P13-17

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ADVANCED PATTERN PART TEST-4(APT-4)

TARGET : JEE (MAIN+ADVANCED) 2018

SUBJECT : MATHEMATICS COURSE : VIJAY (07JR)

Date : 11-02-2018 Time: 2 Hours Maximum Marks : 160

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

GENERAL :

1. The sealed booklet is your Question Paper. Do not break the seal till you are instructed to do so.
2. The question paper CODE is printed on the right hand top corner of this sheet.
3. Use the Optical Response Sheet (ORS) provided separately for answering the question.
4. Blank spaces are provided within this booklet for rough work.
5. Write your Name and Roll Number in the space provided on the below cover.
6. After the open booklet, verify that the booklet contains all the **40** questions along with the options are legible.

QUESTION PAPER FORMAT AND MARKING SCHEME :

7. This questions paper consists of **Two sections**.
8. Each section as detailed in the following table :

Section	Question Type	Number of Questions	Category-wise Marks for Each Question				Maximum Marks of the Section
			Full Marks	Partial Marks	Zero Marks	Negative Marks	
1	One or More Correct Option(s)	20	+4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened	+1 For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened	0 If none of the bubbles is darkened	–2 In all other cases	80
2	Comprehension (One or More Correct Option(s))	20	+4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened	–	0 If none of the bubbles is darkened	–2 In all other cases	80

OPTICAL RESPONSE SHEET :

9. Darken the appropriate bubbles on the original by applying sufficient pressure.
10. The original is machine-gradable and will be collected by the invigilator at the end of the examination.
11. Do not tamper with or mutilate the ORS.
12. Write your name, roll number and the name of the examination centre and sign with pen in the space provided for this purpose on the original. **Do not write any of these details anywhere else**. Darken the appropriate bubble under each digit of your roll number.

DARKENING THE BUBBLES ON THE ORS :

13. Use a **BLACK BALL POINT** to darken the bubbles in the upper sheet.
14. Darken the bubble **COMPLETELY.**
15. Darken the bubble **ONLY** if you are sure of the answer.
16. The correct way of darkening a bubble is as shown here : ●
17. There is **NO** way to erase or "un-darkened bubble.
18. The marking scheme given at the beginning of each section gives details of how darkened and **not darkened** bubbles are evaluated.

NAME OF THE CANDIDATE : .....

ROLL NO. : .....

I have read all the instructions and shall abide by them

I have verified the identity, name and roll number of the candidate.

- -
Signature of the Candidate

- -
Signature of the Invigilator

DO NOT BREAK THE SEAL WITHOUT BEING INSTRUCTED TO DO SO BY THE INVIGILATOR

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MATHEMATICS

SECTION – 1: (Maximum Marks : 80)

- õ This section contains **TWENTY** questions
- õ Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- õ For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- õ For each question, marks will be awarded in one of the following categories :

Full Marks	:	+4	If only the bubble(s) corresponding to all the correct option(s) is(are) darkened.
Partial Marks	:	+1	For darkening a bubble corresponding to **each correct option,** provided NO incorrect option is darkened.
Zero Marks	:	0	If none of the bubbles is darkened.
Negative Marks	:	–2	In all other cases.

- õ For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in +4 marks ; darkening only (A) and (D) will result in +2 marks and darkening (A) and (B) will result in –2 marks, as a wrong option is also darkened.

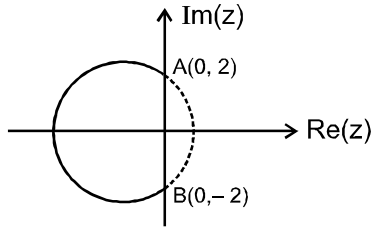
1. If the lines $\frac{x-2}{1}=\frac{y-3}{1}=\frac{z-4}{\lambda}$ and $\frac{x-1}{\lambda}=\frac{y-4}{2}=\frac{z-5}{1}$ intersect at a point (α, β, γ), then

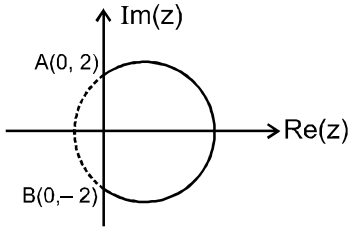
(A) $\lambda = -1$ (B) $\lambda = 2$

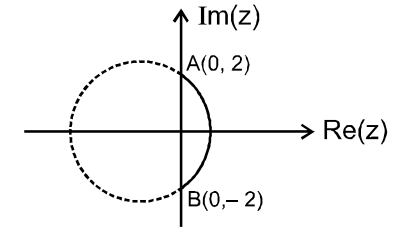
(C) $\lambda = -3$ (D) $\lambda = 0$

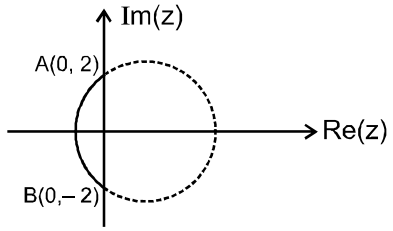
Space for Rough Work

2. If $\arg\left(\frac{z-2i}{z+2i}\right) = \frac{\pi}{6}$, then which of the following option(s) gives the correct locus of z ?

(A) 

(B) 

(C) 

(D) 

3. Let ΔPQR be a triangle. Let $\vec{a} = \overrightarrow{QR}, \vec{b} = \overrightarrow{RP}$ and $\vec{c} = \overrightarrow{PQ}$. If $|\vec{a}| = 12$, $|\vec{b}| = 4\sqrt{3}$ and $\vec{b}.\vec{c} = 24$, then which of the following is(are) true?

(A) $\frac{|\vec{c}|^2}{2} - |\vec{a}| = 12$

(B) $\frac{|\vec{c}|^2}{2} + |\vec{a}| = 30$

(C) $|\vec{a} \times \vec{b} + \vec{c} \times \vec{a}| = 48\sqrt{3}$

(D) $\vec{a}.\vec{b} = -72$

4. If $x^2 + x + 1 = 0$ and $N = \left(x + \frac{1}{x}\right)^2 + \left(x^2 + \frac{1}{x^2}\right)^2 + \left(x^3 + \frac{1}{x^3}\right)^2 + ... + \left(x^{81} + \frac{1}{x^{81}}\right)^2$ then

(A) Number of divisors of N is 10

(B) Number of prime factors of N is 2

(C) Highest prime factor of N is 3

(D) N is perfect square

Space for Rough Work

5. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{a}.\vec{b} = 2$ and $\vec{a} \times \vec{b} = 2\hat{i} + \hat{j} - 3\hat{k}$, then

(A) $\vec{a} + \vec{b} = 5\hat{i} - 4\hat{j} + 2\hat{k}$ (B) $\vec{a} + \vec{b} = 3\hat{i} + 2\hat{k}$

(C) $\vec{b} = 2\hat{i} - \hat{j} + \hat{k}$ (D) $\vec{b} = \hat{i} - 2\hat{j} - 3\hat{k}$

6. Projection of line $\frac{x+1}{2} = \frac{y+1}{-1} = \frac{z+3}{4}$ on the plane x + 2y + z = 6; has equation

(A) x + 2y + z – 6 = 0 = 9x – 2y – 5z – 8 (B) x + 2y + z + 6 = 0, 9x – 2y + 5z = 4

(C) $\frac{x-1}{4} = \frac{y-3}{-7} = \frac{z+1}{10}$ (D) $\frac{x+3}{4} = \frac{y-2}{7} = \frac{z-7}{-10}$

7. If the vertices of an equilateral triangle are situated at 0, z_1, z_2 ; then which of the following is/are true (where 0 is the origin)

(A) $|z_1| = |z_2|$ (B) $|z_1 - z_2| = |z_1|$

(C) $|z_1 + z_2| = |z_1| + |z_2|$ (D) |principle arg (z_1) – principle arg (z_2)| = $\frac{\pi}{3}$

8. Let $\vec{\alpha} = a\hat{i} + b\hat{j} + c\hat{k}, \vec{\beta} = b\hat{i} + c\hat{j} + a\hat{k}$ and $\vec{\gamma} = c\hat{i} + a\hat{j} + b\hat{k}$ be three coplanar vectors with $a \neq b$, and $\vec{v} = \hat{i} + \hat{j} + \hat{k}$. Then $\vec{v}$ is perpendicular to

(A) $\vec{\alpha} + 2\vec{\beta}$ (B) $\vec{\beta} - 3\vec{\alpha} + 4\vec{\gamma}$

(C) $\vec{\gamma} + \vec{\beta} - \vec{\alpha}$ (D) $\vec{\beta} - 2\vec{\gamma}$

Space for Rough Work

9. If $|Z_1| = 12$ and $\left|Z_2 - \left(5 + 2\sqrt{6}\,i\right)\right| = 3$ be two curves satisfied by two points $Z_1$and Z_2 respectively, then which of the following is/are **CORRECT** ?

(A) maximum value of $|Z_1 - Z_2|$ is 22

(B) maximum value of $|Z_1 - Z_2|$ is 21

(C) minimum value of $|Z_1 - Z_2|$ is 2

(D) maximum of $|Z_1 - Z_2|$ occurs along the line joining centre of two circles.

10. If $\sqrt{5-12i} + \sqrt{-5-12i} = z$ then principle value of arg (z) can be

(A) $-\frac{\pi}{4}$ (B) $\frac{\pi}{4}$ (C) $\frac{3\pi}{4}$ (D) $\frac{-3\pi}{4}$

11. If $\vec{x} + \vec{y} = \vec{a}$, $\vec{x} \times \vec{y} = \vec{b}$ and $\vec{x} \cdot \vec{a} = 1$, then

(A) $\vec{x} = \frac{\vec{a} + \vec{a} \times \vec{b}}{|\vec{a}|^2}$ (B) $\vec{x} = \frac{\vec{a} \times \vec{b} + \vec{b}}{|\vec{a}|^2}$ (C) $\vec{y} = \frac{\vec{a} \times \vec{b} - \vec{a}}{|\vec{a}|^2}$ (D) $\vec{y} = \vec{a} - \frac{\vec{a} \times \vec{b} + \vec{a}}{|\vec{a}|^2}$

12. Let $\vec{a}$, $\vec{c}$ be unit vectors and $|\vec{b}| = 4$ with $\vec{a} \times \vec{b} = 2\vec{a} \times \vec{c}$. The angle between $\vec{a}$ and $\vec{c}$ is $\cos^{-1}\left(\frac{1}{4}\right)$. If $\vec{b} - 2\vec{c} = k\vec{a}$, then k is equal to

(A) $\frac{1}{3}$ (B) $\frac{1}{4}$ (C) -4 (D) 3

Space for Rough Work

13. The equation $(26x-1)^2+(26y-3)^2=k(5x-12y+1)^2$ will represent a parabola for some value 'k' then

(A) k is an even number (B) k is a prime number

(C) unit digit in 7^k is 1 (D) k = 8

14. Given α, β respectively, the fifth and fourth non real roots of unity, then the value of

$(1+\alpha)(1+\beta)(1+\alpha^2)(1+\beta^2)(1+\alpha^4)(1+\beta^4)$, is

(A) 1 (B) 0 (C) 2 (D) 8

15. The volume of a right triangular prism $ABCA_1B_1C_1$ is equal to 3. If the position vectors of the vertices of the base ABC are A(1, 0, 1), B(2,0, 0) and C(0, 1, 0), then position vectors of the vertex A_1 can be:

(A) (2, 2, 2) (B) (0, 2, 0) (C) (0, – 2, 2) (D) (0, – 2, 0)

16. Let $\vec{a}=2\hat{i}-\hat{j}+\hat{k}$, $\vec{b}=\hat{i}+2\hat{j}-\hat{k}$ and $\vec{c}=\hat{i}+\hat{j}-2\hat{k}$ be three vectors. A vector in the plane of b and c whose projection on a is of magnitude $\sqrt{2/3}$ is

(A) $2\hat{i}+3\hat{j}-3\hat{k}$ (B) $2\hat{i}+3\hat{j}+3\hat{k}$ (C) $-2\hat{i}-\hat{j}+5\hat{k}$ (D) $2\hat{i}+\hat{j}+5\hat{k}$

Space for Rough Work

17. If $|Z - 3| = \min \{|Z-1|, |Z-5|\}$, then Re(z) equals to

(A) 2 (B) $\frac{5}{2}$ (C) $\frac{7}{2}$ (D) 4

18. The locus of the mid point of the focal radii of a variable point moving on the parabola, $y^2 = 4ax$ is a parabola whose

(A) Latus rectum is half the latus rectum of the original parabola

(B) Vertex is (a/2, 0)

(C) Directrix is y-axis

(D) Focus has the co-ordinates (a,0)

19. The vector $\vec{a} = x\hat{i} - 2\hat{j} + 5\hat{k}$ and $\vec{b} = \hat{i} + y\hat{j} - z\hat{k}$ are collinear, if

(A) x = 1, y = –2, z = –5 (B) $x = \frac{1}{2}$, y = –4, z = –10

(C) $x = \frac{-1}{2}, y = 4, z = 10$ (D) $x = -1, y = 2, z = 5$

20. Let C denote the set of all complex numbers and let us define two sets A and B as

$A = \left\{z : z \in C \text{ and } \text{Arg}(z - i) \geq \frac{\pi}{3}\right\}$, where Arg(z) represents principal arguments of z.

$B = \{z : z \in C \text{ and } |z - i| \leq 1\}$

then identify the correct statement

(A) $A \cap B$ represents complex numbers lying inside or on boundary of sector of a circle

(B) set B is a subset of set A

(C) $A \cap B$ represents complex numbers lying on an arc of a circle

(D) $A \cap B$ represents all complex numbers lying inside on boundary of segment of a circle

Space for Rough Work

SECTION – 2 : (Maximum Marks : 80)

- This section contains **TEN** paragraphs
- Based on each paragraph, there will be **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- Marking scheme :

  +4 If the bubbles corresponding to the answers are darkened

  0 If none of the bubbles is darkened

  –2 In all other cases

Paragraph for Question Nos. 21 to 22

Consider the lines

$L_1 : \frac{x+1}{3} = \frac{y+2}{1} = \frac{z+1}{2}$

$L_2 : \frac{x-2}{1} = \frac{y+2}{2} = \frac{z-3}{3}$

21. The unit vector perpendicular to both L_1 and L_2 is

(A) $\frac{-\hat{i}+7\hat{j}+7\hat{k}}{\sqrt{99}}$ (B) $\frac{-\hat{i}-7\hat{j}+5\hat{k}}{5\sqrt{3}}$ (C) $\frac{-\hat{i}+7\hat{j}+5\hat{k}}{5\sqrt{3}}$ (D) $\frac{7\hat{i}-7\hat{j}-\hat{k}}{\sqrt{99}}$

22. The shortest distance between L_1 and L_2 is

(A) 0 (B) $\frac{17}{\sqrt{3}}$ (C) $\frac{41}{5\sqrt{3}}$ (D) $\frac{17}{5\sqrt{3}}$

Space for Rough Work

Paragraph for Question Nos. 23 to 24

If Z = x + iy and the minimum value of the expression $E = |z|^2 + |z-3|^2 + |z-6i|^2$ is m then

23. Value of 2m is equal to

(A) 30 (B) 60 (C) 90 (D) 15

24. Value of x and y is equal to $[Z = x + iy]$

(A) $x = 2, y = 1$ (B) $x = 3, y = 2$ (C) x = 1, y = 2 (D) x = 5, y = 2

Paragraph for Question Nos. 25 to 26

A ray of light is coming along the line L = 0 and strikes the plane mirror kept along the plane P = 0 at B. A (2, 1, 6) is a point on the line L = 0 whose image about P = 0 is A′. It is given that L = 0 is $\frac{x-2}{3} = \frac{y-1}{4} = \frac{z-6}{5}$ and P = 0 is x + y – 2z = 3.

25. Co-ordinates of A′ are

(A) (6, 5, 2) (B) (6, 5, –2) (C) (6, –5, –2) (D) (–6, –5, 2)

26. If $L_1 = 0$ is the reflected ray, then its equation is

(A) $\frac{x+10}{4} = \frac{y-5}{4} = \frac{z+2}{3}$ (B) $\frac{x+10}{3} = \frac{y+15}{5} = \frac{z+14}{5}$

(C) $\frac{x+10}{4} = \frac{y+15}{5} = \frac{z+14}{3}$ (D) none of these

Space for Rough Work

Paragraph for Question Nos. 27 to 28

Let $\vec{a} = \hat{i} + 2\hat{j} + 2\hat{k}$, $\vec{b} = 2\hat{i} - 3\hat{j} + \hat{k}$ and $\vec{c}$ is a vector such that $(\vec{a} \times \vec{b}) \times \vec{c} = \vec{a} \times (\vec{b} \times \vec{c}), |\vec{c}| = 6$, then answer the following questions :

27. $\vec{c}$ is

(A) Parallel with $\vec{a}$ (B) Parallel with $\vec{b}$

(C) Parallel with $\vec{a} \times \vec{b}$ (D) Coplanar with $\vec{a}$ and $\vec{b}$

28. Volume of parallelopiped whose coterminus edges are $\vec{a}$, $\vec{b}$ and $\vec{b} \times \vec{c}$ is

(A) $(\vec{a} \times \vec{b})^2$ (B) $2(\vec{a} \times \vec{b})^2$ (C) 244 (D) 122

Paragraph for Question Nos. 29 to 30

Consider a line $z(1 - i) + \bar{z}(1 + i) - 2k = 0$ and the circle $z\bar{z} - (1 - 2i)z - (1 + 2i)\bar{z} - 13 = 0$.

29. The possible values of k so that the line is secant to the circle is/are

(A) –3 (B) 4 (C) 6 (D) 9

30. The given circle can also be represented by the equation

(A) $|z - 1 + 2i| = 18$ (B) $|z - 1 - 2i| = 3\sqrt{2}$

(C) $|z + 1 + 2i| = 18$ (D) $|z + 1 + 2i| = 3\sqrt{2}$

Space for Rough Work

Paragraph for Question Nos. 31 to 32

Let $\overrightarrow{PR} = 3\hat{i} + \hat{j} - 2\hat{k}$ and $\overrightarrow{SQ} = \hat{i} - 3\hat{j} - 4\hat{k}$ determine diagonals of a parallelogram PQRS and $\overrightarrow{PT} = \hat{i} + 2\hat{j} + 3\hat{k}$ be another vector.

31. Area of the parallelogram PQRS is

(A) $10\sqrt{3}$ (B) $5\sqrt{3}$ (C) $\frac{5\sqrt{3}}{2}$ (D) None of these

32. The volume of the parallelepiped determined by the vectors $\overrightarrow{PT}$, $\overrightarrow{PQ}$ and $\overrightarrow{PS}$ is

(A) 5 (B) 20 (C) 10 (D) 30

Paragraph for Question Nos. 33 to 34

On a complex plane, let three points A, B, C with affixes z_1, z_2, z_3 respectively lie on unit circle $|z| = 1$. D is a point on BC such that AD is perpendicular to BC and AD is produced to a point E on the circle $|z| = 1$. Then

33. Orthocentre of ΔABC is

(A) $z_1 + z_2 + z_3$ (B) $z_1z_2 + z_2z_3 + z_3z_1$ (C) $z_1^2 + z_2^2 + z_2^3$ (D) none of these

34. Affix of the point E is

(A) $-\frac{z_2z_1}{z_3}$ (B) $-\frac{z_2z_3}{z_1}$ (C) $-\frac{z_1z_3}{z_2}$ (D) $-\frac{\bar{z}_1z_3}{\bar{z}_2}$

Space for Rough Work

Paragraph for Question Nos. 35 to 36

Let $z_1, z_2, z_3, \ldots, z_6$ are the roots of the equation $z^6 + z^5 + z^4 + z^3 + z^2 + z + 1 = 0$

35. Which of the following is/are True ?

(A) $\sum_{i=1}^{6} z_i^5 = -1$ (B) $\prod_{i=1}^{5} z_i = -1$ (C) $\sum z_i^5 + \prod z_i = 0$ (D) $\sum_{i=1}^{6} z_i^5 = 1$

36. $(2 - z_1)(2 - z_2)(2 - z_3)(2 - z_4)(2 - z_5)(2 - z_6) =$

(A) 63 (B) 127 (C) 32 (D) 31

Paragraph for Question Nos. 37 to 38

Consider complex number $z = \frac{1 - i\sin\theta}{1 + i\cos\theta}$

37. The value of θ for which z is purely imaginary are

(A) $n\pi - \frac{\pi}{4},\ n \in I$ (B) $n\pi + \frac{\pi}{4},\ n \in I$ (C) $n\pi,\ n \in I$ (D) no real value of θ

38. The value of θ for which $\arg(z) = \frac{\pi}{4}$ is given by

(A) $n\pi \pm \pi/6$ (B) $n\pi \pm \frac{\pi}{3}$ (C) $n\pi \pm \frac{\pi}{4}$ (D) $(2n+1)\frac{\pi}{4}$

Space for Rough Work

Paragraph for Question Nos. 39 to 40

Let $\hat{u}, \hat{v}, \hat{w}$ be three non–coplanar unit vectors with angles between $\hat{u}$ and $\hat{v}$ is α, between $\hat{v}$ and $\hat{w}$ is β and between $\hat{w}$ and $\hat{u}$ is γ. Further $\vec{a}, \vec{b}, \vec{c}$ be unit vectors along angle bisectors of α, β, γ respectively.

39. $[\vec{a}+\vec{b}\ \ \vec{b}+\vec{c}\ \ \vec{c}+\vec{a}]$ =

(A) $\frac{1}{2}[\hat{u}\ \hat{v}\ \hat{w}]\sec\frac{\alpha}{2}\sec\frac{\beta}{2}\sec\frac{\gamma}{2}$

(B) $[\hat{u}\ \hat{v}\ \hat{w}]\sec\frac{\alpha}{2}\sec\frac{\beta}{2}\sec\frac{\gamma}{2}$

(C) $\frac{1}{4}[\hat{u}\ \hat{v}\ \hat{w}]\sec\frac{\alpha}{2}\sec\frac{\beta}{2}\sec\frac{\gamma}{2}$

(D) $[\hat{u}\ \hat{v}\ \hat{w}]\left|\sec\alpha\sec\beta\sec\gamma\right|$

40. $[\vec{a}\times\vec{b}\ \ \vec{b}\times\vec{c}\ \ \vec{c}\times\vec{a}]$ =

(A) $\frac{1}{4}[\hat{u}\ \hat{v}\ \hat{w}]^2\sec^2\frac{\alpha}{2}\sec^2\frac{\beta}{2}\sec^2\frac{\gamma}{2}$

(B) $\frac{1}{8}[\hat{u}\ \hat{v}\ \hat{w}]^2\sec^2\frac{\alpha}{2}\sec^2\frac{\beta}{2}\sec^2\frac{\gamma}{2}$

(C) $\frac{1}{16}[\hat{u}\ \hat{v}\ \hat{w}]^2\sec^2\frac{\alpha}{2}\sec^2\frac{\beta}{2}\sec^2\frac{\gamma}{2}$

(D) $\frac{1}{16}[\hat{u}\ \hat{v}\ \hat{w}]^2\sec\frac{\alpha}{2}\sec\frac{\beta}{2}\sec\frac{\gamma}{2}$

Space for Rough Work