, & 0 < x < 1 \\ 3 - x, & 1 \le x \le 2 \end{cases}$

Clearly, the value of functions is changing at $x = 1$ therefore we check limit at $x = 1$.

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

and $\lim_{x \to 1^+} f(x) = \lim_{h \to 0} f(1 + h)$

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

Solution : $\lim[3-(1+h)]=2$

Correct Answer: C

The pointwise limit of sequence of real-valued function

Question 179 : $f_n(x) = \sin x + \frac{x}{n}, \forall x \in i$ is

(A) $f(x) = 0, \ \forall x \in i$

(B) $f(x) = \begin{cases} 0, & x = 0 \\ 1, & \text{else} \end{cases}$

(C) $f(x) = \sin x, \ \forall x \in j$

(D) does not exists

Let $\alpha \in j$, then

$a_n(\alpha) = f_n(\alpha) = \sin\alpha + \frac{\alpha}{n}$

$\therefore \ f(\alpha) = \lim_{n\to\infty} a_n(\alpha) = \lim_{n\to\infty} \sin\alpha\frac{\alpha}{n}$

$= \sin\alpha$

$\therefore$ The pointwise limit

Solution : $f(x) \sin x, \forall x \in j$

Correct Answer: C

Question 180 : The radius of convergence of the power series $f(z) = \sum_{n=0}^{\infty}\left(1+\frac{1}{n}\right)^{n^2} z^n$ is

(A) e

(B) e^2

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

(D) e^{-2}

Solution :

$$\text{Here, } a_n = \left(1+\frac{1}{n}\right)^{n^2} \Rightarrow a_n^{1/n} = \left(1+\frac{1}{n}\right)^{n}$$

$$\text{Now, } \frac{1}{R} = \lim_{n\to\infty} |a_n|^{\frac{1}{n}} = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^{n} = e$$

$$\Rightarrow R = \frac{1}{e}$$

Correct Answer: C