"विध्न विचारत भीरू जन, नहीं आरम्भे काम, विपति देख छोड़े तुरंत मध्यम मन कर श्याम ।
पुरूष सिंह संकल्प कर, सहते विपति अनेक, 'बना' न छोड़े ध्येय को, रघुबर राखे टेक ।।"

रचितः मानव धर्म प्रणेता
सद्‌गुरू श्री रणछोड़दासजी महाराज

SOLUTION OF IIT JEE – 2010

BY SUHAAG SIR &

HIS STUDENTS OF CLASS MOVING FROM 11TH TO 12TH

S.No.	Student's Name	School
1	Syd. Almas Ali	All Saints' School
2	Anmol Rehani	Vikram Hr. Sec.
3	Devashish Saxena	St. Mary's Sr. Sec.
4	Mujahid Mohd. Khan	All Saints' School
5	Shahrukh Ahmed	People's Public School
6	Sparsh Mehta	People's Public School
7	Geet Soni	Jawahar Lal Nehru
8	Amit Sarathe	K.V. – 3
9	Ranjeet Singh	Peragatisheel School
10	Rahul Jharwade	People's Public School
11	Anamika Singh	K.V. – 2
12	Shailja Aouthanere	People's Public School
13	Yamini Jain	Chavara Vidya Bhawan Mandideep
14	Kirti Chopariya	Bourbon School

Results of year 2009 -- 15 IIT & 37 AIEEE selections out of 70 Fresh students

All India Rank 1
BITS (Birla, Pilani)

Nida Khan

Best Rank of Bhopal
AIEEE State Rank 7

Shubham Sirothiya

International Maths Olympiad
2nd Rank All over the World
i.e Internationally
Result declared on 01.02.2010

Tushar Saxena

Solution of IIT JEE 2010 is also available on website :

www.tekoclasses.com OR come to our Institute

On the same day at 6.30 pm, we uploaded on our website.

Question sequence as per Paper **CODE - 1**

MATHEMATICS PAPER – 2
SECTION – 1
Single Correct Choice Type

This section contains 8 multiple choice question. Each question has 4 choices A), B), C) and D) for its answer, out of which ONLY ONE is correct.

20. Two adjacent sides of a parallelogram ABCD are given by $\overrightarrow{AB} = 2\hat{i} + 10\hat{j} + 11\hat{k}$ and $\overrightarrow{AD} = -\hat{i} + 2\hat{j} + 2\hat{k}$ The side AD is rotated by an acute angle α in plane of the parallelogram so that AD becomes AD'. If AD' makes a right angle with the side AB, then the cosine of the angle α is given by

(a) $\frac{8}{9}$ (b) $\frac{\sqrt{17}}{9}$ (c) . $\frac{1}{9}$ (d) $\frac{4\sqrt{5}}{9}$

21. A sinnal which can be green or red with probability $\frac{4}{5}$ and $\frac{1}{5}$ respectively, is received by station A then transmitted to station B. The probability of each station receiving the signal received at station B is green, then the probability that the original signal was green is

(a) $\frac{3}{5}$ (b) $\frac{6}{7}$ (c) $\frac{20}{23}$ (d) $\frac{9}{20}$

22. If the distance of the point $P(1, -2, 1)$ from the plane $x + 2y - 2z = \alpha,$ where $\alpha > 0,$ is 5, then the foot of the perpendicular from P to the plane is

(a) $\left(\frac{8}{3}, \frac{4}{3}, -\frac{7}{3}\right)$ (b) $\left(\frac{4}{3}, -\frac{4}{3}, \frac{1}{3}\right)$ (c) $\left(\frac{1}{3}, \frac{2}{3}, \frac{10}{3}\right)$ (d) $\left(\frac{2}{3}, -\frac{1}{3}, \frac{5}{2}\right)$

23. Let f be a real – valued function defined on the interval on the interval $[-1, 1]$ such that $e^{-x} f(x) = 2 + \int_0^x \sqrt{t^4 + 1}\,dt,$ for all $x \in [-1, 1]$, and let f^{-1} be the inverse function of f. Then $(f^{-1})'(2)$ is equal to

(a) 1 (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) $\frac{1}{e}$

24. For $r = 0, 1 ...... 10,$ let A_r, B_r and C_r denote, respectively, the coefficient of x^r in the expansions of $(1+x)^{10}$, $(1+x)^{20}$ and $(1+x)^{30}$. Then $\sum_{r=1}^{10} A_r (B_{10}B_r - C_{10}A_r)$ is equal to

(a) $B_{10} - C_{10}$ (b) $A_{10}(B_{10}^2 - C_{10}A_{10})$ (c) 0 (d) $C_{10} - B_{10}$

25. Let $S = \{1, 2, 3, 4\}$. The total number of unordered pairs of disjoint subsets of S is equal to

(a) 25 (B) 34 (c) 42 (d) 41

SECTION – II
(Integer Type)

This Section contains **5 questions.** The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question no. in the ORS is to be bubbled.

26. Let k be a positive real number and let

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$$A=\begin{bmatrix}2k-1 & 2\sqrt{k} & 2\sqrt{k}\\ 2\sqrt{k} & 1 & -2k\\ -2\sqrt{k} & 2k & -1\end{bmatrix} \text{ and } B=\begin{bmatrix}0 & 2k-1 & \sqrt{k}\\ 1-2k & 0 & 2\sqrt{k}\\ -\sqrt{k} & -2\sqrt{k} & 0\end{bmatrix}.$$

If det (adj A) + det(adj B) $=10^6$, then [k] is equal to

[NOTE : adj M denotes the adjoint of a square matrix M and[k] denotes the largest integer less then or equal to k].

27. Two parallel chords of a circle of radius 2 are at a distance $\sqrt{3}+1$ apart. If the chords subtend at the center, angles of $\frac{\pi}{k}$ and $\frac{2\pi}{k}$, where k>0, then the value of [k] is

[NOTE : [k] denotes the largest integer less than or equal to k]

28. Consider a triangle ABC and let a,b and c denote the lengths of the sides opposite to vertices A,B and C respectively. Suppose a = 6, b = 10 and the area of the triangle is $15\sqrt{3}$. If $\angle ACB$ is obtuse and if r denotes the radius of the incircle of the triangle, then r^2 is equal to

29. Let f be a function defined on R (the set of all real numbers) such that $f(x)=2010\ \ x-2009\ \ \ x-2010\ ^2\ \ x-2011\ ^3\ \ x-2012\ ^4$, for all $x\in R$.

If g is a function defined on R with values in the interval $\ 0,\infty\ $ such that $f(x)=\ell n\ \ g(x)\ $, for all $x\in R$. then the number of points in R at which g has a local maximum is

30. Let $a_1, a_2, a_3, ..., a_{11}$ be real numbers satisfying $a_1=15,\ \ 27-2a_2>0$ and $a_k=2a_{k-1}-a_{k-2}$ for $k=3,4,....11.$ If $\frac{a_1^2=a_2^2+....+a_{11}^2}{11}=90,$ then the value fo $\frac{a_1+a_2+...+a_{11}}{11}$ is equal to

SECTION – III
Paragraph Type

This section contains **2 paragraphs.** Based upon each of the paragraphs **3 multiple choice questions have** to be answered. Each of these question has four choices A), B), C) and D) out of which **ONLY ONE** is correct.

Paragraph for questions 31 to 33.

Tangents are drawn from the point P(3, 4) to the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ touching the ellipse at points A and B.

31. The coordinates of A and B are

A) (3,0) and (0, 2) B) $\left(-\frac{8}{5},\frac{2\sqrt{161}}{15}\right)$ *and* $\left(-\frac{9}{5},\frac{8}{5}\right)$

C) $\left(-\frac{8}{5},\frac{2\sqrt{161}}{15}\right)$ *and* $\ 0, 2$ D) $\ 3, 0\ $ *and* $\left(-\frac{9}{8},\frac{8}{5}\right)$

32. The orthocenter of the triangle PAB is

A) $\left(5,\frac{8}{7}\right)$ B) $\left(\frac{7}{5},\frac{25}{8}\right)$ C) $\left(\frac{11}{5},\frac{8}{5}\right)$ D) $\left(\frac{8}{25},\frac{7}{5}\right)$

33. The equation of the locus of the point whose distances from the point P and the line AB are equal, is

A) $9x^2 + y^2 - 6xy - 54x - 62y + 241 = 0$ B) $x^2 + 9y^2 + 6xy - 54x - 62y - 241 = 0$

C) $9x^2 + 9y^2 - 6xy - 54x - 62y - 241 = 0$ D) $x^2 + y^2 - 2xy + 27x + 31y - 120 = 0$

Paragraph for question 34 to 36.

Consider the polynomial $f(x) = 1 + 2x + 3x^2 + 4x^3$. Let s be the sum of all distinct real roots of $f(x)$ and let $t = |s|$.

34. The real number of s lies in the interval

A) $\left(-\frac{1}{4}, 0\right)$ B) $\left(-11, -\frac{3}{4}\right)$ C) $\left(-\frac{3}{4}, -\frac{1}{2}\right)$ D) $\left(0, \frac{1}{4}\right)$

35. The area bounded by the curve $y = f(x)$ and the lines $x = 0, y = 0$ and $x = t$, lies in the interval

A) $\left(\frac{3}{4}, 3\right)$ B) $\left(\frac{21}{64}, \frac{11}{16}\right)$ C) $(9, 10)$ D) $\left(0, \frac{21}{64}\right)$

36. The function $f'(x)$ is

A) increasing in $\left(-t, -\frac{1}{4}\right)$ and decreasing in $\left(-\frac{1}{4}, t\right)$

B) decreasing in $\left(-t, -\frac{1}{4}\right)$ and increasing in $\left(-\frac{1}{4}, t\right)$

C) increasing in $(-t, t)$ D) decreasing in $(-t, t)$

SECTION – IV
(Matrix Type)

This Section contains **2 question.** Each question has **four statements** (A, B, C and D) given in **Column I** and five statements (p, q, r, s and t) in **Column II.** Any given statement in **Column I** can have correct matching with one or more statement(s) given in **Column II.** For example, if for a given question, statement B matches with the statements given in q and r, then for that particular question, against statement B, darken the bubbles corresponding to q and r in the ORS.

37. Match the statements in Column – I with the values in Column - II

Column I	Column II
A. A line from the origin meets the lines $\frac{x-2}{1} = \frac{y-1}{-2} = \frac{z+1}{1}$ and $\frac{x-\frac{8}{3}}{2} = \frac{y+3}{-1} = \frac{z-1}{1}$ at P and Q respectively. If length PQ = d, then d^2 is	P. -4
B. The values of x satisfying $\tan^{-1}(x+3) - \tan^{-1}(x-3) = \sin^{-1}\left(\frac{3}{5}\right)$ are	Q. 0
C. Non-zero vectors $\vec{a}, \vec{b}, \vec{c}$ satisfy $\vec{a}.\vec{b} = 0$, $(\vec{b} - \vec{a}).(\vec{b} + \vec{c}) = 0$ and $2|\vec{b} + \vec{c}| = |\vec{b} - \vec{a}|$. If $\vec{a} = \mu\vec{b} + 4\vec{c}$, then the possible values of μ are	R. 0

D. Let f be the function on $(-\pi, \pi)$ given by $f(0) = 9$ and $f(x) = \sin\left(\frac{9x}{2}\right) \Big/ \sin\left(\frac{x}{2}\right)$ for $x \neq 0$. The value of $\frac{2}{\pi}\int_{-\pi}^{\pi} f(x)dx$ is

S. 5

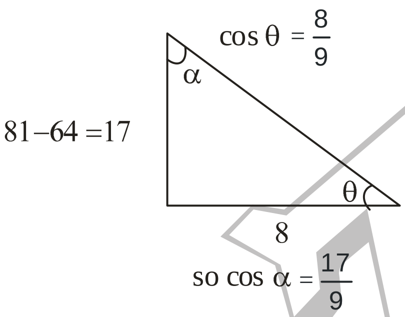
T. 6

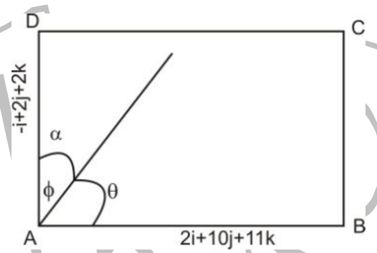
38. Match the statements in **Column-I** with those in **Column-II.** [**Note** : Here z takes values in the complex plane and Im z and Re z denote, respectively, the imaginary part and the real part of z.]

Column I	Column II
A. The set of points z satisfying $\lvert z - i\lvert z\rvert\rvert = \lvert z + i\lvert z\rvert\rvert$ is contained in or equal to	P. an ellipse with eccentricity $\frac{4}{5}$
B. The set of points z satisfying $\lvert z+4\rvert + \lvert z-4\rvert = 10$ is contained in or equal to	Q. the st of points z satisfying Im z = 0
C. If $\lvert w\rvert = 2$, then the set of points $z = w - \frac{1}{w}$ is contained in or equal to	R. the set of points z satisfying $\lvert \text{Im}\, z\rvert \leq 1$
D. If $\lvert w\rvert = 1$. then the set of points $z = w + \frac{1}{w}$ is contained in or equal to	S. the set of points z satisfying $\lvert \text{Re}\, z\rvert \leq 2$
	T. the set of points z satisfying $\lvert z\rvert \leq 3$

SOLUTION – IIT JEE 2010 (PAPER - 2)

20. (B) $\cos\theta = \frac{-2+20+22}{\sqrt{1+4+4}\sqrt{4+100+121}} \Rightarrow \cos\theta = \frac{8}{9}$





21. (C) Event G = original signal is green , $E_1 = A$ receives the signal correct, $E_2 = B$ receives the signal correct, E = signal received by B is green, P(signal received by B is green) $= P(GE_1E_2) + P(G\bar{E}_1\bar{E}_2) + P(\bar{G}\bar{E}_1E_2)$ $P(E) = \frac{46}{5\times16}$, $P(G/E) = \frac{40/5\times16}{46/5\times16} = \frac{20}{23}$.

22. (A) Let PN be normal to plane. $\lvert PN\rvert = \left|\frac{1-4-2-\alpha}{\sqrt{1^2+2^2+2^1}}\right|$, $5 = \left|\frac{-5-\alpha}{3}\right| \pm 5\times3 = -5-\alpha$
$\alpha = -5 \pm 15 \Rightarrow \alpha = +10$ or -15(cancle) plane $x + 2y - 2z = 10$ Now check all option only A will satisfy the plane.

23. Diff. Eq $e^{-x}f'(x) - e^{x}f(x) = \sqrt{x^4+1}$ Put x = 0 $1.f'(0) - 1.f(0) = \sqrt{0+1}$ (form equation. 1) $f'(0) - 2 = 1, f'(0) = 3$ if $g(x)$ is $f^{-1}(x)$, so $g^{-1}(x)$ is $f(x)$, $g^{-1}(x) = f(x), x = g(f(x))$ $, 1 = g'(f(x)).f'(x)$ $\frac{1}{f'(x)} = g'(f(x)), x = 0 \to f(0) = 2$ .....(1) $\frac{1}{f'(0)} = g'(f(0)) \Rightarrow \frac{1}{3} = g'(2)$.

24. (D) Here we are applying INDUCTION CONCEPT GIVEN BY SUHAAG SIR so here we can't print it.

25. Total No. of subsets = 2^n, Here $n = 4$ therefore total sets = 16

$1\ ,\ 2\ ,\ 3\ ,\ 4\ ,\ 1,2\ ,\ 2,3\ ,\ 3,4\ ,\ 4,1\ ,\ 2,4\ ,\ 1,3$

$1,2,3\ ,\ 2,3,4\ ,\ 3,4,1\ ,\ 2,4,1\ ,\ 1,2,3,4\quad \phi$

Set	its disjoints	Set	its disjoints
1	8	2,4	1
2	7	1,3	2
3	6	1,2,3	1
4	5	2,3,4	1
1,2	3	3,4,1	1
2,3	2	2,4,1	1
3,4	1	1,2,3,4	1
4,1	1	ϕ	0

Therefore Ans = Total No. of disjoint sets i.e. = 41

26. (5) $|A| = (2k+1)^3, |B| = 0$ (since B is a skew – symmetric matrix of order 3) $\Rightarrow$ det(adj A) $= |A|^{n-1} = \left(\left(2k+1\right)^{3}\right)^{2} = 106 \Rightarrow 2k+1 = 10 \Rightarrow 2k = 9,\ k = 4.$

27. (2) $2\cos\frac{\pi}{2k} + 2\cos\frac{\pi}{k} = \sqrt{3}+1, \cos\frac{\pi}{2k} + \cos\frac{\pi}{k} = \frac{\sqrt{3}+1}{2}$ Let $\frac{\pi}{k} = 0, \cos\theta + \cos\frac{\theta}{2} = \frac{\sqrt{3}+1}{2}$

$\Rightarrow 2\cos^2\frac{\theta}{2} - 1 + \cos\frac{\theta}{2} = \frac{\sqrt{3}+1}{2}, \cos\frac{\theta}{2} = t, 2t^2 + t - \frac{\sqrt{3}+3}{2} = 0, t = \frac{-1 \pm \sqrt{1+4\left(3+\sqrt{3}\right)}}{4}$

$= \frac{-1 \pm \left(2\sqrt{3}+1\right)}{4} = \frac{-2-2\sqrt{3}}{4}, \frac{\sqrt{3}}{2}$ $\because t \in [-1,1], \cos\frac{\theta}{2} = \frac{\sqrt{3}}{2}, \frac{\theta}{2} = \frac{\pi}{6} \Rightarrow k = 3.$

28. (3)

$\Delta = \frac{1}{2}ab\sin C \Rightarrow \sin C = \frac{2\Delta}{ab} = \frac{2\times15\sqrt{3}}{6\times10} = \frac{\sqrt{3}}{2} \Rightarrow C = 120^o \Rightarrow c = \sqrt{a^2+b^2-2ab\cos C}$

$= \sqrt{6^2+10^2-2\times6\times10\times\cos120^o} = 14 \quad \therefore r = \frac{\Delta}{s} \Rightarrow r^2 = \frac{225\times3}{\left(\frac{6+10+14}{2}\right)^2} = 3.$

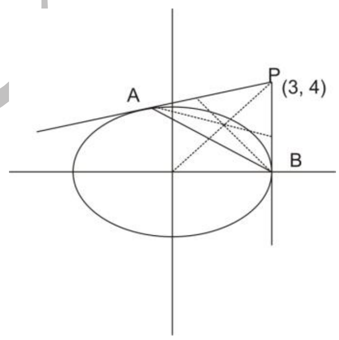
29. (1) $f(x) = \ln\ g(x)\ , g(x) = e^{f(x)}, f'(x) = e^{f(x)}.f'(x), g'(x) = 0 \Rightarrow f'(x) = 0$ as $e^{f(x)} \neq 0$ $\Rightarrow 2010(x-2009)^2\,(x-2011)^3(x-2012)^4 = 0$ so there is only one point of local maxima.

30. Ans (0) This series is A.P. so a = 15 and 2nd term is a + d , given $27-2(a+d)>0, 27-2(15+d)>0, 27-30-2d>0, -3-2d>0, -3>2d., -\frac{3}{2}>d.$ so acceding to condition of question d must be -3 so now check answer will be 0.

31. (D) Coordinate of point P $3, 4$ equation of tangency $\frac{x.x_1}{9}+\frac{y.y_1}{4}=1 \Rightarrow \frac{x}{3}+y=1$, $x+3y=3$ Because the points (3, 0) and $\left(-\frac{9}{5}, \frac{8}{5}\right)$ satisfies the above equation hence the answer is (D) Ans (D)

OR II METHOD

(D) By using Suhaag Short Trick 1. They satisfy the given equation according to the graph (3,4) Ans (D)



32. (C) Slope $\frac{\frac{8}{5}-0}{\frac{-9}{5}-3}=\frac{-1}{3}$

$y-4=3\ x-3 \Rightarrow y-4=3x-9 \Rightarrow 3x-y-5=0$ ….. (1)

$y-0=-2\ x-3 \Rightarrow y=-2x+6$ …… (2)

$3x-y=5$

$2x+y=6$

$5x=11 \Rightarrow x=\frac{11}{5}$ By putting the value of x in eq. (1)

$3\left(\frac{11}{5}\right)-y=5 \Rightarrow y=\frac{8}{5} \Rightarrow$ Ans $\left(\frac{11}{5}, \frac{8}{5}\right)$ Ans (C)

OR II METHOD (C) By using Suhaag Short Trick According to the figure given above $\left(\frac{11}{5}, \frac{8}{5}\right) \Rightarrow\ 2.2, 1.6$ Ans (C)

33. (A) Locus is parabola Equation of AB is $\frac{3x}{9}+\frac{4y}{4}=1 \Rightarrow \frac{x}{3}+y=1 \Rightarrow x+4y-3=0$

$x-3^{\ 2}+\ y-4^{\ 2}=\frac{x+3y-3^{\ 2}}{10},$

$10x^2+90-60x+10y^2+160-80y=x^2+9y^2+9+6xy-6x-18y$

$\Rightarrow\ 9x^2+v^2-6xy-54x-62y+241=0.$

34. (C) Since $f\left(-\frac{1}{2}\right).f\left(-\frac{3}{4}\right)<0 \Rightarrow$ S lie in $\left(-\frac{3}{4}, -\frac{1}{2}\right).$

35. (A) $-\frac{3}{4}<s<-\frac{1}{2}, \frac{1}{2}<t<\frac{3}{4}, \int_0^{1/2} 4x^3+3x^2+2x+1\ dx<\text{area}<\int_0^{3/4} 4x^3+3x^2+2x+1\ dx$

$\left[x^4+x^3+x^2+x\right]_0^{1/2}<\text{area}>\left[x^4+x^3+x^2+x\right]_0^{3/4}$

$,\frac{1}{16}+\frac{1}{8}+\frac{1}{4}+\frac{1}{2}<\text{area}>\frac{81}{256}+\frac{27}{64}+\frac{9}{16}+\frac{3}{4}, \frac{15}{16}<\text{area}<\frac{525}{256}.$

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36. (B) $f'(x) = 2(12x+3) = 0 \Rightarrow x = -1/4.$

37. (A) - (T) Let the line be $\frac{x}{a} = \frac{y}{b} = \frac{z}{c}$ intersects the lines $\Rightarrow S.D = 0 \Rightarrow a + 3b + 5c = 0$ and $3a + b - 5c = 0 \Rightarrow a : b : c :: 5r : -5r : 2r$

(B) - (P&R) $\tan^{-1}(x+3) - \tan^{-1}(x-3) = \sin^{-1}(3/5)$

$\Rightarrow \tan^{-1}\frac{(x+3)-(x-3)}{1+(x^2-9)} = \tan^{-1}\frac{3}{4} \Rightarrow \frac{6}{x^2-8} = \frac{3}{4}$ $\therefore x^2 - 8 = 8$ or $x = \pm 4.$

(C) - (Q,S) As $\vec{a} = \mu\vec{b} + 4\vec{c} \Rightarrow \mu|\vec{b}| = -4\vec{b}.\vec{c}$ and $|\vec{b}|^2 = 4\vec{a}.\vec{c}$ and $|\vec{b}|^2 + \vec{b}.\vec{c} - \vec{d}.\vec{c} = 0$ Again, as $2|\vec{b}+\vec{c}| = |\vec{b}-\vec{a}|$ solve and eliminating $\vec{b}.\vec{c}$ and eliminating $|\vec{a}|^2$ we get $2\mu^2 - 10\mu|\vec{b}|^2 = 0 \Rightarrow \mu = 0$ and $5.$

(D) - (R) $I = \frac{2}{\pi}\int_{-\pi}^{\pi}\frac{\sin 9(x/2)}{\sin(x/2)}dx = \frac{2}{\pi}\times 2\int_{0}^{\pi}\frac{\sin 9(x/2)}{\sin(x/2)}dx, x/2 = \theta \Rightarrow dx = 2d\theta, x = 0, \theta = 0$

$x = \pi\theta = \pi/2$ $I = \frac{8}{\pi}\int_0^{\pi/2}\frac{\sin 9\theta}{\sin\theta}d\theta = \frac{8}{\pi}\int\left(\frac{\sin 9\theta - \sin 7\theta}{\sin\theta} + \frac{\sin 7\theta - \sin 5\theta}{\sin\theta} + \frac{\sin 3\theta - \sin\theta}{\sin\theta} + \frac{\sin\theta}{\sin\theta}\right)d\theta$

$= \frac{16}{\pi}\int_0^{\pi/2}(\cos 8\theta + \cos 6\theta + \cos 4\theta + \cos 2\theta + 1)d\theta + \frac{8}{\pi}\int_0^{\pi/2}d\theta = \frac{16}{\pi}\left[\frac{\sin 8\theta}{8} + \frac{\sin 6\theta}{6} + \frac{\sin 4\theta}{4} + \frac{\sin 2\theta}{2}\right]$

$+\frac{8}{\pi}(\theta)_0^{\pi/2} = 0 + \frac{8}{\pi}\times\left[\frac{\pi}{2} - 0\right] = 4$

38. **(A) - (Q)** $\left|\frac{z}{|z|} - 1\right| = \left|\frac{z}{|z|} + 1\right|, z \neq 0, \frac{z}{|z|}$ is unimodular complex number and lies on perpendicular bisector of I and –i $\Rightarrow \frac{z}{|z|} + \pm 1 \Rightarrow z = \pm 1|z| \Rightarrow A$ is real number $\Rightarrow Im(z) = 0.$

(B) - (P) $|z+4| + |z-4| = 10$ z lies on an ellipse whose focus are (4,0) and (–4,0) and length of major axis is 10 $\Rightarrow 2ae = 8$ and $2a = 10 \Rightarrow e = 4/5$ $|Re(z)| \leq 5.$

(C) - (P,T) $|w| = 2 \Rightarrow w = 2(\cos\theta + i\sin\theta), x + iy = 2(\cos\theta + i\sin\theta) = -\frac{1}{2}(\cos\theta - i\sin\theta)$

$= \frac{3}{2}\cos\theta + i\frac{5}{2}\sin\theta \Rightarrow \frac{x^3}{(3/2)^2} + \frac{y^2}{(5/2)^2} = 1, e^2 = 1 - \frac{9/4}{25/4} = 1 - \frac{9}{25} = \frac{16}{25} \Rightarrow e = \frac{4}{5}.$

(D) - (Q,T) $|w| = 1 \Rightarrow x + iy + \cos + i\sin\theta + \cos\theta - i\sin\theta, x + iy = 2\cos\theta$ $|Re(z)| \leq 1, |Im(z)| = 0.$