# JEE (MAIN)-2025 (Online)

# Physics Memory Based Answer & Solutions

**MORNING SHIFT**

**DATE : 03-04-2025**

## Disclaimer

The questions and solutions provided for JEE Main 2025 Session-2 are based on students' memory. While every effort has been made to ensure accuracy, there may be discrepancies or variations from the actual exam. These materials are intended for reference and educational purposes only. They do not represent the official question paper or solutions provided by the exam conducting authority.

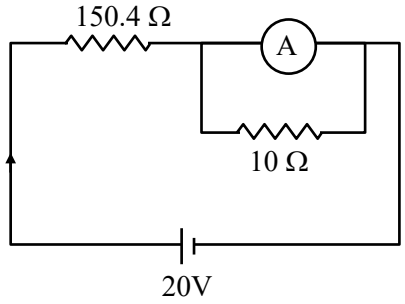
We recommend cross-verifying with official sources and using this content as a supplementary resource for your preparation.

# MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – APRIL, 2025

**(Held On Thursday 3rd April, 2025) TIME : 9 : 00 AM to 12 : 00 PM**

## SECTION-A

**1.** An ammeter having resistance 240Ω is connected in the given circuit as shown. Find current through the ammeter.




(1) 2 mA (2) 5 mA

(3) 8 mA (4) 9 mA

**Ans.** **(2)**

**Sol.** $I_1 = I_0 \times \frac{10}{250}$

$= \frac{20}{150.4+9.6} \times \frac{10}{250}$

$= \frac{20}{160} \times \frac{10}{250} = 5\text{mA}$

**2.** A particle is released from height 'h' above the surface of the earth. At certain height it's K.E is 3 times of PE. The height from the surface of the earth and the speed of the Particle at the instant are respectively.

(1) $\frac{h}{2}, \sqrt{\frac{3gh}{2}}$ (2) $\frac{h}{4}, \sqrt{\frac{3gh}{2}}$

(3) $\frac{h}{2}, \sqrt{\frac{3gh}{4}}$ (4) $\frac{h}{4}, \sqrt{\frac{3gh}{4}}$

**Ans.** **(2)**

**Sol.** mgh = KE + PE

mgh = 4mgh'

$h' = \frac{h}{4}$

$\frac{1}{2}mv^2 = 3 \times mg\frac{h}{4}$

$v = \sqrt{\frac{3}{2}gh}$

**3.** The work function of a metal 3 eV. The colour of the visible light that is required to cause emission of photo electrons is :-

(1) Violet (2) Red

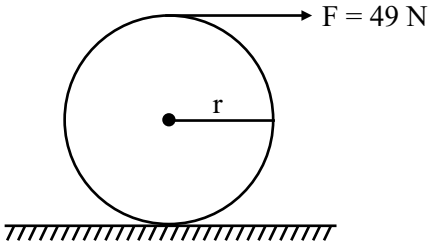
(3) Yellow (4) Green

**Ans.** **(1)**

**Sol.** $\phi_0 = E = \frac{hc}{\lambda} = \frac{1240}{\lambda}$

$\lambda = \frac{1240}{3} = 413.3\text{ nm}$

**4.** A force of 49 N acts tangentially at the highest point of a sphere (solid sphere of mass 20 kg) kept on a rough horizontal plane. If the sphere rolls without slipping, then the acceleration of the center of the sphere is :-




(1) 2.5 m/s² (2) 3.5 m/s²

(3) 0.35 m/s² (4) 0.45 m/s²

**Ans.** **(2)**

**Sol.** F + f = ma

$(F - f)R = \frac{2}{5}mR^2\frac{a}{R}$

$2F = \frac{7}{5}ma$

$a = \frac{10}{7} \times \frac{F}{m} = \frac{10}{7} \times \frac{49}{20} = 3.5\text{ m/s}^2$

**5.** The electrostatic potential on the surface of uniformly charged spherical shell of radius R = 10 cm is 120 V. The potential at the centre of shell, at a distance 5 cm from centre and a distance 15 cm from the centre of the shells are :-

(1) 0V, 120 V, 40 V (2) 40 V, 40 V, 80 V

(3) 120 V, 120 V, 80 V (4) 0 V, 0 V, 80 V

**Ans.** **(3)**

**Sol.** $v_{surface} = \frac{KQ}{R} = 120 = (V_{in})_{surface}$

$v_c = 120V$

$v_{5cm} = 120V$

$v_{15} = \frac{kQ}{r} = 120 \times \frac{10}{15} = 80$

**6.** In a biconvex lens $R_1$, $R_2$ and f are 15 cm, 10 cm and 12 cm respectively find refractive index of lens.

(1) 2 (2) $\frac{3}{4}$

(3) $\frac{4}{3}$ (4) $\frac{3}{2}$

**Ans.** **(4)**

**Sol.** $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$\frac{1}{12} = (\mu - 1)\left(\frac{1}{15} + \frac{1}{10}\right)$

$\frac{1}{12} = (\mu - 1)\frac{1}{5}\left(\frac{5}{6}\right)$

$\frac{1}{2} + 1 = \mu$

**7.** Power of point source is 450 watt. Radiation pressure on a perfectly Reflecting surface at a distance of 2 m is

(1) $2 \times 10^{-8}$ (2) $4 \times 10^{-8}$

(3) $6 \times 10^{-8}$ (4) $8 \times 10^{-8}$

**Ans.** **(3)**

**Sol.** $\frac{2I}{C} = \frac{2}{C}\left(\frac{P}{4\pi r^2}\right)$

$= \frac{2 \times 450}{3 \times 10^8 \times 4\pi 2^2} = \frac{300}{16\pi} 10^{-8}$

**8.** When block of ice melts

(1) Internal energy decreases

(2) Internal energy constant

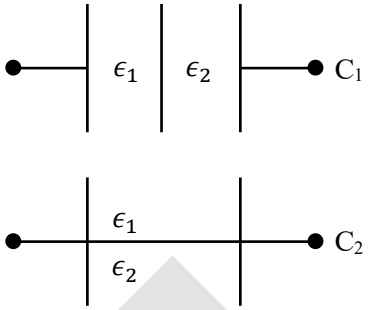
(3) Work done by atmosphere is positive

(4) Work done by atmosphere is negative

**Ans.** **(3)**

**Sol.** Work done by atmosphere is positive.

**9.** Two dielectric of dielectric constants $\epsilon_1$ & $\epsilon_2$ are inserted between the plates of two identical parallel plate capacitors as shown in the figure. The ratio of their capacitances $C_2/C_1$ is (Given $\frac{\epsilon_1}{\epsilon_2} = 2$) :-




(1) $\frac{9}{8}$ (2) $\frac{7}{8}$ (3) $\frac{8}{7}$ (4) $\frac{8}{9}$

**Ans.** **(1)**

**Sol.** $C_1^{**} = \frac{2k\frac{A}{2}\varepsilon_0}{d} = C_0 (Let)$

$C_2^{**} = \frac{2\frac{A}{2}\varepsilon_0}{d} = \frac{C_0}{2}$

$C_2 = \frac{3C_0}{2}$

$C_1^* = \frac{2KA\varepsilon_0}{\frac{d}{2}}$

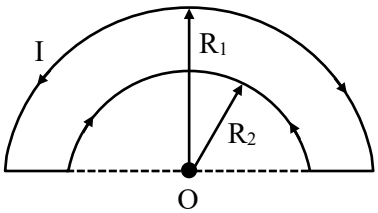
$C_1^* = 4C_0$

$C_2^* = \frac{KA\varepsilon_0}{\frac{d}{2}} = 2C_0$

$C_{effc} = \frac{4C_0 2C_0}{6C_0}$

$C_{effc} = \frac{4}{3}C_0$

**10.** A current carrying wire is bent as shown in the figure. Find magnetic field at centre O of the semi-circles. (Take $R_1 = 4\pi$ and $R_2 = 6\pi$) :-




(1) $8.3\ I \times 10^{-9}$ T (2) $8.3\ I \times 10^{-6}$ T

(3) $6\ I \times 10^{-8}$ T (4) $4\ I \times 10^{-6}$ T

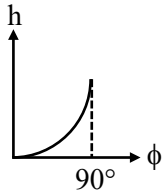
**Ans.** **(1)**

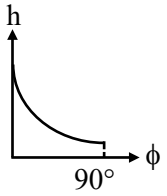
**Sol.** $B_{net} = B_1 - B_2$

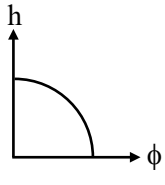
$$= \frac{\mu_0}{4} = \frac{I}{R} - \frac{\mu_0}{4}\frac{I}{r_2} = \frac{\mu_0 I}{4}\left(\frac{1}{4\pi} - \frac{1}{6\pi}\right)$$

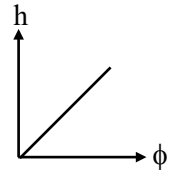
$$= \frac{\mu_0}{4\pi}\frac{I}{2}\left(\frac{1}{2} - \frac{1}{3}\right) = 8.3I \times 10^{(-9)}\,T$$

**11.** If a particle is thrown at an angle $\phi$ with vertical then mark the graph between h and $\phi$.

(1) 

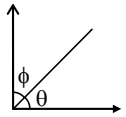

(2) 


(3) 


(4) 

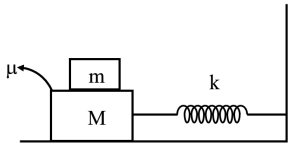

**Ans.** **(3)**

**Sol.**




$$H = \frac{u^2 \sin^2\theta}{2g} \Rightarrow H = \frac{u^2 \cos^2\theta}{2g}$$

**12.** The figure below shows an oscillating system of two blocks and a spring. The horizontal surface is smooth and the contact between the blocks is rough with coefficient of static friction $\mu$. Considering that the blocks of mass m is always stationary relative to M, choose the correct option regarding the statement below :




smooth

(A) Maximum frictional force between blocks is $\mu$ mg

(B) Time period of oscillation is $2\pi\sqrt{\frac{m+M}{k}}$

(C) Friction between the blocks at any instant is $\mu$Mg

(1) Only A & B are correct

(2) Only A is correct

(3) Only B is correct

(4) None of these

**Ans.** **(3)**

**Sol.** $f_{max.} = ma_{max.}$

$= m\omega^2 A$

$f = ma$

$= m\omega^2 x$

**13.** Choose the correct option.

| | |
|---|---|
| a. Gravitational potential | (i) $M^{-1}L^3T^{-2}$ |
| b. Gravitational constant | (ii) $ML^2T^{-2}$ |
| c. Acceleration due to gravity | (iii) $M^0L^2T^{-2}$ |
| d. Potential energy | (iv) $M^0LT^{-2}$ |

(1) a(iii), b(i), c(iv), d(ii)

(2) a(iii), b(ii), c(iv), d(i)

(3) a(ii), b(i), c(iv), d(iii)

(4) a(ii), b(iv), c(i), d(iii)

**Ans.** **(1)**

**Sol.** Gravitational potential

$$v = \frac{-GM}{R} = M^0L^2T^{-2}$$

Gravitational constant $F = \frac{GM_1M_2}{R^2} = M^{-1}L^3T^{-2}$

$$g = \frac{GM}{R^2} = M^0LT^{-2}$$

$$U = \frac{GM_1M_2}{R} = ML^2T^{-2}$$

**14.** A thin uniform wire of length 25 m and area of cross-section 5 mm$^2$ has resistivity $2 \times 10^{-6}$ $\Omega$-m. If the wire is bent to form a circle, the resistance across diametrically opposite points is

(1) 12.5 $\Omega$ (2) 5 $\Omega$

(3) 10 $\Omega$ (4) 2.5 $\Omega$

**Ans.** **(4)**

**Sol.** $R = \frac{\rho\ell}{A}$

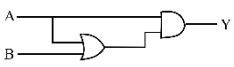
$$R_{net} = \frac{R}{4}$$

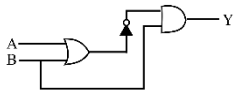
$$= \frac{\rho\ell}{A4}$$

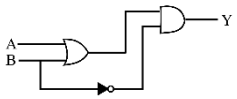
$$= \frac{\rho\ell}{A4} = \frac{2\times10^{-6}\times25}{5\times10^{-6}\times4} = \frac{10}{4} = 2.5\Omega$$

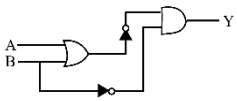
**15.** For given truth table, which option is correct

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

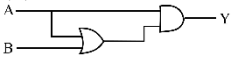
(1) 

(2) 

(3) 

(4) 

**Ans.** **(1)**

**Sol.** 

Option 1 is correct because its follow the given truth table

**16.** Which of the following is correct when deviation is minimum regarding an equilateral prism of angle A :

(1) i = e

(2) Ray inside prism becomes parallel to base of prism.

(3) More is 'A', smaller is deviation.

(4) All of these

**Ans.** **(4)**

**Sol.** From condition of minimum deviation

$i = e$

Ray inside prism becomes parallel to base of prism.

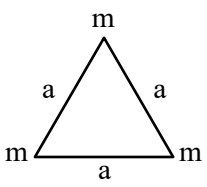
$\delta = (i + e) - A$

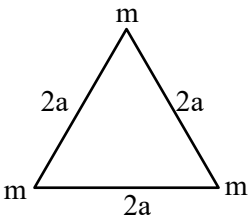
$\delta = 2i - A$

So, More is 'A', smaller is deviation.

## SECTION-B

**1.** Three particles in figure (a) collide at centroid in 4 sec. In how much time will they collide in figure (b)



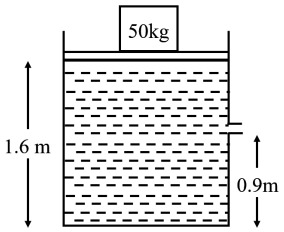




**Ans.** **(8)**

**Sol.** $v_{rel} = \frac{3v}{2}$ $\quad t' = 8s$

$$t = \frac{2d}{3v} = 4$$

**2.** In the shown diagram a block of 50 kg is kept on a light plate of area 1 $m^2$ covering the surface of a water tank in which a hole is pierced at a height of 0.9 m from the bottom. Given the height of water is 1.6 m. If the velocity of efflux is v (in SI unit), then find $10v^2$ :




**Ans.** **(150)**

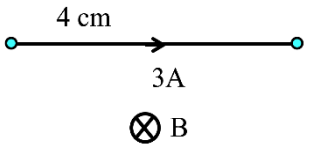
**Sol.** $P_0 + \frac{50 \times 10}{1} + 1000 \times 10 \times 0.7$

$= P_0 + \frac{1}{2}\rho v^2$

$2\left(\frac{500 \times 7000}{1000}\right) = V^2 = 15$

$10V^2 = 150$

**3.** If a rod of length 4 cm is placed in magnetic field 0.15 T perpendicularly having current 3 amp. The magnitude of force on Rod is $2x \times 10^{-3}$. Find x :-




**Ans.** **(x = 9)**

**Sol.** $\vec{F} = i(\vec{\ell} \times \vec{B})$

$F = i \ell B$

$3 \times 4 \times 10^{-2} \times 0.15$

$= 12 \times 10^{-2} \times 0.15$

$F = 180 \times 10^{-4}\ N$

$= 18 \times 10^{-3}\ N$

$2x = 18$

$x = 9\ s$

# JEE (MAIN)-2025 (Online)

# Chemistry Memory Based Answer & Solutions

**MORNING SHIFT**

**DATE : 03-04-2025**

## Disclaimer

The questions and solutions provided for JEE Main 2025 Session-2 are based on students' memory. While every effort has been made to ensure accuracy, there may be discrepancies or variations from the actual exam. These materials are intended for reference and educational purposes only. They do not represent the official question paper or solutions provided by the exam conducting authority.

We recommend cross-verifying with official sources and using this content as a supplementary resource for your preparation.

# MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – APRIL, 2025

**(Held On Thursday 03rd April, 2025) TIME : 09 : 00 AM to 12 : 00 PM**

## CHEMISTRY

## TEST PAPER WITH SOLUTION

### SECTION-A

**1.** Which of the following has highest atomic number

(1) Po (2) Pt

(3) Pr (4) Pb

**Ans.** **(1)**

**Sol.** $_{84}Po \rightarrow$ p-block

$_{78}Pt \rightarrow$ d-block

$_{59}Pr \rightarrow$ f-block

$_{82}Pb \rightarrow$ p-block

**2.** Which of the following ion shows spin only magnetic of 4.9 B.M.

(1) $Mn^{2+}$ (2) $Cr^{2+}$

(3) $Fe^{3+}$ (4) $Co^{2+}$

**Ans.** **(2)**

**Sol.** $\mu = \sqrt{n(n+2)}$ B.M., where n = no. of unpaired $e^{\ominus}$ if $\mu = 4.9$ B.M. then $n = 4$

$Cr^{2\oplus} \Rightarrow 3d^4$ | 1 | 1 | 1 | 1 | | n=4

**3.** An ideal gas with an adiabatic exponent 1.5, initially at 27°C is compressed adiabatically from 800 cc to 200 cc. The final temperature of the gas is

(1) 600 K (2) 300 K

(3) 450 K (4) 273 K

**Ans.** **(1)**

**Sol.** $PV^x$ = constant

$$\frac{T_1}{T_2} = \left(\frac{V_2}{V_1}\right)^{x-1}$$

$$\frac{300}{T_2} = \left(\frac{200}{800}\right)^{\frac{3}{2}-1}$$

$T_2 = 600K$

**4.** 2 moles each of ethylene glycol and glucose are mixed with 500 g of water. Find the boiling point of solution.

Given : $K_b = 0.52$ K kg $mol^{-1}$

(1) 377.16 K (2) 368.84 K

(3) 376.16 K (4) 369.84 K

**Ans.** **(1)**

**Sol.** $\Delta T_b = ik_b m$

$$\Delta T_b = k_b \times \frac{4\times1000}{500} \qquad (i = 1)$$

$= 0.52 \times 8$

$= 4.16$

$(T_b)_{solution} - T_b = 4.16$

$(T_b)_{solution} = 373 + 4.16$

$= 377.16$

**5.** Match the column.

| List-I | | List-II | |
|---|---|---|---|
| (a) | $PF_5$ | (i) | Tetrahedral and $sp^3$ |
| (b) | $SF_6$ | (ii) | Square planar and $dsp^2$ |
| (c) | $[Ni(CO)_4]$ | (iii) | Octahedral and $sp^3d^2$ |
| (d) | $[PtCl_4]^{2-}$ | (iv) | Trigonal bipyramidal and $sp^3d$ |

(1) a→(iv), b→(iii), c→(i), d→(ii)

(2) a→(ii), b→(i), c→(iv), d→(iii)

(3) a→(iii), b→(ii), c→(i), d→(iv)

(4) a→(ii), b→(iv), c→(i), d→(iii)

**Ans.** **(1)**

**Sol.** (a) $PF_5 \rightarrow sp^3d$ (Trigonal bipyramidal)

(b) $SF_6 \rightarrow sp^3d^2$ (Octahedral)

(c) $Ni(CO)_4 \rightarrow sp^3$ (Tetrahedral)

(d) $[PtCl_4]^{2-} \rightarrow dsp^2$ (Square Planar)

**6.** Arrange the following cations in increasing order of limiting molar conductivities of at 298 K

$H^+$, $Ca^{+2}$, $Na^+$, $K^+$, $Mg^{+2}$.

(1) $K^+ > Na^+ > H^+ > Ca^{+2} > Mg^{+2}$

(2) $H^+ > Ca^{+2} > Mg^{+2} > K^+ > Na^+$

(3) $H^+ > Ca^{+2} > K^+ > Mg^{+2} > Na^+$

(4) $H^+ > Ca^{+2} > Mg^{+2} > Na^+ > K^+$

**Ans.** **(2)**

**Sol.** Reference NCERT table

Limiting Molar Conductivity for some Ions in Water at 298 K

| Ion | $\lambda^0/(S\ cm^2mol^{-1})$ |
|---|---|
| $H^+$ | 349.6 |
| $Na^+$ | 50.1 |
| $K^+$ | 73.5 |
| $Ca^{2+}$ | 119.0 |
| $Mg^{2+}$ | 106.0 |

Molar conductivity ∝ charge

∝ Mobility

Limiting Molar Conductivity :

$H^+ > Ca^{+2} > Mg^{+2} > K^+ > Na^+$

**7.** Which is **correct :**

(1) $A + e^- \rightarrow A^- \rightarrow$ is always exothermic.

(2) $A \rightarrow A^+ + e^- \rightarrow$ is always endothermic.

(3) $IE_1$ of (Be) < $IE_1$ (B).

(4) Lithium is most electropositive in its group.

**Ans.** **(2)**

**Sol.** (1) $A + e^- \rightarrow A^-$

If A = inert gas, Be, Mg & N then it will be endothermic.

(2) $A \rightarrow A^+ + e^-$

Ionisation energy is always endothermic

(3) Be > B ionisation energy (due to $2s^2$ configuration)

(4) Li is not most electropositive in its group

Cs is more electropositive

**8.** Which of the following property shows irregular trend in group 16?

(1) Electronegativity (2) Atomic radius

(3) Electron affinity (4) Ionisation enthalpy

**Ans.** **(3)**

**Sol.** Electron affinity

S > Se > Te > Po > O

**9.** Consider the following statements

**Statement I:** N–N has less bond strength than P–P

**Statement II:** All group-15 elements in +3 oxidation state undergo disproportionation.

In the above statements, choose the correct option.

(1) Both Statement are correct.

(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct.

(4) Both Statement are incorrect.

**Ans.** **(2)**

**Sol.** $\ddot{N}-\ddot{N} < \ddot{P}-\ddot{P}$

(due to Lone pair. – Lone pair repulsion)

**10.** Consider the following complex ions

(a) $[Co(NH_3)_6]^{3+}$ (b) $[Co(NH_3)_5Cl]^{2+}$

(c) $[Co(NH_3)_5(H_2O)]^{3+}$ (d) $[Co(CN)_6]^{3-}$

Choose the correct order of wavelength absorbed by complex ions

(1) b > a > c > d (2) a > b > c > d

(3) b > c > a > d (4) d > c > b > a

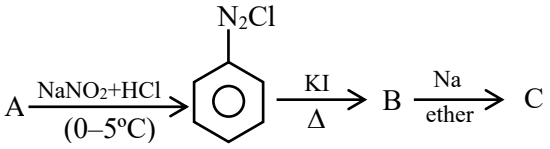
**Ans.** **(3)**

**Sol.** $\Delta \propto \frac{1}{\lambda_{obs}}$

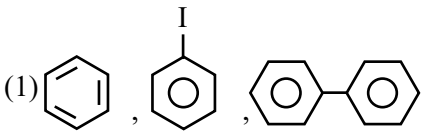
$\Delta$ : d > a > c > b

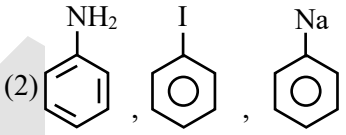
$\lambda_{obs}$ : b > c > a > d

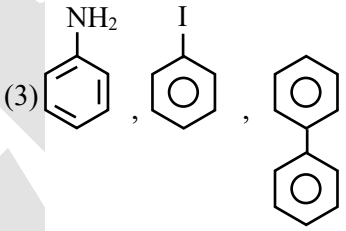
**11.**

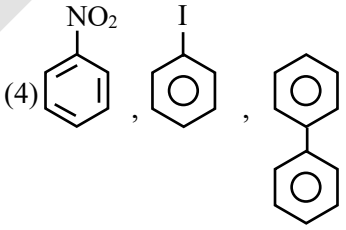



Identify A, B, C respectively

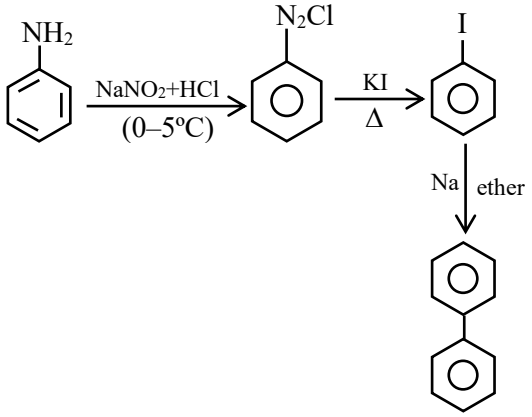
(1) 


(2) 

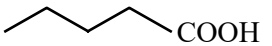

(3) 

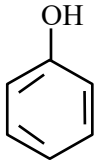

(4) 

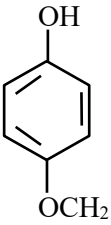

**Ans.** **(3)**

**Sol.** 

**12.** Which of the following is more acidic than others?

(1) 

(2) 

(3) 

(4) 

**Ans.** **(1)**

**Sol.** pKa(p-nitrophenol) is around 7.15

pKa(pentanoic acid) is around 4.82

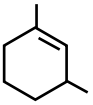
pKa(phenol) is around 10.00

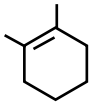
pKa(p-methoxy phenol) is around 10.2

So, pentanoic acid has highest acidic nature among all

**13.** Identify reactant of following reaction

Reactant $\xrightarrow[Zn\text{-}H_2O]{O_3}$ 3-Methyl-6-ketoheptanal

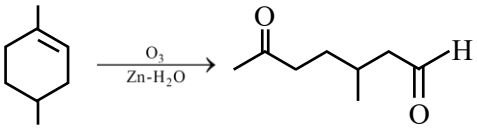
(1) 

(2) 

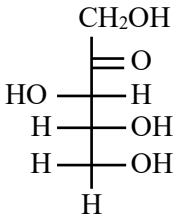
(3) 

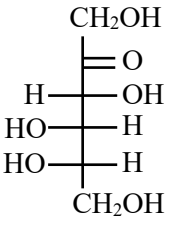
(4) 

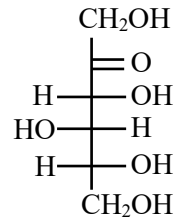
**Ans.** **(3)**

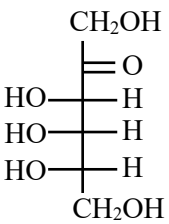
**Sol.** 

**14.** Identify structure of L-Fructose

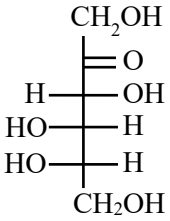
(1) 

(2) 

(3) 

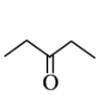
(4) 

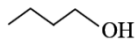
**Ans.** **(2)**

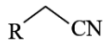
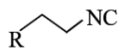
**Sol.** 

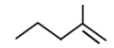
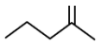
(L-Fructose)

**15.** Which of the following is/are correct

(a)  and  : are Metamers

(b)  and  : are Position isomers

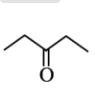
(c)  and  : are Functional isomers

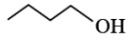
(d)  and  : are Position isomers

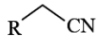
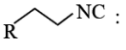
(1) (a), (b), (c) (2) (a), (b), (d)

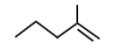
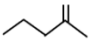
(3) (a), (b) (4) (a), (b), (c), (d)

**Ans.** **(3)**

**Sol.** (a)  and  : are Metamers

(b)  and  : are Position isomers

(c)  and  : are not any type of isomers

(d)  and  : are identical

**16.** The given reaction is at equilibrium starting with only $PCl_5$

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$,

When addition of Xe gas takes place at constant pressure, then which of the following is correct?

(1) Conc. of $PCl_3$ will become more than $Cl_2$

(2) $PCl_3$ and $Cl_2$ will have same concentration at new equilibrium.

(3) Conc. of $Cl_2$ will become more than $PCl_3$.

(4) $PCl_3$ will be 30% and $Cl_2$ will be 70% at the new equilibrium

**Ans.** **(2)**

**Sol.** $PV = nRT$

$(V) \uparrow \propto (n) \uparrow$

Reaction will be shift at that direction where no. of gases mole more.

**17.** Which of the following statement(s) is/are **INCORRECT**

I. $NO_2$ dimerises easily

II. $NF_5$ does not exist but $PF_5$ exists

III. The oxides $N_2O_5$ and $P_2O_5$ are purely acidic but $As_2O_5$ and $Sb_2O_5$ are basic

IV. Nitrogen cannot form pπ-dπ bond as the heavier elements

(1) Only I, II and IV (2) Only III

(3) Only III and IV (4) Only I and II

**Ans.** **(3)**

**Sol.** I. $NO_2$ dimerises easily to form $N_2O_4$ due to presence of unpaired electron.

II. N does not have any d-orbital so it cannot increase its valancy to 5 to form $NF_5$

III. $N_2O_5$, $P_2O_5$ $As_2O_5$ $Sb_2O_5$ = Acidic oxides

IV. Nitrogen can form pπ-dπ bond

Eg. $\ddot{N}(SiH_3)_3$

**18.** Correct set of four Quantum numbers for last electron of $Cr^{3+}$ on is:

(1) $n = 4, l = 1, m = 0, s = +\frac{1}{2}$

(2) $n = 4, l = 2, m = 0, s = +\frac{1}{2}$

(3) $n = 3, l = 2, m = 0, s = +\frac{1}{2}$

(4) $n = 3, l = 2, m = -1, s = 0$

**Ans.** **(3)**

**Sol.** $Cr+3 = [Ar]3d^3$

$n = 3, l = 2, m = 0, s = +\frac{1}{2}$

**19.** Given below are two statements about X-ray spectra of elements:

**Statement I:** A plot of $\sqrt{\upsilon}$ (ν = frequency of X-rays emitted) vs atomic mass is a straight line.

**Statement II:** A plot of ν (ν = frequency of X-rays emitted) vs atomic number is a straight line.

In the light of the above statements, choose the correct answer from the options given below:

(1) Both Statement are correct.

(2) Statement I is correct but Statement II is incorrect.

(3) Statement I is incorrect but Statement II is correct.

(4) Both Statement are incorrect.

**Ans.** **(4)**

**Sol.** $\sqrt{\upsilon} = a(z-b)$

$\sqrt{\upsilon} \propto Z$

$\sqrt{\upsilon}$ vs Z graph is a straight line

## SECTION-B

**20.** There are two solutions of compounds A & B. The initial concentration of B is 8 times initial concentration of A. If half life of A & B are 40 and 10 min. then find the time when concentration of both A & B are same.

(Assume first order reaction)

**Ans.** **(40)**

**Sol.**

| | $A \longrightarrow P$ | $B \longrightarrow P$ |
|---|---|---|
| t=0 | a | 8a |
| t=t | $C_A$ | $C_B$ |

$C_A = a.e^{-k_A t}$ $\quad C_B = 8a \times e^{-K_B t}$

$k_A = \frac{\ln 2}{40}$ $\quad k_B = \frac{\ln 2}{10}$

$a \times e^{-\frac{\ln 2}{40} \times t} = 8a \times e^{-\frac{\ln 2}{10} \times t}$

$\frac{t}{10} - \frac{t}{40} = 3$

t = 40 min

**21.** $K_2Cr_2O_7 + H_2SO_4 + 4H_2O_2 \rightarrow A + K_2SO_4 + 5H_2SO_4$.

Find the number of oxygen atom in product A.

**Ans.** **(5)**

**Sol.** $K_2Cr_2O_7 + H_2SO_4 + 4H_2O_2 \rightarrow CrO_5 + K_2SO_4 + 5H_2SO_4$.

Number of 'O' atom in A = 5

**22.** $FeCl_3 + KOH + H_2C_2O_4 \longrightarrow A$

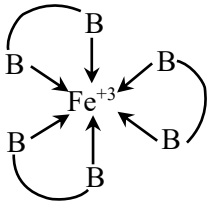
'A' is a complex, find the number of optical isomer of product A.

**Ans.** **(2)**

**Sol.** $K_3[Fe(C_2O_4)_3] = A$

$C_2O_4^{2-} \rightarrow$ Symmetrical bidentate ligand

$[Fe(BB)_3]^{3-}$




POS ×

Optically active

**23.** 0.5 g of a hydrocarbon gives 1.46 g $CO_2$ and 0.9 g $H_2O$ on combustion. What is the percentage of carbon in hydrocarbon. (Nearest integer)

**Ans.** **(80)**

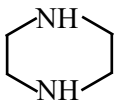
**Sol.** $C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$

$$\%C = \frac{12}{44} \times \frac{\text{wt. of } CO_2}{\text{wt. of Hydrocarbon}} \times 100$$

$$\%C = \frac{12}{44} \times \frac{1.46}{0.5} \times 100$$

$\%C = 79.63 \approx 80\%$

**24.** Calculate the mass of nitrogen present in 1.6 g of following compound




**Ans.** **(0.52)**

**Sol.** $C_4H_{10}N_2 \rightarrow$ Molar mass $= 12 \times 4 + 1 \times 10 + 14 \times 2$

$= 48 + 10 + 28$

$= 86$

86 g m o.c $\rightarrow$ 28g nitrogen

1.6 gm o.c $\rightarrow \frac{28}{86} \times 1.6$

$= 0.52$ g

# JEE (MAIN)-2025 (Online)

# Mathematics Memory Based Answer & Solutions

**MORNING SHIFT**

**DATE : 03-04-2025**

## Disclaimer

The questions and solutions provided for JEE Main 2025 Session-2 are based on students' memory. While every effort has been made to ensure accuracy, there may be discrepancies or variations from the actual exam. These materials are intended for reference and educational purposes only. They do not represent the official question paper or solutions provided by the exam conducting authority.

We recommend cross-verifying with official sources and using this content as a supplementary resource for your preparation.

# MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – APRIL, 2025

**(Held On Thursday 3rd April, 2025) TIME : 9 : 00 AM to 12 : 00 PM**

## MATHEMATICS

## TEST PAPER WITH SOLUTION

**1.** Let A be 3×3 matrix such that $\det(A) = 5$. If $\det\left(3adj\left(2Aadj(2A)\right)\right) = 2^{\alpha}.3^{\beta}.5^{\gamma}$, then $(\alpha+\beta+\gamma)$ is equal to

(1) 25 (2)26 (3) 27 (4) 28

**Ans.** **(4)**

**Sol.** $\left|3adj\left(2Aadj\left(2A\right)\right)\right| = 3^3\left|adj\left(2A.adj\left(2A\right)\right)\right|$

$= 3^3\left|2A.adj\left(2A\right)\right|^2$

$= 3^3\left\|2A\right|I_3\right|^2$

$= 3^3\left(\left|2A\right|^3\right)^2$

$= 3^3\times\left(2^9.\left|A\right|^3\right)^2$

$= 3^3\times 2^{18}\times 5^6$

**2.** The sum of all rational terms in $\left(2+\sqrt{3}\right)^8$ is

(1) 18117 (2) 18817

(3) 17280 (4)1800

**Ans.** **(2)**

**Sol.** $T_{r+1} = {}^8C_r\times 2^{8-r}\times\left(\sqrt{3}\right)^r$

Sum of all rational terms

$= {}^8C_0\times 2^8 + {}^8C_2\times 2^6\times 3 + {}^8C_4\times 2^4\times 3^2$

$+ {}^8C_6\times 2^2\times 3^3 + 3^4$

= 256 + 28 × 64 ×3 + 70 × 16 × 9 + 28 ×4 ×27 + 81

= 256 + 5376 + 10080 + 3024 + 81

= 18817

**3.** If the sum $\sum_{r=1}^{9}\left(\frac{r+3}{2^r}\right)\cdot {}^9C_r = \alpha\cdot\left(\frac{3}{2}\right)^9 - \beta$, then the value of $(\alpha+\beta)^2$ is equal to

(1) 9 (2) 81

(3) 27 (4) 36

**Ans.** **(2)**

**Sol.** $\sum_{r=1}^{9} r.\frac{9}{r}.{}^8C_{r-1}.\frac{1}{2^r} + \sum_{r=1}^{9}\frac{3}{2^r}.{}^9C_r$

$= \frac{9}{2}\left(1+\frac{1}{2}\right)^8 + 3\left\{\left(1+\frac{1}{2}\right)^9 - 1\right\}$

$= \frac{9}{2}.\left(\frac{3}{2}\right)^8 + 3.\left(\frac{3}{2}\right)^9 - 3$

$= 6.\left(\frac{3}{2}\right)^9 - 3 = \alpha\left(\frac{3}{2}\right)^9 - \beta$

$\therefore\ \alpha = 6, \beta = 3$

$\therefore\ (\alpha+\beta)^2 = 81.$

**4.** Let $S_n = 1 + 3 + 11 + 25 + 45 + \cdots$ Then sum upto 20th term equals to

(1) 6200 (2) 7200

(3) 7240 (4) 6240

**Ans.** **(3)**

**Sol.** Using method of difference

$S_n = 1 + 3 + 11 + 25 + 45 + \ldots..$

2 8 14 20

$T_1 = 1$

$T_2 = 1 + 2$

$T_3 = 1 + 2 + 8$

$T_4 = 1 + 2 + 8 + 14$

$T_n = \underbrace{1+2+8+14+20+....}_{\text{upto n terms}}$

$T_n = 1+\frac{n-1}{2}\left[2\times 2+(n-2)\times 6\right] = 3n^2 - 7n + 5$

$S_{20} = \sum_{n=1}^{20} T_n = 3\sum_{1}^{20} n^2 - 7\sum_{1}^{20} n + 5\sum_{1}^{20} 1$

$= 3\times\frac{20\times 21\times 41}{6} - \frac{7\times 20\times 21}{2} + 5\times 20$

= 7240

**5.** Let $f(x)=\int x^3\sqrt{3-x^2}\,dx$. If $5f(\sqrt{2})=-4$, then $f(1)$ is equal to

(1) $-\frac{2\sqrt{2}}{5}$ (2) $-\frac{6\sqrt{2}}{5}$

(3) $-\frac{4\sqrt{3}}{5}$ (4) $-\frac{8\sqrt{2}}{5}$

**Ans.** **(2)**

**Sol.** Let $3 - x^2 = y^2$

$\therefore -x\,dx = y\,dy$

$\therefore x\,dx = -y\,dy$

$$\int(3-y^2)(-y\,dy).y=\int-(3y^2-y^4)\,dy$$

$$=-3\left(y^3-\frac{y^5}{5}\right)+c$$

$$=-\frac{y^3}{5}(5-y^2)+c$$

$$=-\frac{(3-x^2)^{3/2}}{5}(5-3+x^2)+c$$

$$f(x)=-\frac{(3-x^2)^{3/2}}{5}(2+x^2)+c$$

$$f(\sqrt{2})=-\frac{4}{5}\ \therefore\ -\frac{4}{5}=-\frac{1}{5}(2+2)+c\ \therefore\ c=0$$

$$\therefore\ f(1)=-\frac{(2)^{3/2}}{5}(3)=-\frac{6\sqrt{2}}{5}$$

**6.** A relation

$R=\{(x,y):x,y\epsilon A=\{-3,-2,-1,0,1,2,3\}\}$ such that $x^2+2y\le 4$. Then, the number of ordered pairs in relation R be r and number of ordered pairs required to add in R so that it becomes reflexive relations is m, then $r+m$ is equal to

(1) 26 (2) 28

(3) 24 (4) 23

**Ans.** **(2)**

**Sol.** $A=\{-3,-2,-1,0,1,2,3\}$

No of ordered pairs in relation R

$2y \le 4 - x^2$ $\quad\therefore\ y\le\frac{4-x^2}{2}$

Now put:

(1) $x = \pm3,\ y\le\frac{4-9}{2}\Rightarrow y\le\frac{-5}{2}\Rightarrow y=-3$

$(\pm3,-3)\to 2$ pairs

(2) $x = \pm2,\ y\le\frac{4-4}{2}\Rightarrow y\le 0$

$\Rightarrow y = -3, -2, -1, 0$

$(\pm2,-3),(\pm2,-2),(\pm2,-1),(\pm2,0)$

8 pairs.

(3) $x \pm1,\ y\le\frac{3}{2}\Rightarrow y=-3,-2,-1,0,1$

No of ordered pairs = 10

(4) $x = 0,\ y \le 2$

$\Rightarrow y = -3, -2, -1, 0, 1, 2$

6 pairs.

$\therefore$ total order pair

$\therefore$ r = 26

For reflexive m = 2

$\therefore$ r + m = 28.

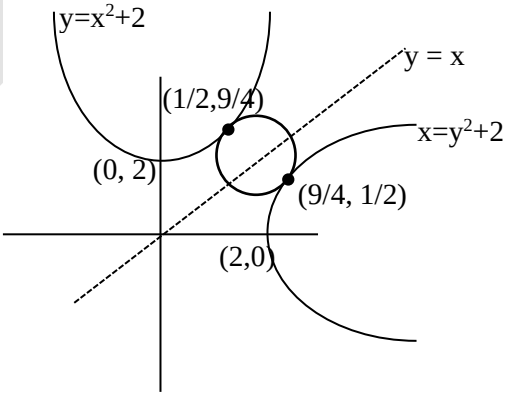
**7.** The radius of circle touching both parabolas $y=x^2+2$ and $x=y^2+2$ is

(1) $\frac{7\sqrt{2}}{8}$ (2) $\frac{7\sqrt{2}}{2}$

(3) $\frac{7\sqrt{2}}{4}$ (4) $\frac{7\sqrt{2}}{6}$

**Ans.** **(1)**

**Sol.**




For $y = x^2 + 2$

$$\frac{dy}{dx}=2x=1$$

at $x=\frac{1}{2}$ and $y=\frac{9}{4}$

For $x = y^2 + 2$

$$1=2y\frac{dy}{dx}\Rightarrow\frac{1}{2y}=1$$

at $y=\frac{1}{2}$ and $x=\frac{9}{4}$

$$\Rightarrow 2R = \sqrt{2\times\left(\frac{9}{4}-\frac{1}{2}\right)^2} = \sqrt{2\times\left(\frac{7}{4}\right)^2} = \sqrt{2}\times\frac{7}{4}$$

$$\Rightarrow R = \frac{7\sqrt{2}}{8}$$

**8.** If $3x + 2\tan x = \pi,\ x\epsilon[-2\pi, 2\pi] - \left\{\pm\frac{\pi}{2}, \pm\frac{3\pi}{2}\right\}$. Then number of values of $x$ that satisfies the above equation is

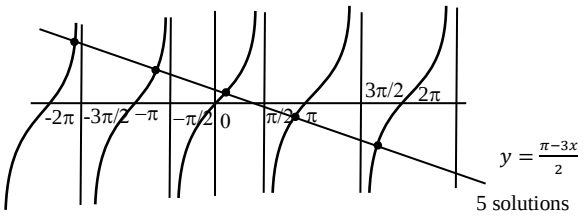
(1) 7 (2) 5

(3) 4 (4) 6

**Ans.** **(2)**

**Sol.** $3x + 2\tan x = \pi,\ x \in [-2\pi, 2\pi] - \{\pm \pi/2, \pm 3\pi/2\}$

$$\tan x = \frac{\pi - 3x}{2}$$




**9.** Let $\int_0^x g(t)\,dt = x - \int_0^x tg(t)\,dt, x \geq 0$ and $\frac{dy}{dx} - y\tan x = 2(x+1)\sec x\, g(x)$ satisfying the condition $y(0) = 0$. Then $y\left(\frac{\pi}{3}\right)$ is

(1) $\pi$ (2) $2\pi$

(3) $\frac{2\pi}{3}$ (4) $\frac{4\pi}{3}$

**Ans.** **(4)**

**Sol.** $\int_0^x g(t)dt = x - \int_0^x tg(t)dt \qquad x \geq 0$

$g(x) = 1 - xg(x)$

$$\Rightarrow g(x) = \frac{1}{1+x}$$

$$\frac{dy}{dx} - y\tan x = 2(x+1)\sec x g(x)$$

$$\frac{dy}{dx} - y\tan x = 2\sec x$$

$\cos x.y = 2x + c$

$$y = \frac{2x}{\cos x}$$

$$y\left(\frac{\pi}{3}\right) = \frac{\frac{2\pi}{3}}{\frac{1}{2}} = \frac{4\pi}{3}$$

**10.** If $f(x) = \begin{vmatrix} \sin x & \cos x & \sin x + \cos x + 1 \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$, then the value of $f''(x) + f(x)$ is

(1) –1 (2) 28

(3) 27 (4) 1

**Ans.** **(1)**

**Sol.** $$f(x) = \begin{vmatrix} \sin x & \cos x & \sin x + \cos x + 1 \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$$

$$f'(x) = \begin{vmatrix} \cos x & -\sin x & \cos x - \sin x \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$$

$$f''(x) = \begin{vmatrix} -\sin x & -\cos x & -\sin x - \cos x \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$$

$$f''(x) + f(x) = \begin{vmatrix} 0 & 0 & 1 \\ 27 & 28 & 27 \\ 1 & 1 & 1 \end{vmatrix}$$

= 27 – 28

= –1

**11.** The number of seven digit numbers whose sum of digits is 7, is___.

**Ans.** **(924)**

**Sol.** Let the seven digit number be $a_0,a_1,a_2,a_3,a_4,a_5,a_6$ where $a_0$, $a_1$, $a_2$, $a_3$, $a_4$, $a_5$, $a_6$ are digits from 0 to 7 & $a_0 \neq 0$

$\therefore$ When $a_0 = 1$, $a_1 + a_2 + a_3 + a_4 + a_5 + a_6 = 6$

$\therefore$ No. of ways = ${}^{6+6-1}C_{6-1} = {}^{11}C_5$

$\therefore$ When $a_0 = 2$, $a_1 + a_2 + a_3 + a_4 + a_5 + a_6 = 5$

$\therefore$ No. of ways = ${}^{5+6-1}C_{6-1} = {}^{10}C_5$

$\vdots$

$\therefore$ When $a_0 = 7$, $a_1 + a_2 + a_3 + a_4 + a_5 + a_6 = 0$

$\therefore$ No. of ways = ${}^{0+6-1}C_{6-1} = {}^{5}C_5$

$\therefore$ Total number of nos.

$= {}^5C_5 + {}^6C_5 + {}^7C_5 + \ldots + {}^{11}C_5$

$$= {}^{12}C_6 = \frac{12.11.10.9.8.7}{6.5.4.3.2.1} = 924$$

**12.** Let $\alpha, \beta$ are the roots of the equation $x^2 + \sqrt{3}x - 16 = 0$ and $\gamma, \delta$ are the roots of the equation $x^2 + 3x - 1 = 0$.

If $Q_n = \alpha^n + \beta^n \forall\, n \epsilon N$ then the value of $\frac{Q_{25}+\sqrt{3}Q_{24}}{2Q_{23}} + \left(\frac{P_{25}-P_{23}}{P_{24}}\right)$ is

(1) 5 (2) 6

(3) 7 (4) 8

**Ans.** **(1)**

**Sol.**

$x^2 + \sqrt{3}x - 16 = 0 \begin{cases} \alpha \\ \beta \end{cases}$, $Q_n = \alpha^n + \beta^n$

so, it will satisfy $Q_{n+2} + \sqrt{3}Q_{n+1} - 16Q_n = 0$

$x^2 + 3x - 1 = 0 \begin{cases} \gamma \\ \delta \end{cases}$, $P_n = \gamma^n + \delta^n$

so, it will satisfy $P_{n+2} + 3P_{n+1} - P_n = 0$

So, the value of $\left(\frac{Q_{25}+\sqrt{3}Q_{24}}{2Q_{23}}\right) + \left(\frac{P_{25}-P_{23}}{P_{24}}\right)$

$\because \frac{Q_{25}+\sqrt{3}Q_{24}}{2Q_3} = 8$ and $\frac{P_{25}-P_{23}}{P_{24}} = -3$

$\Rightarrow$ the required value = 8 – 3 = 5

**13.** If $y = \max\{|x|, x, |x-2|\}$, then the area under the curve from $x = -2$ to $x = 4$ is (in square units)

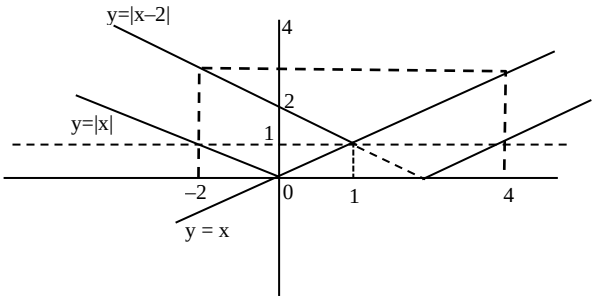
(1) 15 (2) 20

(3) 12 (4) 8

**Ans.** **(1)**

**Sol.** $\therefore$ Area = $\frac{1}{2}\times3\times3 + 3\times1 + 3\times1 + \frac{1}{2}\times3\times3$

= 15



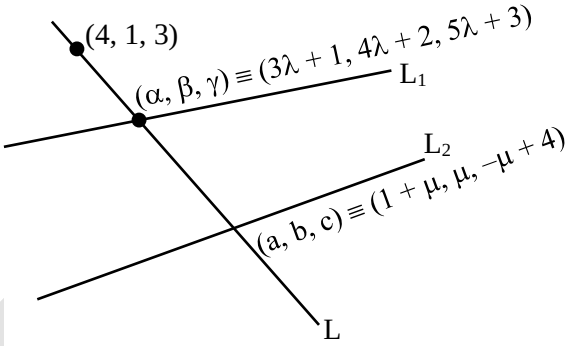

**14.** Let a line passing through (4,1,3) intersects the lines $l_1: \frac{x-1}{3} - \frac{y-2}{4} = \frac{z-3}{5}$ at $(\alpha, \beta, \gamma)$ and $l_2: x - 1 = y = -z + 4$ at (a,b,c), then find $\begin{vmatrix} 63 & 21 & -21 \\ \alpha & \beta & \gamma \\ a & b & c \end{vmatrix}$ is equal to

(1) 102 (2) 204

(3) 63 (4) 21

**Ans.** **(2)**

**Sol.**




$\frac{3\lambda+1-4}{1+\mu-4} = \frac{4\lambda+2-1}{\mu-1} = \frac{5\lambda+3-3}{-\mu+4-3}$

$\frac{3\lambda-3}{\mu-3} = \frac{4\lambda+1}{\mu-1} = \frac{5\lambda}{-\mu+1} = \frac{9\lambda+1}{0}$

$\Rightarrow \lambda = \frac{-1}{9}$, $\mu = \frac{9}{7}$

$\begin{vmatrix} 63 & 21 & -21 \\ 3\lambda+1 & 4\lambda+2 & 5\lambda+3 \\ \mu+1 & \mu & -\mu+4 \end{vmatrix}$

Using $C_2 \to C_2 + C_3$

$= \begin{vmatrix} 63 & 0 & -21 \\ 3\lambda+1 & 9\lambda+5(=4) & 5\lambda+3 \\ \mu+1 & 4 & -\mu+4 \end{vmatrix}$

Using $R_2 \to R_2 - R_3$

$= \begin{vmatrix} 63 & 0 & -21 \\ 3\lambda-\mu & 0 & 5\lambda+\mu-1 \\ \mu+1 & 4 & -\mu+4 \end{vmatrix}$

$= -4[63(5\lambda + \mu - 1) + 21(3\lambda - \mu)]$

$= -4 \times 21[15\lambda + 3\mu - 3 + 3\lambda - \mu]$

$= -84[18\lambda + 2\mu - 3]$

$= -84\left[-2 + \frac{18}{7} - 3\right]$

$= -84\left[-5 + \frac{18}{7}\right] = -12[-35 + 18]$

$= 12 \times 17$

$= 204$

**15.** Let $a_1, a_2, a_3, \ldots$ be the terms of an increasing G.P. such that $a_3 \cdot a_5 = 729$ and $a_2 + a_4 = \frac{111}{4}$, then $24(a_1 + a_2 + a_3)$ is equal to

(1) 139 (2) 129

(3) 125 (4) 119

**Ans.** **(2)**

**Sol.** Let the first term of the increasing G.P. be a and common ratio be r then as per the question

$a_3 \cdot a_5 = ar^2 \cdot ar^4 = 729 \Rightarrow ar^3 = 27$

$$a_2 + a_4 = \frac{111}{4} \Rightarrow ar + ar^3 = \frac{111}{4}$$

$$\Rightarrow ar = \frac{111}{4} - 27 = \frac{3}{4}$$

So, $r^2 = \frac{27}{3/4} = 36 \Rightarrow$ r = 6

So, $a = \frac{3}{4 \times 6} = \frac{1}{8}$

Hence, $24(a_1 + a_2 + a_3) = 24(a + ar + ar^2)$

$= 24 \times a(1 + r + r^2)$

$$= 24 \times \frac{1}{8}(1 + 6 + 6^2) = 129$$

**16.** Let $z \in C$ such that $\frac{z^2+3i}{z-2+i} = 2 + 3i$ then sum of all possible values of $z^2$ is

(1) $-19 - 2i$ (2) $19 + 2i$

(3) $-19 + 2i$ (4) $19 - 2i$

**Ans.** **(1)**

**Sol.** $\frac{z^2 + 3i}{z - 2 + i} = 2 + 3i$

$\Rightarrow z^2 + 3i = (2 + 3i)(z - 2 + i)$

$\Rightarrow z^2 + 3i = 2z - 4 + 2i + 3iz - 6i - 3$

$\Rightarrow z^2 + 3i = 2z - 4i - 7 + 3iz$

$\Rightarrow z^2 - z(2 + 3i) + 7(1 + i) = 0$

Which has roots as α and β sum of whose squares will be given as

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$

$= (2 + 3i)^2 - 2 \times 7(1 + i)$

$= (4 - 9 + 12i) - 14 - 14i$

$= -19 - 2i$

**17.** Let $f(x) = \begin{cases} (1 + ax)^{\frac{1}{x}} & , \quad x < 0 \\ 1 + b & , \quad x = 0 \\ \frac{(x+4)^{\frac{1}{2}} - 2}{(x+c)^{\frac{1}{3}} - 2} & , \quad x > 0 \end{cases}$ be continuous at $x = 0$ then $e^a bc$ is equal to

(1) 64 (2) 48

(3) 72 (4) 36

**Ans.** **(2)**

**Sol.** $f(x) = \begin{cases} (a + ax)^{\frac{1}{x}}, & x < 0 \\ (1 + b), & x = 0 \\ \frac{(x+4)^{\frac{1}{2}} - 2}{(x+c)^{\frac{1}{3}} - 2}, & x > 0 \end{cases}$

$$\Rightarrow \frac{2 - 2}{c^{\frac{1}{3}} - 2} \Rightarrow \text{finite}$$

$c^{\frac{1}{3}} = 2$

c = 8

$\frac{1}{e^x} \times ax = 1 + b \Rightarrow e^a = b + 1$

$$\frac{\frac{1}{2}(x+4)^{\left(\frac{-1}{2}\right)}}{\frac{1}{3}(x+c)^{\frac{-2}{3}}} \Rightarrow \frac{\frac{1}{2} \times \frac{1}{2}}{\frac{1}{3} \times c^{\frac{-2}{3}}}$$

$$= \frac{3}{4} c^{\frac{2}{3}} = \frac{3}{4} \times 4 = 3$$

$b + 1 = 3 \Rightarrow$ b = 2

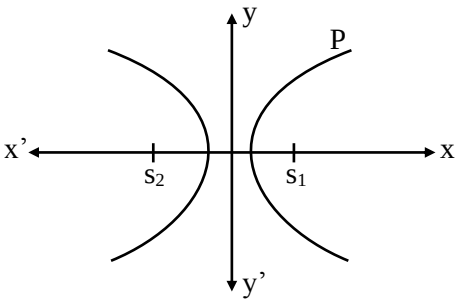
$e^a \times bc = (b + 1)bc$

$= 3 \times 2 \times 8 = 48$

**18.** Let the product of the focal distances of the point $P(4, 2\sqrt{3})$ on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ be 32. The length of conjugate axis be p and the length of it's latus rectum be q. Then $p^2 + q^2$ is equal to___.

**Ans.** **(120)**

**Sol.** $P\left(4,2\sqrt{3}\right)\equiv P\left(x_1,y_1\right)$




$$PS_1 = e\left|x_1 - \frac{a}{e}\right| = ex_1 - a$$

$$PS_2 = e\left|x_1 + \frac{a}{e}\right| = ex_1 + a$$

$PS_1 \times PS_2 = 32$

$$\Rightarrow e^2x_1^2 - a^2 = 32$$

$$\Rightarrow \left(1+\frac{b^2}{a^2}\right)\times 16 - a^2 = 32$$

$$\Rightarrow 16\frac{b^2}{a^2} - a^2 = 16 \quad \ldots(i)$$

$$\frac{16}{a^2} - \frac{12}{b^2} = 1 \quad \ldots(ii)$$

$$\Rightarrow 16\frac{b^2}{a^2} - 12 = b^2$$

$\Rightarrow 16 + a^2 - 12 = b^2$

$\Rightarrow b^2 = a^2 + 4 \quad \ldots(iii)$

Solving (ii) & (iii)

$$\frac{16}{a^2} - \frac{12}{a^2+4} = 1$$

$\Rightarrow 16a^2 + 64 - 12a^2 = a^4 + 4a^2$

$\Rightarrow a^4 = 64$

$\therefore a^2 = 8$

$b^2 = 12$

$p = 2b$ & $q = \frac{2b^2}{a}$

$$p^2 + q^2 = 4b^2 + \frac{4b^4}{a^2}$$

$$= 4\times 12 + 4\times\frac{144}{8}$$

$= 48 + 72 = 120$

**19.** $f(x) = ln\left(\frac{2x-3}{5+4x}\right) + \sin^{-1}\left(\frac{3x+4}{2-x}\right)$. If domain of $f(x)$ is $[\alpha,\beta)$, then find the value of $\alpha^2 + 4\beta$.

**Ans.** **(4)**

**Sol.** $\frac{2x-3}{5+4x} > 0 \Rightarrow x \in \left(-\infty, \frac{-5}{4}\right) \cup \left(\frac{3}{2}, \infty\right)$

$$-1 \le \frac{3x+4}{2-x} \le 1 \Rightarrow -1 \le \frac{3x+4}{2-x} \text{ and } \frac{3x+4}{2-x} < 1$$

$$\frac{3x+4}{2-x} + 1 \ge 0 \text{ and } \frac{3x+4}{2-x} - 1 < 0$$

$\Rightarrow x \in [-3, 2)$ and $x \in \left(-\infty, \frac{-1}{2}\right] \cup (2, \infty)$

So, Domain is $x \in \left[-3, \frac{-5}{4}\right)$

$\alpha = -3$ & $\beta = -\frac{5}{4}$

So, $\alpha^2 + 4\beta$

$= 9 - 5 = 4.$