ISI MMA PAPER SAMPLE QUESTIONS & SOLUTIONS

SET – 1

There will be 30 questions in MMA Paper. For each question, exactly one of the four choices is correct. You get four marks for each correct answer, one mark for each unanswered question, and zero mark for each incorrect answer.

1. How many zeros are at the end of 1000! ?

(a) 240 (b) 248 (c) 249 (d) None

Ans:- (c) The number of two's is enough to match each 5 to get a 10.

So,

$5^1 \longrightarrow 200$

$5^2 \longrightarrow 40$ ∴Thus, 1000! Ends with 249 zeros

$5^3 \longrightarrow 8$

$5^4 \longrightarrow 1$

[Theorem: (de Polinac's formula)
Statement: Let p be a prime and e be the largest exponent of p such that p^e divides n! , then $e=\sum [n/p^i]$, where i is running from 1 to infinity.]

So, [1000/5]+[1000/25]+[1000/125]+[1000/625]=249 .
Thus, 1000! ends with 249 zeros.

2. The product of the first 100 positive integers ends with

(a) 21 zeros (b) 22 zeros (c) 23 zeros (d) 24 zeros.

Ans:- $5^1 \longrightarrow 20$ (d) 24 zeros .

$5^2 \longrightarrow 4$

Alternatively, put p=5,n=100,thus from above theorem we have [100/5]+[100/25]=24 zeros as the answer.

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3. Let P (x) be a polynomial of degree 11 such that P (x) = $\frac{1}{x+1}$ $for\ x = 0\ (1)11$.

Then P (12) = ?

(a) 0 (b) 1 (c) $\frac{1}{13}$ (d) none of these

Ans:- (a) P (x)= $\frac{1}{x+1}$

⇒ (x+1)[P (x)]-1 = c (x-0)(x-1)….(x-11)

Putting x= -1, 0- 1= c (-1)(-2)….(-12)

⇒ c = - $\frac{1}{12!}$

∴ [P (x)](x+1)-1= - $\frac{1}{12!}$(x-0)(x-1)….(x-11)

⇒ P (12) 13-1 = - $\frac{1}{12!}$ 12 .11. ….2.1

⇒ P (12) 13-1 = -1

⇒P (12) = 0.

4. Let s= {(x_1, x_2, x_3)| 0≤ $x_i \leq 9$ and $x_1 + x_2 + x_3$ is divisible by 3}.

Then the number of elements in s is

(a) 334 (b) 333 (c) 327 (d) 336

Ans:- (a) with each (x_1, x_2, x_3) identify a three digit code, where reading zeros are allowed. We have a bijection between s and the set of all non-negative integers less than or equal to 999 divisible by 3. The no. of numbers between 1 and 999, inclusive, divisible by 3 is $\left(\frac{999}{3}\right) = 333$

Also, '0' is divisible by 3. Hence, the number of elements in s is = 333 + 1= 334.

5. Let x and y be positive real number with x< y. Also 0 < b< a < 1.

Define E =$\log_a\left(\frac{y}{x}\right) + \log_b\left(\frac{x}{y}\right)$. Then E can't take the value

(a) -2 (b) -1 (c) -$\sqrt{2}$ (d) 2

Ans :- (d) E =$\log_a\left(\frac{y}{x}\right) + \log_b\left(\frac{x}{y}\right)$ $= \frac{\log \frac{y}{x}}{\log a} - \frac{\log \frac{y}{x}}{\log b}$

$= \log\left(\frac{y}{x}\right)\{\frac{1}{\log a} - \frac{1}{\log b}\}$ $= \log\left(\frac{y}{x}\right)\{\frac{\log b - \log a}{(\log a)(\log b)}\}$

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$$= \log\left(\frac{y}{x}\right).\frac{\log\left(\frac{b}{a}\right)}{(\log_a)(\log_b)} \quad = -\log\left(\frac{y}{x}\right).\frac{\log\left(\frac{a}{b}\right)}{(\log_a)(\log_b)}$$

Log 0< a < 1, 0< b <1 ∴ $\log_a$ and $\log_b$ are both negative.

Also $\frac{y}{x} > 1$ and $\frac{a}{b} > 1$. Thus $\log\left(\frac{y}{x}\right)$ and $\log\left(\frac{a}{b}\right)$ are both positive. Finally E turns out to be a negative value. So, E can't take the value '2'.

6. Let S be the set of all 3- digits numbers. Such that

(i) The digits in each number are all from the set {1, 2, 3, …., 9}

(ii) Exactly one digit in each number is even

The sum of all number in S is

(a) 96100 (b) 133200 (c) 66600 (d) 99800

Ans:- (b) The sum of the digits in unit place of all the numbers in s will be same as the sum in tens or hundreds place. The only even digit can have any of the three positions,

i.e. $^3c_1$ ways.

And the digit itself has 4 choices (2, 4, 6 or 8). The other two digits can be filled in 5× 4 = 20 ways.

Then the number of numbers in S = 240.

Number of numbers containing the even digits in units place = 4 × 5 × 4 = 80

The other 160 numbers have digits 1, 3, 5, 7 or 9 in unit place, with each digit appearing

$\frac{160}{5}$ = 32 times. Sum in units place = 32 (1+ 3+ 5+ 7+ 9) + 20 (2+ 4+ 6+ 8)

$= 32.5^2 + 20 \times 2 \times \frac{4\times5}{2} = 32\times 25 + 20 \times 20 = 1200$

∴ The sum of all numbers= 1200 (1+ 10 +10^2) = 1200× 111 = 133200.

7. Let y = $\frac{x}{x^2+1}$, Then $y^4(1)$is equals

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

Ans:- (b) Simply differentiating would be tedious,

So we take advantage of 'i' the square root of '-1'

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

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$\frac{d^4y}{dx^4} = \frac{1}{2}\{\frac{4!}{(x-i)^5} + \frac{4!}{(x-i)^5}\}$

Note that, $\frac{d^n}{dx^n}\left\{\frac{1}{x+a}\right\} = \frac{(-1)^n\, n!}{(x+a)^{n+1}}$

So, $y^4(x) = \frac{4!}{2}\{\frac{1!}{(x-i)^5} + \frac{1!}{(x-i)^5}\}$ Then

$y^4(1) = 12\,\{\frac{1!}{(x-i)^5} + \frac{1!}{(x-i)^5}\}$ = 12 $\{\frac{1-i}{(-2i)^3} + \frac{1-i}{(2i)^3}\}$ = 12 $\{\frac{1-i}{8i} + \frac{1-i}{8i}\}$ = 12 $(-\frac{1}{8} - \frac{1}{8})$ = -3.

8. A real 2× 2 matrix. M such that $M^2 = \begin{pmatrix} -1 & 0 \\ 0 & -1-\epsilon \end{pmatrix}$

(a) exists for all ∊ > 0 **(b) does not exist for any ∊> 0**

(c) exists for same ∊> 0 **(d) none of the above**

Ans:- (b) since M^2 is an diagonal matrix, so M= $\begin{bmatrix} i & 0 \\ 0 & \sqrt{1-\epsilon} \end{bmatrix}$,

So, M is not a real matrix, for any values of ∊

M is a non –real matrix.

9. The value of $\left(\frac{1+i\sqrt{3}}{2}\right)^{2008}$ is

(a) $\frac{1+i\sqrt{3}}{2}$ **(b) $\frac{1-i\sqrt{3}}{2}$** **(c) $\frac{-1-i\sqrt{3}}{2}$** **(d) $\frac{-1+i\sqrt{3}}{2}$**

Ans:- (c) A = $(\frac{1+i\sqrt{3}}{2})$, $A^2 = \frac{-1+i\sqrt{3}}{2}, A^4 = \frac{-1-i\sqrt{3}}{2} = -A$

$\therefore A^{2008} = (A^4)^{502} = A^4 = \frac{-1-i\sqrt{3}}{2}$.

10. Let f(x) be the function f(x)= $\begin{cases} \frac{x^P}{(sinx)^q} & if\ x > 0 \\ 0 & if\ x = 0 \end{cases}$

Then f(x) is continuous at x= 0 if

(a) p > q **(b) p > 0** **(c) q > 0** **(d) p < q**

Ans:- (b) |f(x)-f(0)|= $|\frac{x^P}{(sinx\,)^q} - 0| \leq |x^P| <$ ∊

Whenever |x-0| < $\epsilon^{\frac{1}{p}} = \delta$ if p > 0.

So, f(x)is continuous for p > 0 at x= 0.

11. The limit $\lim_{x\to\infty} \log(1-\frac{1}{n^2})^n$ equals

(a) e^{-1} (b) $e^{-\frac{1}{2}}$ (c) e^{-2} (d) 1

Ans:- (d) L= $(1-\frac{1}{n^2})^n$

⇨ $logL = nlog(1-\frac{1}{n^2})$

⇨ $\lim_{x\to\infty} logL = \lim_{x\to\infty}[-n\{\frac{1}{n^2}+\frac{1}{2n^4}+\cdots\infty\}] = 0$

∴L = $e^0 = 1$.

12. The minimum value of the function f(x, y)= $4x^2+9y^2-12x-12y+14$ is

(a) 1 (b) 3 (c) 14 (d) none

Ans:- (a) f(x, y) = $4x^2+9y^2-12x-12y+14$

= $(4x^2-12x+9)+(9y^2-12y+4)+1$

= $(2x-3)^2+(3y-2)^2+1 \geq 1$

So, minimum value of f(x, y) is 1.

13. From a group of 20 persons, belonging to an association, A president, a secretary and there members are to be elected for the executive committee. The number of ways this can be done is

(a) 30000 (b) 310080 (c) 300080 (d) none

Ans:- (b) $20_{c_1} \times 19_{c_1} \times 18_{c_3}$ *or* $\frac{20!}{1!1!3!15!}$ = 310080

14. The $\lim_{x\to 0}\frac{\cos x-\sec x}{x^2(1+x)}$ is

(a) -1 (b) 1 (c) 0 (d) does not exist

Ans:- (a) $\lim_{x\to 0}\frac{\cos x-\sec x}{x^2(1+x)} = \lim_{x\to 0}\frac{-\sin^2 x}{\cos x\,(x^2)(x+1)}$

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

15. Let R = $\frac{48^{52}-46^{52}}{96^{26}+92^{26}}$. Then R satisfies

(a) R < 1 (b) 23^{26}< R < 24^{26} (c) 1 < R < 23^{26} (d) R > 24^{26}

Ans:- (b) R= $\frac{(2.24)^{52}-(2.23)^{52}}{(4.24)^{26}+(4.23)^{26}} = \frac{2^{52}(24^{52}-23^{52})}{4^{26}(24^{26}+23^{26})} = \frac{2^{52}}{2^{52}}.\frac{(24^{26}+23^{26})(24^{26}-23^{26})}{24^{26}+23^{26}}$

$= 24^{26} - 23^{26} < 24^{26}$

Also, R= $24^{26} - 23^{26} = (1+23)^{26} - 23^{26}$

= $23^{26} + 26_{c_1}.23^{25} + 26_{c_2}.23^{24} + \ldots + 1 - 23^{26}$

= $26.\ 23^{25} + 26_{c_2}.23^{24} + \ldots + 1 > 26.\ 23^{25} > 23.\ 23^{25} = 23^{26}$

∴ $23^{26} < R < 24^{26}$

16. A function f is said to be odd if f (-x)= -f (x) ∀ x. Which of the following is not odd?

(a) f (x+ y)= f(x)+ f(y) ∀ x, y

(b) f (x)= $\frac{xe^{x/2}}{1+e^x}$

(c) f (x) = x - [x]

(d) f (x) = $x^2 \sin x + x^3 \cos x$

Ans:- (c) f (x+ y)= f(x)+ f(y) ∀ x, y

Let x = y = 0

⇒ f (0) = f (0) + f (0)

∴ f (0)= 0

Replacing y with –x , we have

f (x- x) = f(x) + f (-x)

⇒ f (0) = f(x) + f (-x)

⇒ f(x) + f (-x) = 0

⇒ f (-x) = -f(x)

Thus f is odd.

Again for f (x) = $\frac{xe^{x/2}}{1+e^x}$

f(-x)= $\frac{(-x)(e^{-x/2})}{1+e^{-x}} = \frac{(-x)\left(e^{-x/2}\right).e^x}{1+e^x}$ = - $\frac{xe^{x/2}}{1+e^x}$ = -f (x)

∴ f is odd.

f (x) = x- [x] is not odd.

Counter example:-

f (-2.3) = -2.3 – [-2.3] =-2.3 – (-3) = 3- 2.3 = 0.7

f (2.3) = 2.3 – [2.3] = 2.3 -2 =0.3

∴ f(2.3) ≠ f(-2.3)

Thus f is not odd

f (x) = $x^2 \sin x + x^3 \cos x$

f(-x) = -$x^2 \sin x - x^3 \cos x$ = -f(x)

∴ f is odd here.

17. Consider the polynomial $x^5 + ax^4 + bx^3 + cx^2 + dx + 4$. If (1+2i) and (3-2i) are two roots of this polynomial then the value of a is
(a) -524/65 (b) 524/65 (c) -1/65 (d) 1/65

Ans:- (a) The polynomial has 5 roots. Since complex root occur in pairs, so there is one real root taking it as m.

So, m, 1+2i, 1-2i, 3+2i, 3-2i are the five roots.

Sum of the roots= $-\frac{a}{1} = 8 + m.$

Product of the roots= (1+4)(9+4)m= 65 m=$\frac{4}{65}$

∴ m = $\frac{4}{65}$.

∴ a= $-8 - \frac{4}{65} = -\frac{524}{65}$.

18. In a special version of chess, a rook moves either horizontally or vertically on the chess board. The number of ways to place 8 rooks of different colors on a 8×8 chess board such that no rook lies on the path of the other rook at the start of the game is
(a) 8× ⌊8 (b) ⌊8 × ⌊8 (c) 2^8 × ⌊8 (d) $2^8 \times \binom{64}{8}$

Ans:- The first rook can be placed in any row in 8 ways & in any column in 8 ways. So, it has 8^2 ways to be disposed off. Since no other rook can be placed in the path of the first rook, a second rook can be placed in 7^2 ways for there now remains only 7 rows and 7 columns. Counting in this manner, the number of ways = $8^2.7^2.6^2$ ... $1^2 = (8!)^2$

19. The value of $\int_0^1 \int_0^1 \{Min\,(x, y) - xy\}dxdy$ is
(a) ½ (b) 1/3 (c) 1/6 (d) 1/12

Ans:- (d) $\int_0^1 \int_0^1 \{Min\,(x, y) - xy\}dxdy$

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$= \int_0^1 \int_0^y xdxdy + \int_0^1 \int_0^x ydxdy$

$= \frac{1}{3}$

And $\int_0^1 \int_0^1 xy\, dxdy = \frac{1}{4}$

$\therefore$ I $= \frac{1}{3} - \frac{1}{4} = \frac{1}{12}$

20. Given that $\sum a_n$ converges ($a_n > 0$); Then $\sum {a_n}^3 \sin n$

(a) Converges (b) Diverges (b) Doesn't exist (d) None

Ans:- (a) Since $\sum a_n$ converges, we have $\lim_{n\to\infty} n\,.\,a_n$ converges.

i.e. $|n\,.\,a_n| \le 1\; for\; n \ge M$ (say)

$\Rightarrow n\,.\,a_n < 1$ $[\because a_n > 0]$

$\Rightarrow a_n < \frac{1}{n}$

$\therefore {a_n}^3 < \frac{1}{n^3}$

$\Rightarrow {a_n}^3 \sin n \le \frac{1}{n^3} \sin n \le \frac{1}{n^3}$

$\Rightarrow \sum {a_n}^3 \sin n \le \sum \frac{1}{n^3}$

$\because$ RHS converges so LHS will also converge.

21. The differential equation of all the ellipses centered at the origin is

(a) $y^2 + x(y')^2 - yy' = 0$ (b) x y y″+ $x(y')^2 - yy' = 0$

(c) y y″+ $x(y')^2 - xy' = 0$ (d) none

Ans:- (d) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, after differentiating w.r.t x, we get

$\Rightarrow \frac{2x}{a^2} + \frac{2yy'}{b^2} = 0 \Rightarrow \frac{yy'}{b^2} = -\frac{x}{a^2}$

$\Rightarrow \frac{(y')^2}{b^2} + \frac{y(y'')}{b^2} = -\frac{1}{a^2}$

$\Rightarrow (y')^2 + y(y'')^2 = -\frac{b^2}{a^2}$.

22. If f(x)= x+ sinx, then find $\frac{2}{\pi^2}.\int_{\pi}^{2\pi}(f^{-1}(x)+sinx)dx$

(a) 2 **(b) 3** **(c) 6** **(d) 9**

Ans:- (b) Let x= f(t) ⇒ dx= f′(t)dt

$\Rightarrow \int_{\pi}^{2\pi} f^{-1}(x)dx = \int_{\pi}^{2\pi} t\ f'(t)dt = (t\,[f(t)])^{2\pi}{}_{\pi} - \int_{\pi}^{2\pi} f(t)dt = (4\pi^2-\pi^2) - \int_{\pi}^{2\pi} f(t)dt$

I= $\int_{\pi}^{2\pi}(f^{-1}(x)+sinx)dx = \int_{\pi}^{2\pi} f^{-1}(x)dx + \int_{\pi}^{2\pi} sinxdx$

= $3\pi^2 - \int_{\pi}^{2\pi} f(t)dt + \int_{\pi}^{2\pi} sinxdx$

= $3\pi^2 - \int_{\pi}^{2\pi}(f(x)-sinx)dx$

= $3\pi^2 - \int_{\pi}^{2\pi} xdx = 3\pi^2 - \frac{1}{2}(4\pi^2-\pi^2)$

=$\frac{3}{2}\pi^2$

$\Rightarrow \frac{2}{\pi^2}I = 3.$

23. Let P= (a, b), Q= (c, d) and 0 < a < b < c < d, L≡(a, 0), M≡(c, 0), R lies on x-axis such that PR + RQ is minimum, then R divides LM

(a) Internally in the ratio a: b **(b) internally in the ratio b: c**

(c) internally in the ratio b: d **(d) internally in the ratio d: b**

Ans:- (c) Let R = (α, 0). PR+RQ is least

⟹ PQR should be the path of light

⟹ Δ PRL and QRM are similar

$\Longrightarrow \frac{LR}{RM} = \frac{PL}{QM} \Longrightarrow \frac{\alpha-a}{c-\alpha} = \frac{b}{d}$

⟹ αd- αd= bc –αb

$\Longrightarrow \alpha = \frac{ad+bc}{b+d}$

⟹ R divides LM internally in the ratio b : d (as $\frac{b}{d} > 0$)

24. A point (1, 1) undergoes reflection in the x-axis and then the co-ordinate axes are roated through an angle of $\frac{\pi}{4}$ in anticlockwise direction. The final position of the point in the new co-ordinate system is-

(a) $(0, \sqrt{2})$ **(b) $(0, -\sqrt{2})$** **(c) $-\sqrt{2}, 0$** **(d) none of these**

Ans:- . (b) Image of (1, 1) in the x-axis is (1, -1). If (x, y) be the co-ordinates of any point and (x' , y') be its new co-ordinates, then x' = x cos θ+ y sin θ,

y'= y cosθ – x sin θ, where θ is the angle through which the axes have been roated.

Here $\theta = \frac{\pi}{4}$, x= 1, y= -1

∴ x'= 0, y'= $-\sqrt{2}$

25. If a, $x_1, x_2, \ldots, x_k$ and b, $y_1, y_2, \ldots, y_k$ from two A.P. with common difference m and n respectively, then the locus of point (x, y) where x= $\frac{\sum_{i=1}^{k} x_1}{k}$ $is\ and\ y = \frac{\sum_{i=1}^{k} y_1}{k}$ is

(a) (x-a)m= (y-b)n **(b) (x-m) a= (y-n) b**

(c)(x-n)a = (y-m)b **(d) (x-a) n-(y-b) m**

Ans:- (d)

X= $\frac{\frac{k}{2}(x_1+x_k)}{k} = \frac{x_1+x_k}{2} = \frac{a+m+a\ mk}{2}$

$or,\ x = a + \frac{(k+1)m}{2}$

or, 2(x-a)= (k+1)m ……………..(1)

Similarly,

2(y-b)= (k+ 1)n ……………….(2)

We have to eliminate k

From (1) and (2)

$\frac{x-a}{y-b} = \frac{m}{n}$

or, (x- a)n = (y -b)m

26. An unbiased die with faces marked 1, 2, 3, 4, 5 and 6 is rolled four times. Out of four face values obtained the probability that the minimum face value is not less than 2 and the maximum face value is not greater than 5 is-

(a) $\frac{16}{81}$ **(b)** $\frac{1}{81}$ **(c)** $\frac{80}{81}$ **(d)** $\frac{65}{81}$

Ans. (a)

For minimum face value not to be less than 2 and maximum face value not to be greater than 5, a number out of 2, 3, 4, 5 must occur in each toss.

Probability of occurrence of 2, 3, 4, 5 in one toss = $\frac{4}{6} = \frac{2}{3}$

∴ Required probability = $\left(\frac{2}{3}\right)^4 = \frac{14}{81}$

27. The probability of India winning test match against west Indies is ½ . Assuming independence from match to match, the probability that in a 5 match series India's second win occurs at the third test, is

(a) $\frac{2}{3}$ **(b)** $\frac{1}{2}$ **(c)** $\frac{1}{4}$ **(d)** $\frac{1}{8}$

Ans. (c)

Let E_r denotes the probability that india wine the rth match. Required probability

= $P(E_1)P(E_2')P(E_3)+P(E_1')P(E_2)P(E_3) = \frac{1}{2}\left(1-\frac{1}{2}\right)\frac{1}{2}+\left(1-\frac{1}{2}\right).\frac{1}{2}.\frac{1}{2} = \frac{1}{8}.\frac{1}{8} = \frac{1}{4}$

28. The remainder on dividing $1234^{567} + 89^{1011}$ by 12 is

(a) 1 **(b) 7** **(c) 9** **(d) none**

Ans:- (c) 1234≡1 (mod 3)⇒ $1234^{567} \equiv 1\ (mod\ 3) and\ 89 \equiv\ -1 (mod 3)$

$\Rightarrow 89^{1011} \equiv -1\ (mod\ 3)$

$\therefore 1234^{567} + 89^{1011} \equiv 0\ (mod\ 3)$

Here 1234 is even, so $1234^{567} \equiv 0 (mod\ 4) and\ 89 \equiv 1\ (mod\ 4)$

$\Rightarrow 89^{1011} \equiv 1\ (mod\ 4)$

Thus $1234^{567} + 89^{1011} \equiv 1\ (mod\ 4)$

Hence it is 9 (mod 12)

29. Given that $\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$, then the value of

$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-(x^2+xy+y^2)} dxdy$ **, where** $D = \{(x, y) \in \mathbb{R}^2; x^2 + y^2 \le 1\}$ **is**

(a) $\frac{\pi}{3}$ **(b)** $\frac{2\pi}{3}$ **(c)** $\frac{2\pi}{\sqrt{3}}$ **(d)** $\frac{\pi}{2}$

Ans:- (c) $\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-(x^2+xy+y^2)} dxdy$

$=\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-\{(x-\frac{y}{2})^2+\frac{3}{4}y^2)\}} dxdy$

$= \int_{-\infty}^{\infty}\{\int_{-\infty}^{\infty} e^{-(x-\frac{y}{2})^2} dx\} e^{-\frac{3}{4}y^2} dy$

$= \int_{-\infty}^{\infty} \sqrt{\pi}\ e^{-\frac{3}{4}y^2} dy = \frac{2\sqrt{\pi}}{\sqrt{3}} \int_{-\infty}^{\infty} e^{-u^2} du$ [let $\frac{\sqrt{3}}{2} y = u$]

$= 2\sqrt{\frac{\pi}{3}} \times \sqrt{\pi}$

$= \frac{2\pi}{\sqrt{3}}$.

30. The value of $\int_1^2\int_1^2\int_1^2\int_1^2 \frac{x_1+x_2+x_3-x_4}{x_1+x_2+x_3+x_4}\, dx_1dx_2dx_3dx_4$ **is**

(a) ½ **(b) 1/3** **(c) ¼** **(d) 1**

Ans:- (a)

$\int_1^2\int_1^2\int_1^2\int_1^2 \frac{x_i\, dx_1dx_2dx_3dx_4}{x_1+x_2+x_3+x_4} = \frac{1}{4}\ as\ \int_1^2\int_1^2\int_1^2\int_1^2 \frac{x_1+x_2+x_3-x_4}{x_1+x_2+x_3+x_4}\, dx_1dx_2dx_3dx_4 = 1.$

$\therefore$ I $= \frac{3}{4} - \frac{1}{4} = \frac{1}{2}$.

Note:- Questions are collected from ISI MMA Previous Year Sample Papers, Previous Question Papers & from Test of Mathematics at 10+2 level Book.