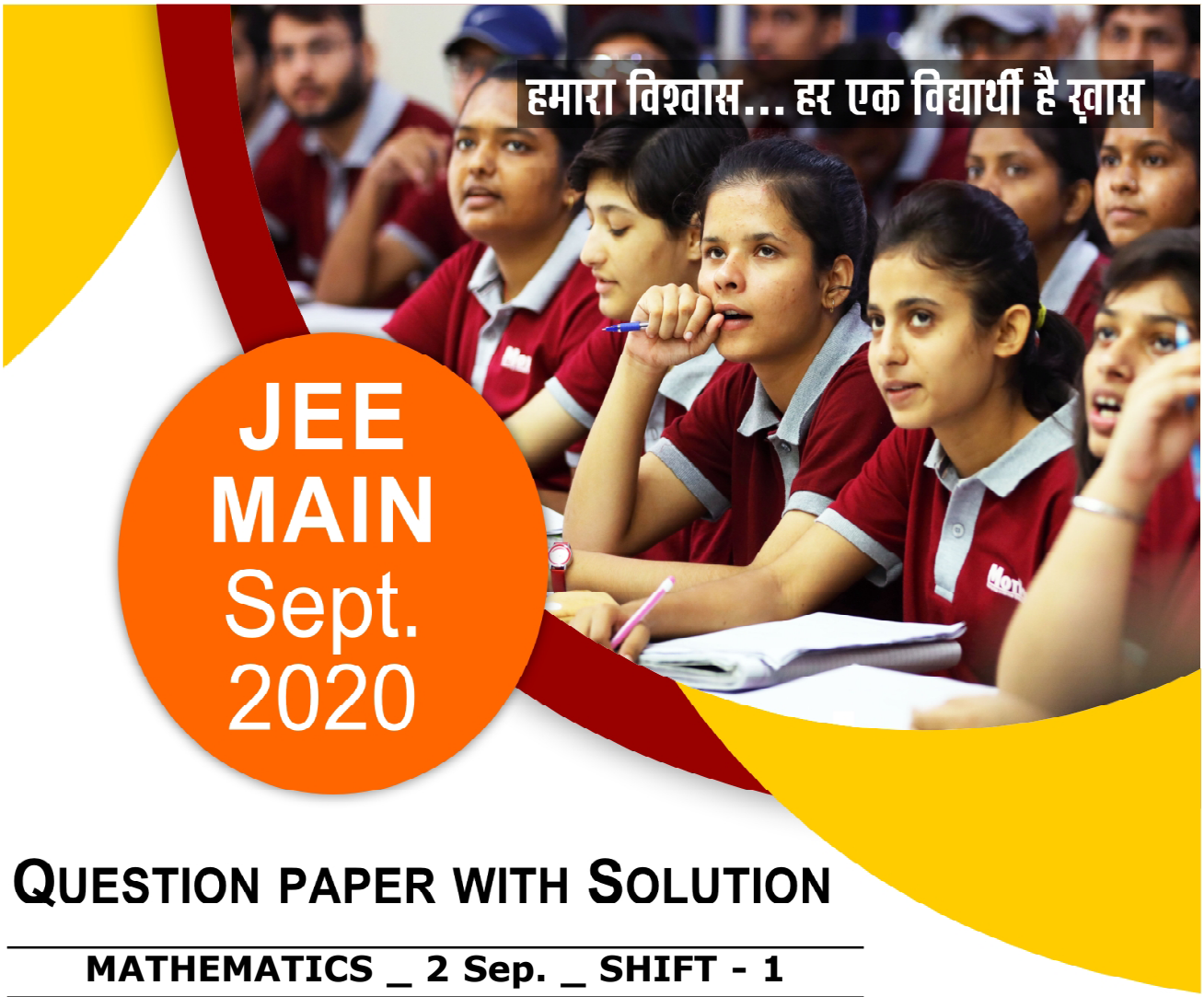

JEE MAIN Sept. 2020

QUESTION PAPER WITH SOLUTION

MATHEMATICS _ 2 Sep. _ SHIFT - 1

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Q.1 A line parallel to the straight line 2x-y=0 is tangent to the hyperbola $\frac{x^2}{4}-\frac{y^2}{2}=1$ at the point (x_1,y_1). Then $x_1^2+5y_1^2$ is equal to :

(1) 6 (2) 10 (3) 8 (4) 5

Sol. **1**

$T: \frac{xx_1}{4}-\frac{yy_1}{2}=1$ ....(1)

t : 2x — y = 0 is parallel to T

$\Rightarrow$ T : 2x — y = λ .....(2)

Now compare (1) & (2)

$\frac{x_1}{\frac{4}{2}}=\frac{y_1}{\frac{2}{1}}=\frac{1}{\lambda}$

$x_1=8/\lambda$ & $y_1 = 2/\lambda$

(x_1,y_1) lies on hyperbola $\Rightarrow \frac{64}{4\lambda^2}-\frac{4}{2\lambda^2}=1$

$\Rightarrow 14 = \lambda^2$

Now $=x_1^2+5y_1^2$

$=\frac{64}{\lambda_2}+5\frac{4}{\lambda_2}$

$=\frac{84}{14}$

= 6 Ans.

Q.2 The domain of the function $f(x)=\sin^{-1}\left(\frac{|x|+5}{x^2+1}\right)$ is $(-\infty,-a]\cup[a,\infty)$. Then a is equal to :

(1) $\frac{\sqrt{17}-1}{2}$ (2) $\frac{\sqrt{17}}{2}$ (3) $\frac{1+\sqrt{17}}{2}$ (4) $\frac{\sqrt{17}}{2}+1$

Sol. **3**

$-1 \le \frac{|x|+5}{x^2+1} \le 1$

$-x^2-1 \le |x|+5 \le x^2+1$

case - I

$-x^2-1 \le |x|+5$

this inequality is always right $\forall\ x \in R$

case - II

$|x|+5 \le x^2+1$

$x^2 - |x| \ge 4$

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$|x|^2-|x|-4 \geq 0$

$\left(|x|-\left(\frac{1+\sqrt{17}}{2}\right)\right)\left(|x|-\left(\frac{1-\sqrt{17}}{2}\right)\right) \geq 0$

$|x| \leq \frac{1-\sqrt{17}}{2} \cup |x| \geq \frac{1+\sqrt{17}}{2}$

not possible

$x \in \left(-\infty, \frac{-1-\sqrt{17}}{2}\right] \cup \left[\frac{1+\sqrt{17}}{2}, \infty\right)$

$a = \frac{1+\sqrt{17}}{2}$

Q.3 If a function f(x) defined by $f(x) = \begin{cases} ae^x + be^{-x}, -1 \leq x < 1 \\ cx^2 \quad , \quad 1 \leq x \leq 3 \\ ax^2 + 2cx \ , 3 < x \leq 4 \end{cases}$ be continuous for some a, b, $c \in R$ and f'(0)+f'(2) =e, then the value of a is :

(1) $\frac{1}{e^2-3e+13}$ (2) $\frac{e}{e^2-3e-13}$ (3) $\frac{e}{e^2+3e+13}$ (4) $\frac{e}{e^2-3e+13}$

Sol. **4**

f(x) is continuous

at x=1 $\Rightarrow \boxed{ae+\frac{b}{e}=c}$

at x=3 $\Rightarrow$ 9c = 9a + 6c $\Rightarrow$ c=3a

Now $f'(0) + f'(2) = e$

$\Rightarrow$ a − b + 4c = e

$\Rightarrow$ a − e (3a−ae) + 4.3a = e

$\Rightarrow$ $a - 3ae + ae^2 + 12a = e$

$\Rightarrow$ $13a - 3ae + ae^2 = e$

$\Rightarrow \boxed{a = \frac{e}{13-3e+e^2}}$

Q.4 The sum of the first three terms of a G.P. is S and their product is 27. Then all such S lie in :

(1) $(-\infty,-9] \cup [3,\infty)$ (2) $[-3,\infty)$ (3) $(-\infty, 9]$ (4) $(-\infty,-3] \cup [9,\infty)$

Sol. **4**

$\frac{a}{r}.a.ar = 27 \Rightarrow a = 3$

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$$\frac{a}{r}+a+ar=S$$

$$\frac{1}{r}+1+r=\frac{S}{3}$$

$$r+\frac{1}{r}=\frac{S}{3}-1$$

$$r+\frac{1}{r}\geq 2 \text{ or } r+\frac{1}{r}\leq -2$$

$$\frac{S}{3}\geq 3 \text{ or } \frac{S}{3}\leq -1$$

$S\geq 9$ or $S\leq -3$

$S\in (-\infty,-3]\cup[9,\infty)$

Q.5 If $R=\{(x,y):x,y\in Z, x^2+3y^2\leq 8\}$ is a relation on the set of integers Z, then the domain of R^{-1} is :

(1) $\{-1,0,1\}$ (2) $\{-2,-1,1,2\}$ (3) $\{0,1\}$ (4) $\{-2,-1,0,1,2\}$

Sol. **1**

$3y^2\leq 8-x^2$

R : {(0,1), (0,–1), (1,0),(–1,0), (1,1), (1,-1)
(-1,1), (-1,-1), (2,0), (-2,0),(-2,0),(2,1),(2,-1), (-2,1),(-2,-1)}

$\Rightarrow$ R : {-2,-1,0,1,2}$\rightarrow${-1,0,-1}

Hence R^{-1} : {-1,0,1}$\rightarrow${-2,-1,0,1,2}

Q.6 The value of $\left(\frac{1+\sin\frac{2\pi}{9}+i\cos\frac{2\pi}{9}}{1+\sin\frac{2\pi}{9}-i\cos\frac{2\pi}{9}}\right)^3$ is :

(1) $-\frac{1}{2}\left(1-i\sqrt{3}\right)$ (2) $\frac{1}{2}\left(1-i\sqrt{3}\right)$ (3) $-\frac{1}{2}\left(\sqrt{3}-i\right)$ (4) $\frac{1}{2}\left(\sqrt{3}-i\right)$

Sol. **3**

$$\left(\frac{1+\sin\frac{2\pi}{9}+i\cos\frac{2\pi}{9}}{1+\sin\frac{2\pi}{9}-i\cos\frac{2\pi}{9}}\right)^3$$

$$=\left(\frac{1+\cos\left(\frac{\pi}{2}-\frac{2\pi}{9}\right)+i\sin\left(\frac{\pi}{2}-\frac{2\pi}{9}\right)}{1+\cos\left(\frac{\pi}{2}-\frac{2\pi}{9}\right)-i\sin\left(\frac{\pi}{2}-\frac{2\pi}{9}\right)}\right)^3$$

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$$= \left(\frac{1+\cos\frac{5\pi}{18}+i\sin\frac{5\pi}{18}}{1+\cos\frac{5\pi}{18}-i\sin\frac{5\pi}{18}} \right)^3$$

$$= \left(\frac{2\cos\frac{5\pi}{36}\left\{\cos\frac{5\pi}{36}+i\sin\frac{5\pi}{36}\right\}}{2\cos\frac{5\pi}{36}\left\{\cos\frac{5\pi}{36}-i\sin\frac{5\pi}{36}\right\}} \right)^3$$

$$= \left(\frac{\text{cis}\left(\frac{5\pi}{36}\right)}{\text{cis}\left(\frac{-5\pi}{36}\right)} \right)^3$$

$$= \text{cis}\left(\frac{5\pi}{36}\times 3+\frac{5\pi}{36}\times 3\right)$$

$$= \text{cis}\left(\frac{10\pi}{12}\right)$$

$$= \text{cis}\left(\frac{5\pi}{6}\right) = \boxed{-\frac{\sqrt{3}}{2}+\frac{i}{2}}$$

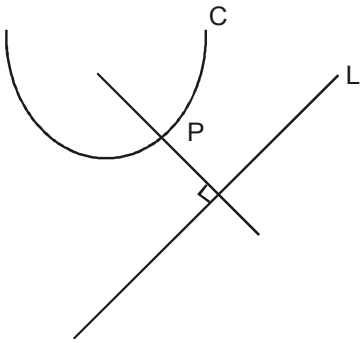
Q.7 Let P(h,k) be a point on the curve $y=x^2+7x+2$, nearest to the line, $y=3x-3$. Then the equation of the normal to the curve at P is:

(1) $x+3y-62=0$ (2) $x-3y-11=0$ (3) $x-3y+22=0$ (4) $x+3y+26=0$

Sol. **4**

$C : y = x^2+7x+2$

Let $P : (h, k)$ lies on



Curve $= k = h^2+7h+2$

Now for shortest distance

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$M_T\big|_p^c = m_L = 2h+7 = 3$
$h = -2$
$k = -8$
P : (-2,-8)
equation of normal to the curve is perpendicular to L : $3x - y = 3$
N : $x + 3y = \lambda$
$\downarrow$ Pass (-2,-8)
$\lambda = -26$
N : $x + 3y + 26 = 0$

Q.8 Let A be a 2×2 real matrix with entries from $\{0,1\}$ and $|A| \neq 0$. Consider the following two statements:
(P) If $A \neq I_2$, then $|A| = -1$
(Q) If $|A| = 1$, then tr(A) = 2,
where I_2 denotes 2×2 identity matrix and tr(A) denotes the sum of the diagonal entries of A. Then:
(1) Both (P) and (Q) are false (2) (P) is true and (Q) is false
(3) Both (P) and (Q) are true (4) (P) is false and (Q) is true

Sol. **4**

P : $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \neq I_2$ & $|A| \neq 0$ & $|A| = 1$(false)

Q : $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ = 1 then Tr(A) = 2 (true)

Q.9 Box I contains 30 cards numbered 1 to 30 and Box II contains 20 cards numbered 31 to 50. A box is selected at random and a card is drawn from it. The number on the card is found to be a non-prime number. The probability that the card was drawn from Box I is:

(1) $\frac{4}{17}$ (2) $\frac{8}{17}$ (3) $\frac{2}{5}$ (4) $\frac{2}{3}$

Sol. **2**

$\boxed{1 \text{ to } 30}$
box I
Prime on I
{2,3,5,7,11,13,17,19,23,29}

$\boxed{31 \text{ to } 50}$
box II
Prime on II
{31,37,41,43,47}
A : selected number on card is non - prime
P(A) = P(I).P(A/I) + P(II). P(A/II)

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$$= \frac{1}{2}\times\frac{20}{30}+\frac{1}{2}\cdot\frac{15}{20}$$

Now, $P(I/A) = \dfrac{P(II).P(A/I)}{P(A)}$

$$= \frac{\frac{1}{2}\cdot\frac{20}{30}}{\frac{1}{2}\cdot\frac{20}{30}+\frac{1}{2}\cdot\frac{15}{20}} = \frac{\frac{2}{3}}{\frac{2}{3}+\frac{3}{4}} = \frac{8}{17}$$

Q.10 If p(x) be a polynomial of degree three that has a local maximum value 8 at x=1 and a local minimum value 4 at x=2; then p(0) is equal to :

(1) 12 (2) -12 (3) -24 (4) 6

Sol. **2**

$p'(1) = 0$ & $p'(2) = 0$

$p'(x) = a(x-1)(x-2)$

$$p(x) = a\left(\frac{x^3}{3}-\frac{3x^2}{2}+2x\right)+b$$

$$p(1)= 8 \Rightarrow a\left(\frac{1}{3}-\frac{3}{2}+2\right)+b=8 \qquad ...(i)$$

$$p(2) = 4 \Rightarrow a\left(\frac{8}{3}-\frac{3.4}{2}+2.2\right)+b = 4 \qquad .....(ii)$$

from equation (i) and (ii)

$a = 24$ & $b = -12$

$p(0) = b = \boxed{-12}$

Q.11 The contrapositive of the statement "If I reach the station in time, then I will catch the train" is:

(1) If I will catch the train, then I reach the station in time.

(2) If I do not reach the station in time, then I will catch the train.

(3) If I do not reach the station in time, then I will not catch the train.

(4) If I will not catch the train, then I do not reach the station in time.

Sol. **4**

Statement p and q are true

Statement, then the contra positive of the implication

$p \rightarrow q = (\sim q) \rightarrow (\sim p)$

hence correct Ans. is 4

Q.12 Let α and β be the roots of the equation, $5x^2+6x-2=0$. If $S_n = \alpha^n + \beta^n$, n=1,2,3,....., then:

(1) $5S_6+6S_5+2S_4=0$ (2) $6S_6+5S_5=2S_4$

(3) $6S_6+5S_5+2S_4=0$ (4) $5S_6+6S_5=2S_4$

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Sol. **4**

$5x^2 + 6x - 2 = 0 <_{\beta}^{\alpha} = 5\alpha^2 + 6\alpha = 2$

$6\alpha - 2 = -5\alpha^2$

Simillarly

$6\beta - 2 = -5\beta^2$

$S_6 = \alpha^6 + \beta^6$

$S_5 = \alpha^5 + \beta^5$

$S_4 = \alpha^4 + \beta^4$

Now $6S_5 - 2S_4$

$= 6\alpha^5 - 2\alpha^4 + 6\beta^5 - 2\beta^4$

$= a^4(6\alpha-2) + \beta^4(6\beta-2)$

$= \alpha^4(-5\alpha^2) + \beta^4(-5\beta^2)$

$= -5(\alpha^6 + \beta^6)$

$= -5S_6$

$= 6S_5 + 5S_6 = 2S_4$

Q.13 If the tangent to the curve y=x+siny at a point (a,b) is parallel to the line joining $\left(0,\frac{3}{2}\right)$ and $\left(\frac{1}{2},2\right)$, then:

(1) $b = \frac{\pi}{2} + a$ (2) $|a+b|=1$ (3) $|b-a|=1$ (4) $b=a$

Sol. **3**

$$\left.\frac{dy}{dx}\right|_{p(a,b)}^{c} = \frac{2-\frac{3}{2}}{\frac{1}{2}-0}$$

$1+\cos b = 1 \;\Big|\; p:(a,b)\text{lies on curve}$

$\cos b = 0 \;\Big|\; b = a + \sin b$

$\boxed{b = a \pm 1}$

$b - a = \pm 1$

$\boxed{|b-a|=1}$

Q.14 Area (in sq. units) of the region outside $\frac{|x|}{2}+\frac{|y|}{3}=1$ and inside the ellipse $\frac{x^2}{4}+\frac{y^2}{9}=1$ is:

(1) $3(\pi-2)$ (2) $6(\pi-2)$ (3) $6(4-\pi)$ (4) $3(4-\pi)$

Sol. **2**

$c_1 : \frac{|x|}{2}+\frac{|y|}{3}=1$

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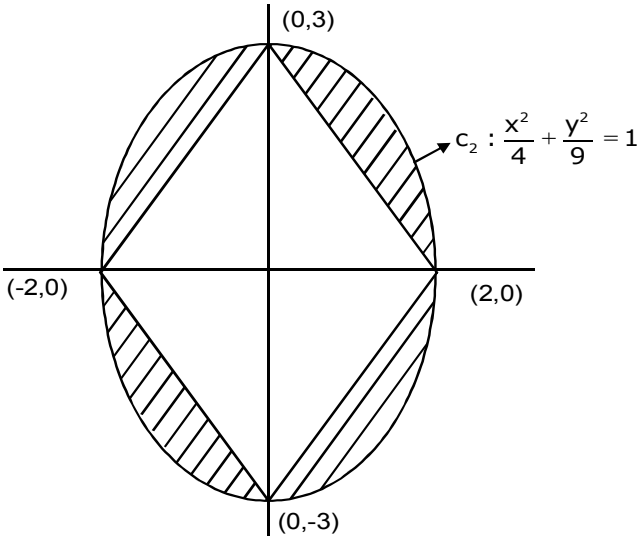

$A = 4\left(\frac{\pi ab}{4} - \frac{1}{2}.2.3\right)$

$A = \pi . 2. 3 - 12$

$A = 6(\pi - 2)$

Q.15 If $|x|<1, |y|<1$ and $x \neq y$, then the sum to infinity of the following series $(x+y)+(x^2+xy+y^2)+(x^3+x^2y+xy^2+y^3)+....$ is:

(1) $\frac{x+y+xy}{(1-x)(1-y)}$ (2) $\frac{x+y-xy}{(1-x)(1-y)}$ (3) $\frac{x+y+xy}{(1+x)(1+y)}$ (4) $\frac{x+y-xy}{(1+x)(1+y)}$

Sol. **2**

$(x+y)+(x^2+xy+y^2)+(x^3+x^2y+xy^2+y^3)+.... \infty$

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

$= \frac{\frac{x^2}{1-x} - \frac{y^2}{1-y}}{x-y}$

$= \frac{x^2(1-y)-y^2(1-x)}{(1-x)(1-y)(x-y)}$

$= \frac{(x^2-y^2)-xy\ (x-y)}{(1-x)(1-y)(x-y)} = \frac{((x+y)-xy)(x-y)}{(1-x)(1-y)(x-y)}$

$= \frac{x+y-xy}{(1-x)(1-y)}$

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Q.16 Let $\alpha > 0, \beta > 0$ be such that $\alpha^3 + \beta^2 = 4$. If the maximum value of the term independent of x in the binomial expansion of $\left(\alpha x^{\frac{1}{9}} + \beta x^{-\frac{1}{6}}\right)^{10}$ is 10k, then k is equal to:

(1) 176 (2) 336 (3) 352 (4) 84

Sol. **2**

For term independent of x

$$T_{r+1} = {}^{10}C_r \left(\alpha x^{\frac{1}{9}}\right)^{10-r} \cdot \left(\beta x^{-\frac{1}{6}}\right)^r$$

$$T_{r+1} = {}^{10}C_r \alpha^{10-r} \beta^r . x^{\frac{10-r}{9}} . x^{-\frac{r}{6}}$$

$$\because \frac{10-r}{9} - \frac{r}{6} = 0 \Rightarrow r = 4$$

$$T_5 = {}^{10}C_r \alpha^6 . \beta^4$$

$\because$ AM $\geq$ GM

$$\text{Now } \frac{\left(\frac{\alpha^3}{2} + \frac{\alpha^3}{2} + \frac{\beta^2}{2} + \frac{\beta^2}{2}\right)}{4} \geq \sqrt[4]{\frac{\alpha^6 . \beta^4}{2^4}}$$

$$\left(\frac{4}{4}\right)^4 \geq \frac{\alpha^6 \beta^4}{2^4}$$

$$\alpha^6 . \beta^4 \leq 2^4$$

$${}^{10}C_4 . \alpha^6 . \beta^4 \leq {}^{10}C_4 \, 2^4$$

$$T_5 \leq {}^{10}C_4 2^4$$

$$T_5 \leq \frac{10!}{6!4!} . 2^4$$

$$T_5 \leq \frac{10.9.8.7.2^4}{4.3.2.1}$$

maximum value of T_5 = 10. 3.7. 16 = 10k

k = 16.7.3

k = 336

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Q.17 Let S be the set of all $\lambda \in R$ for which the system of linear equations

$2x-y+2z=2$

$x-2y+\lambda z=-4$

$x+\lambda y+z=4$

has no solution. Then the set S

(1) is an empty set. (2) is a singleton.

(3) contains more than two elements. (4) contains exactly two elements.

Sol. **4**

For no solution

$\Delta = 0$ & $\Delta_1|\Delta_2|\Delta_3 \neq 0$

$$\Delta = \begin{vmatrix} 2 & -1 & 2 \\ 1 & -2 & \lambda \\ 1 & \lambda & 1 \end{vmatrix} = 0$$

$2(-2-\lambda^2) + 1(1-\lambda) + 2(\lambda+2) = 0$

$-4-2\lambda^2 + 1 - \lambda + 2\lambda + 4 = 0$

$-2\lambda^2 + \lambda + 1 = 0$

$2\lambda^2 - \lambda - 1 = 0 \Rightarrow \lambda = 1, -1/2$

Equation has exactly 2 solution

Q.18 Let $X = \{x \in N : 1 \leq x \leq 17\}$ and $Y = \{ax + b : x \in X \text{ and } a, b \in R, a > 0\}$. If mean and variance of elements of Y are 17 and 216 respectively then a+b is equal to:

(1)-27 (2) 7 (3)-7 (4) 9

Sol. **3**

X : {1,2,.....17}

Y : {ax+b : x∈X & a, b ∈ R , a>o}

Given Var(Y) = 216

$\frac{\sum y_1^2}{n} - (\text{mean})^2 = 216$

$\frac{\sum y_1^2}{17} - 289 = 216$

$\sum y_1 = 8585$

$(a+b)^2 + (2a+b)^2 + \ldots + (17a+b)^2 = 8585$

$105a^2 + b^2 + 18ab = 505$ ....(1)

Now $\sum y_1 = 17 \times 17$

$a(17 \times 9) + 17.b = 17 \times 17$

$9a + b = 17$ ....(2)

from equation (1) & (2)

a = 3 & b = -10

a+b = −7

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Q.19 Let y=y(x) be the solution of the differential equation, $\frac{2+\sin x}{y+1}.\frac{dy}{dx} = -\cos x, y > 0, y(0) = 1.$ If $y(\pi) = a$, and $\frac{dy}{dx}$ at $x = \pi$ is b, then the ordered pair (a,b) is equal to:

(1) $\left(2,\frac{3}{2}\right)$ (2) (1,1) (3) (2,1) (4) (1,-1)

Sol. **2**

$\int \frac{dy}{y+1} = \int \frac{-\cos x\ dx}{2+\sin x}$

$\ln|y+1| = -\ln|2+\sin x| + k$

$\downarrow (0,1)$

$k = \ln 4$

Now C : $(y+1)(2+\sin x) = 4$

$y(\pi)=a \Rightarrow (a+1)(2+0)=4 \Rightarrow (a=1)$

$\left.\frac{dy}{dx}\right|_{x=\pi} = b \Rightarrow b = -(-1)\left(\frac{2+0}{1+1}\right)$

$\Rightarrow b = 1$

$(a,b) = (1,1)$

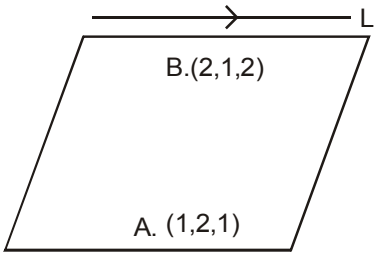
Q.20 The plane passing through the points (1,2,1), (2,1,2) and parallel to the line, 2x=3y, z=1 also passes through the point:

(1) (0,-6,2) (2) (0,6,-2) (3) (-2,0,1) (4) (2,0,-1)

Sol. **3**

$L: \begin{cases} 2x = 3y \\ z = 1 \end{cases} \begin{matrix} P:(0,0,1) \\ Q:(3,2,1) \end{matrix}$

$\vec{V}_L$ Dr of line (3,2,0)



$\vec{n}_p = \overrightarrow{AB} \times \vec{V}_L$

$\vec{n}_p = \langle 1,-1,1\rangle \times \langle 3,2,0\rangle$

$\vec{n}_p = \langle -2,+3,5\rangle$

Plane : $-2(x-1)+3(y-2)+5(z-1)=0$

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Plane : -2x+3y+5z+2–6-5=0
Plane : 2x – 3y - 5z = -9

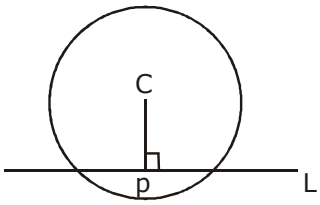
Q.21 The number of integral values of k for which the line, 3x+4y=k intersects the circle, $x^2+y^2-2x-4y+4=0$ at two distinct points is.....

Sol. **9**

c : (1,2) & r = 1
|cp| < r

$$\left|\frac{3.1+4.2-k}{5}\right|<1$$

|11-k|<5
–5<k-11<5
6<k<16
k = 7, 8, 9, ..., 15 ⇒ total 9 value of k



Q.22 Let $\vec{a},\vec{b}$ and $\vec{c}$ be three unit vectors such that $|\vec{a}-\vec{b}|^2+|\vec{a}-\vec{c}|^2=8$. Then $|\vec{a}+2\vec{b}|^2+|\vec{a}+2\vec{c}|^2$ is equal to :

Sol. **2**

$$|\vec{a}-\vec{b}|^2+|\vec{a}-\vec{c}|^2=8$$

$$(\vec{a}-\vec{b}).(\vec{a}-\vec{b})+(\vec{a}-\vec{c})(\vec{a}-\vec{c})=8$$

$a^2+b^2-2a.b+a^2+c^2-2a.c=8$
$2a^2+b^2+c^2-2a.b-2a.c=8$
$a.b+a.c=-2$

Now $|\vec{a}+2\vec{b}|^2+|\vec{a}+2\vec{c}|^2$

$= 2a^2+4b^2+4c^1+4\bar{a}.\bar{b}+4\bar{a}.\bar{c}$
$= 2+4+4+4(-2)$
$= 2$

Q.23 If the letters of the word 'MOTHER' be permuted and all the words so formed (with or without meaning) be listed as in a dictionary, then the position of the word 'MOTHER' is.....

Sol. **309**

E H M O R T

E - - - - -	= 5!
H - - - - -	= 5!
M E - - - -	= 4!
M H - - - -	= 4!
M O E - - -	= 3!
M O H - - -	= 3!
M O R - - -	= 3!
M O T E - -	= 2!
M O T H E R	= 1
	309

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Q.24. If $\lim\limits_{x\to1}\dfrac{x+x^2+x^3+...+x^n-n}{x-1}=820,(n\in N)$ then the value of n is equal to :

Sol. **40**

$\lim\limits_{x\to1}\dfrac{(x-1)}{x-1}+\dfrac{(x^2-1)}{x-1}+....+\dfrac{(x^n-1)}{x-1}=820$

$\Rightarrow 1+2+3+.....+n=820$

$\Rightarrow \sum n=820$

$\Rightarrow \dfrac{n(n+1)}{2}=820$

$\Rightarrow n=40$

Q.25 The integral $\int_0^2 ||x-1|-x|\,dx$ is equal to :

Sol. **1.5**

$\int_0^2 ||x-1|-x|\,dx$

$=\int_0^1 |1-x-x|\,dx+\int_1^2 |x-1-x|\,dx$

$=\int_0^1 |2x-1|\,dx+\int_1^2 1\,dx$

$=\int_0^{\frac{1}{2}}(1-2x)\,dx+\int_{\frac{1}{2}}^1(2x-1)\,dx+\int_1^2 1\,dx$

$=\left[\left(\frac{1}{2}-0\right)-\left(\frac{1}{4}-0\right)\right]+\left(1-\frac{1}{4}\right)-\left(1-\frac{1}{2}\right)+1$

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

$=\frac{3}{2}$

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