MATHS

JEE (MAIN AND ADVANCED MATHEMATICS) FOR BOARD AND COMPETITIVE EXAMS

COMPLEX NUMBERS AND QUADRATIC EQUATIONS

Example

1. Evaluate the followings :

(i) i^{23}

(ii) i^{-97}

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2. Evaluate $\dfrac{i^{.81}+1}{\left(i^{253}\right)^{9}}$

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3. Plot the complex number - 6 + 7i on the Argand plane.

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4. write the complex numbers that are represented by the following points in the complex plane

(i) 0,3 (ii) (-1 ,0)

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5. Find the values of x and y , if 2 x + 3yi = 2+ 12i , where $x, y \in R$

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6. If $Z_1 = 2 + 3i$ and $z_2 = -1 + 2i$ then find

(i) $z_1 + z_2$

(ii) $z_1 - z_2$

(iii) $z_1 . z_2$

(iv) $\frac{z_1}{z_2}$

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7. If $z_1 = 3 - 2i, z_2 = 2 - i$ and $z_3 = 2 + 5i$ then find $z_1 + z_2 - 2z_3$

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8. If z= 4+ 7i be a complex number, then find

(i) Additive inverser of z.

(ii) Multiplicative inverse of z.

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9. Express the following in the form of a + ib .

(i) $\left(\frac{1}{2}+3i\right)^2$

(ii) (2+ 3i) (2-3i)

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10. Express the following in the form of a + ib .

(i) $\left(\frac{1}{4}+4i\right)^2$

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11. Express the following in the form of a + ib

(i) $\frac{4+3i}{5+3i}$

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12. Prove that the complex number $\left(\frac{3+2i}{2-3i}\right)+\left(\frac{3-2i}{2+3i}\right)$ is purely real.

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13. Plot the conjugate of the complex number -2 + 7i on the Argand plane

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14. Find the conjugate of

$$\frac{1}{2+5i}$$

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15. If $z_1=3+2i$ and $z_2=2-i$ then verify that

$(i)\overline{z_1+z_2}=\bar{z}_1+\bar{z}_2$

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16. if $z_1 = 1 - i$ and $z_2 = -2 + 4i$ then find $Im\left(\frac{z_1 z_2}{\bar{z}_1}\right)$

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17. Find real values of x and y for which the complex numbers $-5 + ix^2y$ and $x^2 + y + 35i$ are conjugate of each other .

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18. If $\frac{p + iq}{r + is} = x + iy$, prove that $\frac{p - iq}{r - is} = x - iy$ and $\frac{p^2 + q^2}{r^2 + s^2} = x^2 + y^2$,where $p, q, r, s, x, y, \in R$

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19. Represent the modulus of 8 + 6i in the Argand plane .

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20. Find the modulus of the following complex number (3+ 4i) (1+ 5i)

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21. If $z_1 = 3 - 4i \text{ and } z_2 = 5 + 7i$,verify

(i) $| - z_1| = |z_1|$

(ii) $|z_1 + z_2| < |z_2|$

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22. Find the modulus and argument of the complex number $3\sqrt{2} - 3\sqrt{2}i$

.

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23. Find modulus of

(i) $\frac{2+4i}{2-6i}$

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24. Find the square roots of the following complex numbers.

(i) -6 -8i

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25. Solve the following quadratic equations :

(i)$9x^2-8x+2=0$

(ii) $\sqrt{7}x^2+x+\sqrt{7}=0$

(iii)$2\sqrt{3}x^2-\sqrt{2}x+3\sqrt{3}=0$

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26. Solve $x^2 - (\sqrt{2} + i)x + \sqrt{2}i = 0$

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27. If $x_n = \frac{\cos \pi}{3^n} + i\frac{\sin(\pi)}{3^n}$, then $x_1, x_2, x_3, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots x_\infty$ is equal to

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28. If $1, \alpha, \alpha^2, \alpha^3, \ldots\ldots, \alpha^{n-1}$ are n n^{th} roots of unity, then find the value of $(2011 - \alpha)(2011 - \alpha^2)\ldots.(2011 - \alpha^{n-1})$

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29. If α is one of the non real imaginary seventh roots of unity, then form the quadratic equation whose roots are given by $\alpha + \alpha^2 + \alpha^4$ and $\alpha^3 + \alpha^5 + \alpha^6$

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30. Find the greatest and least value of $|z_1 + z_2| =$ if $z_1 = 24 + 7i$ and $|z_2| = 7$

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32. if $z_1, z_2, z_3, \ldots .. z_n$ are complex numbers such that $|z_1| = |z_2| = \ldots . = |z_n| = \left|\frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3} + \ldots . + \frac{1}{z_n}\right| = 1$

Then show that $|z_1 + z_2 + z_3 + \ldots \ldots + z_n| = 1$

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33. If z_1 and z_2 are two complex numbers such that $|z_1| < 1 < |z_2|$, then prove that $|(1 - z_1\bar{z}_2)/(z_1 - z_3)| < 1$

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34. Find the complex number z if $z\bar{z} = 2$ and $z + \bar{z} = 2$

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35. If $iz^3 + z^2 - z + i = 0$, where $i = \sqrt{-1}$, then $|z|$ is equal to 1 (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) None of these

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36. If ω is a cube root of unity but not equal to 1, then minimum value of $|a + b\omega + c\omega^2|$, (where a,b and c are integers but not all equal), is

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37. If $arg(z_1) = \frac{2\pi}{3}$ and $arg(z_2) = \frac{\pi}{2}$, then find the principal value of $arg(z_1 z_2)$ and also find the quardrant of $z_1 z_2$.

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38. If $arg(z) < 0,$ then find $arg(-z) - arg(z)$.

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39. if the complex no z_1, z_2 and z_3 represents the vertices of an equilateral triangle such that $|z_1| = |z_2| = |z_3|$ then relation among z_1, z_2 and z_3

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40. Find the condition in order that z_1, z_2, z_3 are vertices of an.isosceles triangle right angled at z_2.

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41. Show that the area of the triangle on the Argand diagram formed by the complex number $z, izandz + iz$ is $\frac{1}{2}|z|^2$

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42. If $|z - 25i| \leq 15$, then find

(i) Maximum |z| (2) Maximum arg (z)

(3) minimum |z| (4) Minimum arg (z)

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43. Show that if $z_1 z_2 + z_3 z_4 = 0$ and $z_1 + z_2 = 0$,then the complex numbers z_1, z_2, z_3, z_4 are concyclic.

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44. Locate the points representing the complex number z on the Argand plane.

(a) $|z + 1 - 2i| = 2\sqrt{2}$

(b) $|z - 1|^2 + |z + 1|^2 = 4$

(c) $\left|\frac{z - 2008}{z + 2008}\right| = 2007$

(d) |z-2008|= |z- 2007i|

(e) |z-2008|+|z + 2008| = 4018

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45. If θ is real and z_1, z_2 are connected by $z12 + z22 + 2z_1 z_2 \cos\theta = 0$, then prove that the triangle formed by vertices $O, z_1 and z_2$ is isosceles.

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46. Show that there is no complex number such that

$|z| \leq \frac{1}{2}$ and $z^n \sin\theta_0 + z^{n-1}\sin\theta_2 + ... + z\sin\theta_{n-1} + \sin\theta_n = 2$

where $\theta, \theta_1, \theta_2, \ldots\ldots, \theta_{n-1}, \theta_n$ are reals and $n \in Z^+$.

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47. If z is a complex number lying in the fourth quadrant of Argand plane and $\left|\left[\frac{kz}{k+1}\right] + 2i\right| > \sqrt{2}$ for all real value of $k(k \neq -1)$, then range of $\arg(z)$ is $\left(\frac{\pi}{8}, 0\right)$ b. $\left(\frac{\pi}{6}, 0\right)$ c. $\left(\frac{\pi}{4}, 0\right)$ d. none of these

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48. If $z_1 = a + ib$ and $z_2 + cid$ are complex numbers such that

$|z_1| = |z_2| = 1$ and $Re(z_1 \bar{z}_2) = 0,$

then the pair of complex numbers $w_1 = a + ic$ and $w_2 = bid$ satisfies :

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49. if the roots of the equation $z^2 + (p + iq)z + r + is = 0$ are real wher p,q,r,s, $\in$,R , then determine $s^2 + q^2 r$.

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50. Let P,Q ,R be points represented by complex numbers z_1, z_2, z_3 and circumcentre of ΔPQR conicides with origin, Let the altitude , PL of the Δ meets the cricumircle again at M, then find the complex number representing the point M.

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51. If the ratio $\frac{z - i}{z - 1}$ is purely imaginary, prove that the point z lies on the circle whose centre is the point $\frac{1}{2}(1 + i)$ and radius is $\frac{1}{\sqrt{2}}$

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52. Find the locus of complex number z, stisfying $(z+1)^n = z^n$

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53. If $2+\sqrt{3}i$ is a root of the equation $x^2+px+1=0$, then write the values of $p \, and \, q$.

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54. If α, β are the roots of the equation $(x-a)(x-b)=c, c \neq 0.$ Find the roots of the equation $(x-\alpha)(x-\beta+c=0$

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55. Discuss the nature of roots of equation $x^2+ax+b=0$ and $x^2+cx+d=0, wherea, b, c, darerealνmbers$ and ac = 2(b +d)`

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56. Fill in the blanks If the quadratic equations $x^2 + ax + b = 0 and x^2 + bx + a = 0 (a \neq b)$ have a common root, then the numerical value of $a + b$ is _______.

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57. Find a relation between a,b,c so that two quadratic equations $ax^2 + bx + c = 0$ and $1003x^2 + 1505x + 2007 = 0$ have a common root.

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58. If two equations $x^2 + ax + bc = 0$ and $x^2 + bx + ca = 0$ have a common root, the find the condition and the quadratic with other roots of the equations.

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59. Discuss the sign scheme of the expesion $\frac{\left(x^2-2011x+2010\right)\left(x^2+2011x-2012\right)}{(x^2-4x+4)(x^2-8x+15)(x^2-5x+6)^2}$

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60. for what values of m, the equation $2x^2-2(2m+1)x+m(m+1)=0m \in R$ has (i) Both roots smallar than 2 ? (ii) Both roots greater than 2 ? (iii) Both roots lie in the interval (2,3) ? (iv) Exactly one root lie in the interval (2,3) ? (v) One root is smaller than 1, and the other root is greater than 1 ? (vi) One root is greater than 3 and the other root is smaller than 2 ? (vii) Roots α and β are such that both 2 and 3 lie between α and β ?

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61. If the roots of the cubic equation $x^3-9x^2+a=0$ are in A.P., Then find one of roots and a

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62. Find the number of real roots of the equation $f(x) = x^3 + 2x^2 + x + 2 = 0$

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63. If the equation $2x^3 - 6x + k = 0$ has three real and distinct roots, then find the value (s) of k.

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64. if α, β, γ are the roots of $x^3 + x^2 + x + 9 = 0$, then find the equation whose roots are $\frac{\alpha+1}{\alpha-1}, \frac{\beta+1}{\beta-1}, \frac{\gamma+1}{\gamma-1}$

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65. The equations $ax^2 + bx + c = 0, x^3 - 2x^2 + 2x - 1 = 0$ have tow roots common, then find the value of a+b.

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66. find the condition that $px^3 + qx^2 + rx + s = 0$ has exactly one real roots, where $p, q, r, s, \in R$

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67. if α, β be the roots of $x^2 - (a-2)x - a - 1 = 0$ then the least value of $\alpha^2 + \beta^2$ is (1) 0 (2) 1 (3) 3 (4) 5

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68. If the quadratic equation $a^2(b^2 - c^2)x^2 + b^2(c^2 - a^2)x + c^2(a^2 - b^2) = 0$ has real and equal roots, than a^2, b^2, c^2 are

(1) A.P. (2) (G.P. (3) H.P. (4) A.G.P.

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69. The number of solution of the equation $|x - x^2 - 1| = |2x - 3 - x^2|$ is

(1) 0 (2) 1 (3) (4) Infinitely many

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70. Let a,b,c $\in R$ and $a > 0.$ If the quadratic equation $ax^2 + bx + c = 0$ has two real roots α and β such that $\alpha > -1$ and $\beta > 1$, then show that $1 + \left|\frac{b}{a}\right| + \frac{c}{a} > 0$

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71. The equation $x^2 + px + q = 0$ has two roots α, β then

Choose the correct answer :

(1) The equation $qx^2 + (2q - p^2)x + q$ has roots

$(1)\frac{\alpha}{\beta}, \frac{\beta}{\alpha}$ (2) $\frac{1}{\alpha}, \frac{1}{\beta}$

$(3)\alpha^2, \beta^2$ (4) None of these

(2) The equation whose roots are $\frac{1}{\alpha}, \frac{1}{\beta}$ is

$(1)px^2 + qx + 1 = 0$ (2) $qx^2 + px + 1 = 0$

(3)$x^2 + qx + p = 0$

(4) $qx^2 + x + p = 0$

3. the values of p and q when roots are -1,2

(1) p = -1 , q = -2 (2) p =-1 , q =2

(3) p=1 , q = -2 (4) None of these

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72. Match the following :

Column I

(A) The total number or real solutions of the equation $\left(x^2 - 7x + 1\right)^{\left(x^2 -\right.}$

(B) Total number of values of a so that $x^2 - x - a = 0$ has distinct inte

(C) The least value of n such that $(n-2)x^2 + 8x + n + 4 > 0 \forall x \in R$ v

(D) Total number of integral values of a such that $x^2 + ax + a + 1 = 0$

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73. if α, β, γ are the roots of the equation $x^3 + 3x + 2 = 0$ then $\dfrac{\alpha^3 + \beta^3 + \gamma^3}{\alpha^2 + \beta^2 + \gamma^2}$

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Try Yourself

1. Evaluate $2i^2 + 6i^3 + 3i^{16} - 6i^{19} + 4i^{25}$

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2. Evaluate $\left[i^{14}-\left(\frac{1}{i}\right)^{34}\right]^{2}$

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3. Plot the complex number -4 + 5i on the Argand plane.

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4. Plot the complex number -3 + 7i on the Argand plane.

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5. Write the complex number represented by the point (-2,5)

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6. Write the complex number represented by the point (-6,-7)

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7. Find the values of x and y , if (3y -2) + (5 -4x)i=0 , where , x y $\in$ R.

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8. Find the values of x and y , if $x + 4yi = ix + y + 3$ where $x, y \in R$

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9. If $z_1 = 4 - I \text{ and } z_2 = -3 + 7i$ then find

(i) $z_1 + z_2$

(ii) $z_1 - z_2$

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10. If $z_1 = 6 + 9i$ and $z_2 = 5 + 2i$ then find $\frac{z_1}{z_2}$

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11. if $z1 = 1 + i$, $z_2 = 2 - 3i$ and $z_3 = 5 + 2i$ then find $z_1 - z_2 + 3z_3$

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12. if $z_1 = 2 + 3i$, $z_2 = 1 - i$ and $z_3 = 3 + 4i$,then find $z_1 z_2 + z_3$

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13. if $z_1 = -1 + 3i$ and $z_2 = 2 + i$ then find $2(z_1 + z_2)$

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14. find the multiplicative inverse of the complex number 2 + 9i .

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15. Express $\left(4-\frac{5}{2}i\right)^2$ in the form of a + ib.

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16. Express $(1-i)^4$ in the form of a +ib.

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17. Express $\left(\frac{1}{3}+\frac{4}{3}i\right)^2$ in the form of a + ib.

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18. if $z_1 = 3i$ and $z_2 = 1+2i$, then find $z_1 z_2 - z_1$

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19. Express $\dfrac{1}{1+\cos\theta - i\sin\theta}$ in the form of $a+ib$.

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20. Express $\left(\dfrac{1}{2-2i}+\dfrac{3}{1+i}\right)\left(\dfrac{3+4i}{2-4i}\right)$ in the form of a +ib

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21. Show that the complex number $\left(\dfrac{4+3i}{3+4i}\right)\left(\dfrac{4-3i}{3-4i}\right)$ is purely real.

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22. Find real q such that $\dfrac{3+2i\sin\theta}{1-2i\sin\theta}$ is purely real.

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23. Plot the conjegate of the complex number 2-3i on the Argand plane.

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24. Plot the conjegate of the complex number -7-4i on the Argand plane.]

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25. Mutiply (5 +2i) by its conjugate.

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26. Find the conjugate of $\frac{(1-2i)^2}{2+i}$

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27. if $z=2+i+4i^2-6i^3$ then verify that

(i) $\left(\overline{z^2}=(\bar{z})^2\right)$

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28. if z=3 -2i, then verify that

(i) $z+\bar{z}=2Rez$

(ii) $z-\bar{z}=2ilmz$

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29. if $z_1=3-i$ and $z_2=-3+i$, then find $Re\left(\frac{z_1z_2}{\bar{z}_1}\right)$

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30. Let $z_1=2-i$ and $z_2=2+i$, then $\mathrm{Im}\left(\frac{1}{z_1z_2}\right)$ is

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31. Find real values of x and y for which the complex numbers $7+ix^2y$ and $x^2+y+18i$ are conjugate of each other.

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32. Find real number x and y if $(x - iy)(4 + 7i)$ is the conjugate of 29-2i.

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33. Find the conjugate of $\dfrac{\sqrt{2} - i\sqrt{2}}{2\sqrt{5} - i\sqrt{2}}$

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34. If $\dfrac{(a+i)^2}{(2a-i)} = p + iq$, show that: $p^2 + q^2 = \dfrac{(a^2+1)^2}{(4a^2+1)}$.

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35. Represent the modulus of 3+4i in the Argand plane.

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36. Represent the modulus of 1+i, in the Argand plane.

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37. Find the modulus of $\frac{2-3i}{4+i}$

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38. Find the modulus of $\frac{(3+2i)^2}{4-3i}$

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39. If $z_1 = 5+2i$ and $z_2 = 2+i$,verify

$(i)|z_1 z_2| = |z_1||z_2|$

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40. if $z_1 = 2 + 3i \text{ and } z_2 = 1 + i$ then find, $|z_1 + z_2|$

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41. Find the modulus and argument of -4i.

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42. Find the modulus and argument of -3.

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43. Convert the complex number $\frac{1+i}{1-i}$ in the polar form

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44. Convert the complex number $\frac{4}{1-i\sqrt{3}}$ in the polar form.

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45. Find the square root of -6+8i.

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46. Find the square root of $5 - 12i$

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47. Solve $9x^2 - 12x + 25 = 0$

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48. Solve $16x^2 + 4 = 0$

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49. Solve $x^2 - x + (1 - i) = 0$

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50. Solve $x^3 + x^2 + x + 1.$

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51. If z_1, z_2, z_3, z_4 are complex numbers, show that they are vertices of a parallelogram In the Argand diagram if and only if $z_1 + z_3 = z_2 + z_4$

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52. If P, Q, R, S are represented by the complex number $4 + i, 1 + 6i, -4 + 3i, -1 - 2i$ respectively, then $PQRS$ is a (A) rectangle (B) square (C) rhombus (D) parallelogram

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53. The length of perpendicular from $P(2-3i)$ on the line $(3+4i)Z+(3-4i)\overline{Z}+9=0$ is equal to

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54. If $z_1=7+6i,\ z_2=2+2i$ and $z_3=1-4i$then find $z_1-z_2+z_3$

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55. The set of values of k for which the equation $z\bar{z}+(-3+4i)\bar{z}-(3+4i)z+k=0$

represents a circle, is

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56. Locus of the point z satisfying the equation $|zi-i|+|z-i|=2$ is

(1) A line segment (2) A circle

(3) An eplipse (4) A pair of straight line

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57. If z=x+iy is a complex number satisfying $\left|z+\frac{i}{2}\right|^2=\left|z-\frac{i}{2}\right|^2$, then the locus of z is

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58. If $\left|z^2-1\right|=|z|^2+1$, then z lies on (a) The Real axis (b)The imaginary axis (c)A circle (d)An ellipse

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59. If $w=z/[z-(1/3)i]and|w|=1,$ then find the locus of $z\cdot$

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60. If $z = x + iy$ and $\arg\left(\frac{z-2}{z+2}\right) = \frac{\pi}{6}$, then find the locus of z.

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Assignment (Section -A) (objective Type Questions (one option is correct)

1. The value of i^{-9999} is

A. $-i$

B. i

C. 1

D. -1

Answer: B

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2. If $z = \frac{1+i}{\sqrt{2}}$, then the value of z^{1929} is

A. 1+i

B. -1

C. $\frac{1+i}{2}$

D. $\frac{1+i}{\sqrt{2}}$

Answer: D

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3. $(\sqrt{-3})(\sqrt{-5})$ is equal to

A. $\sqrt{15}$

B. $-\sqrt{15}$

C. $i\sqrt{15}$

D. $\sqrt{5}$

Answer: B

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4. the value of $\frac{\left(i^{11}+i^{12}+i^{13}+i^{14}+i^{15}\right)}{(1+i)}$ is

A. $\frac{-(1+i)}{2}$

B. $\frac{(1-i)}{2}$

C. $\frac{(1+i)}{2}$

D. $\frac{1}{2}$

Answer: A

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5. if $z=\left(\frac{1+i}{1-i}\right)$ then z^2 equals

A. 1

B. -1

C. i

D. none

Answer: A

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6. If the multiplicative inverse of a complex number is $\frac{\sqrt{2}+5i}{17}$,then the complex number is

A. $\frac{\sqrt{2}-5i}{17}$

B. $\frac{\sqrt{2}+5i}{29}$

C. $\frac{17}{27}\left(\sqrt{2}-5i\right)$

D. $\frac{17}{27}\left(\sqrt{2}+5i\right)$

Answer: C

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7. The additive inverse of 5+7i is

A. 5-7i

B. $-5+7i$

C. 5+7i

D. $-5-7i$

Answer: D

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8. The complex number $\frac{1+2i}{1-i}$ lies in the Quadrant number

A. First quadrant

B. Second quadrant

C. Thrid quadrant

D. Fourth quadrant

Answer: B

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9. If $\left(\frac{1+i}{1-i}\right)^3 - \left(\frac{1-i}{1+i}\right)^3 = a + ib$ find a and b

A. 0 and 2

B. 0 and -2

C. 2 and 0

D. 2 and 2

Answer: B

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10. If $x = -2 - \sqrt{3}i$, where $i = \sqrt{-1}$, find the value of $2x^4 + 5x^3 + 7x^2 - x + 41$

A. 1

B. 3

C. 6

D. 8

Answer: C

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11. $\left[i^{17}+\frac{1}{i^{315}}\right]^{9}$ is equal to

A. 32i

B. -512

C. 512

D. 512i

Answer: D

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12. If $z = 3 - 2i$ then the value s of $(Rez)(Imz)^2$ is

A. 6

B. 12

C. -6

D. -12

Answer: B

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13. If $z_1 = 4 - 3i \text{ and } z_2 = 3 + 9i \text{ then } z_1 - z_2$ is

A. 1+ 12i

B. $-1 + 12i$

C. $1 - 12i$

D. $-1-12i$

Answer: C

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14. If $z_1 = 2+3i$ and $z_2 = 5-3i$ then $z_1 z_2$ is

A. $-9-19i$

B. $-9+19i$

C. $19-19$

D. $19+i9$

Answer: D

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15. $\dfrac{1+2i}{1+3i}$ is equal to

A. $\frac{7}{10}-\frac{i}{10}$

B. $\frac{7}{10}+\frac{i}{10}$

C. $7-i$

D. $\frac{7}{2}+\frac{i}{2}$

Answer: A

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16. $\frac{(1+i)^3}{2+i}$ is equal to

A. $\frac{2}{5}-\frac{6}{5}i$

B. 0

C. $-\frac{1}{5}+\frac{5}{6}i$

D. $-\frac{2}{5}+\frac{6}{5}i$

Answer: D

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17. $\left(\frac{2}{1-i}+\frac{3}{1+i}\right)\left(\frac{2+3i}{4+5i}\right)$ is equal to

A. $-\frac{117}{82}-\frac{13}{82}i$

B. $-\frac{117}{82}+\frac{13}{82}i$

C. $\frac{117}{82}-\frac{13i}{82}$

D. $\frac{117}{82}+\frac{13i}{82}$

Answer: C

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18. In the Argand plane, the conjugate of the complex number 3-7i will lie in

A. First quadrant

B. Second quadrant

C. Thrid quadrant

D. Fourth quadrant

Answer: A

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19. if z= 4-9i then $z\bar{z}$ is

A. -92

B. -97

C. 92

D. 97

Answer: D

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20. The conjugate of $\frac{(1+2i)^2}{3-i}$ is

A. $\frac{-13}{10}+\frac{9}{10}i$

B. $\frac{-13}{10}-\frac{9}{10}i$

C. $\frac{13}{10}+\frac{9}{10}i$

D. $\frac{13}{10}-\frac{9}{10}i$

Answer: B

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21. $\frac{3-\sqrt{-16}}{1-\sqrt{-25}}$ is equal to

A. $\frac{-1}{24}$

B. 0

C. $\frac{23}{26}+\frac{11}{26}i$

D. 23+5i

Answer: C

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22. If $z_1 = 1 + i$ and $z_2 = -3 + 2i$ then $lm\left(\frac{z_1 z_2}{\bar{z}_1}\right)$ is

A. 2

B. -3

C. 3

D. -2

Answer: B

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23. The multiplicative inverse of $\left(3 + \sqrt{5}i\right)^2$ is

A. $\frac{1}{49} - \frac{3\sqrt{5}}{98}i$

B. $\frac{1}{49}+\frac{3\sqrt{5}}{98}i$

C. $4+6\sqrt{5}i$

D. $4-6\sqrt{5}i$

Answer: A

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24. if $z=3+i+9i^2-6i^3 \text{ then } \left(\overline{z^{-1}}\right)$ is

A. 2+i

B. $-\frac{3}{79}+\frac{4}{79}i$

C. $1-i$

D. $-\frac{6}{85}+\frac{7}{85}i$

Answer: D

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25. The conjugate of the complex number represented by the point (6-5) is

A. $6 - 5i$

B. $6 + 5i$

C. $-6 + 5i$

D. $-6 - 5i$

Answer: B

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26. if $z_1 = 3 + i \text{ and } z_2 = 2 - i, \text{ then} \left|\frac{z_1 + z_2 - 1}{z_1 - z_2 + i}\right|$ is

A. $\frac{\sqrt{8}}{5}$

B. $\sqrt{\frac{8}{5}}$

C. $\frac{8}{5}$

D. $\frac{8}{\sqrt{5}}$

Answer: A

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27. The modulus of $\frac{(2+3i)^2}{2+i}$ is

A. $\frac{\sqrt{13}}{5}$

B. $\frac{\sqrt{147}}{5}$

C. $\frac{13}{\sqrt{5}}$

D. $\frac{\sqrt{185}}{5}$

Answer: C

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28. The value of $(1+i)(1-i^2)(1+i^4)(1-i^5)$ is

A. 2i

B. 8

C. -8

D. 8i

Answer: B

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29. If $z = \dfrac{1}{(1+i)(1-2i)}$, then |z| is

A. $\dfrac{2}{10}$

B. $\dfrac{\sqrt{7}}{10}$

C. $\dfrac{9}{\sqrt{10}}$

D. $\dfrac{1}{\sqrt{10}}$

Answer: D

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30. The value of $\left|\frac{1}{2+i}-\frac{1}{2-i}\right|$ is

A. $-\frac{2}{5}$

B. $\frac{4}{25}$

C. $\frac{2}{5}$

D. 0

Answer: C

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31. Find the value of

tan 22.5°

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32. $(4+3i)+(7-4i)-(3+5i)+i^{25}$ is equal to

A. 2+7i

B. 4+7i

C. $8 - 5i$

D. $-8 + 2i$

Answer: C

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33. The conjugate of $\sqrt{-5} + 3^2$ is

A. $9 - \sqrt{5}i$

B. $9 + \sqrt{5}i$

C. $-9 + \sqrt{5}i$

D. $-9 - \sqrt{5}i$

Answer: A

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34. The modulus of $i^{25} + (i+2)^3$ is

A. $\sqrt{47}$

B. $4\sqrt{15}$

C. $\sqrt{35}$

D. $2\sqrt{37}$

Answer: D

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35. If z = a+ib is a complex numbers, then

A. $Re(z) = z + \bar{z}$

B. $Re(z) = \frac{z\bar{z}}{2}$

C. $Re(z) = \frac{z - \bar{z}}{2}$

D. $Re(z) = \frac{z + \bar{z}}{2}$

Answer: D

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36. The modulus of the complex number z =a +ib is

A. $z.\ \bar{z}$

B. a+b

C. $a^2 + b^2$

D. $\sqrt{z.\ \bar{z}}$

Answer: D

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37. The argument of the complex number $(1 + i)^4$ is

A. 135°

B. 180°

C. 90°

D. 45°

Answer: C

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38. The amplitude of $\frac{1}{i}$ is equal to 0 b. $\frac{\pi}{2}$ c. $-\frac{\pi}{2}$ d. π

A. 0

B. $\frac{\pi}{2}$

C. $-\frac{\pi}{2}$

D. π

Answer: D

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39. Find the value of $\cos 75^{\circ}$

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40. If $z = \dfrac{-4 + 2\sqrt{3}i}{5 + \sqrt{3}i}$, then the value of $arg(z)$ is

A. π

B. $\dfrac{\pi}{3}$

C. $\dfrac{2\pi}{3}$

D. $\dfrac{\pi}{4}$

Answer: C

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41. if $z = \cos\dfrac{\pi}{4} + i\sin\dfrac{\pi}{6}$ then

A. $|z| = 1, arg(z) = \frac{\pi}{4}$

B. $|z| = 1, arg(z) = \frac{\pi}{6}$

C. $|z| = \frac{\sqrt{3}}{2}, arg(z) = \frac{5\pi}{24}$

D. $|z| = \frac{\sqrt{3}}{2}, arg(z) = \frac{\tan^{-1} 1}{\sqrt{2}}$

Answer: D

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42. The square root of -8i is

A. $\pm 2(1 - i)$

B. $2(1 + i)$

C. $\pm (1 - i)$

D. $\pm (1 + i)$

Answer: A

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43. Find the square root of the following complex numbers

$3+4i$

A. $\pm(2-i)$

B. $\pm(2+i)$

C. $\pm(3+i)$

D. $\pm(3-i)$

Answer: B

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44. If $\alpha \: and \: \beta$ are the roots of $4x^2=3x+7=0$ then the value of $\frac{1}{\alpha}=\frac{1}{\beta}$ is $\frac{4}{7}$ b. $-\frac{3}{7}$ c. $\frac{3}{7}$ d. $-\frac{3}{4}$

A. $\frac{4}{7}$

B. $-\frac{3}{7}$

C. $\frac{3}{7}$

D. $-\frac{3}{4}$

Answer: B

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45. If $a, \ b$ are the roots of the equation `x^2+x+1=0', then' a^2+b^2'=

a)1 b)2 c)-1 d)3

A. 1

B. 2

C. `-1`

D. 3

Answer: C

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46. if the difference of the roots of the equation $x^2 - px + q = 0$ is unity.

A. $p^2 + 4q = 1$

B. $p^2 - 4q = 1$

C. $p^2 - 4q^2 = (1 + 2q)^2$

D. $4p^2 + q^2 = (1 + 2p)^2$

Answer: B

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47. If α and β are the roots of the equation $x^2 - px + 16 = 0$, such that $\alpha^2 + \beta^2 = 9$, then the value of p is

A. $\pm\sqrt{6}$

B. $\pm\sqrt{41}$

C. ± 8

D. ± 7

Answer: B

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Assignment (Section -B) (objective Type Questions (one option is correct)

1. The solution of the equation $z\left(\overline{z-3i}\right) = 2(2+3i)$ is/are

A. $2+i, 3-2i$

B. $2+2i, 3i$

C. $3+2i, 2i$

D. $2, 2+3i$

Answer: D

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2. If $f(x) = x^4 - 8x^3 + 4x^2 + 4x + 39$ and $f(3+2i) = a + ib$ then $a : b$ is equal to

A. $\frac{1}{8}$

B. $-\frac{1}{4}$

C. $\frac{1}{4}$

D. $-\frac{1}{8}$

Answer: D

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3. If center of a regular hexagon is at the origin and one of the vertices on the Argand diagram is $1 + 2i$, then its perimeter is $2\sqrt{5}$ b. $6\sqrt{2}$ c. $4\sqrt{5}$ d. $6\sqrt{5}$

A. $6\sqrt{5}$

B. $4\sqrt{5}$

C. $6\sqrt{2}$

D. $2\sqrt{5}$

Answer: A

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4. The sum of principal arguments of complex numbers $1+i,\ -1+i\sqrt{3},\ -\sqrt{3}-i,\ \sqrt{3}-i,\ i,\ -3i,\ 2,\ -1$is

A. $\dfrac{11\pi}{12}$

B. $\dfrac{13\pi}{12}$

C. $\dfrac{12\pi}{13}$

D. $\dfrac{\pi}{15}$

Answer: A

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5. If $z=\dfrac{\cos\pi}{4}+i\dfrac{\sin\pi}{6}$, then $|z|=1, arg(z)=\dfrac{\pi}{4}$ b. $|z|=1, arg(z)=\dfrac{\pi}{6}$ c. $|z|=\dfrac{\sqrt{3}}{2}, arg(z)=\dfrac{25\pi}{24}$ d.

$|z| = \frac{\sqrt{3}}{2}, arg(z) = \frac{\tan^{-1} 1}{\sqrt{2}}$

A. $|z| = 1, arg(z) = \frac{\pi}{4}$

B. $|z| = 1, arg|z| = \frac{\pi}{6}$

C. $|z| = \frac{\sqrt{3}}{2}, argz = \frac{5\pi}{24}$

D. $|z| = \frac{\sqrt{3}}{2}, argz = \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$

Answer: D

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6. Represent the complex numbers $\frac{1 + 7i}{(2 - i)^2}$ in polar form

A. $\sqrt{2}\left(\cos (3pi)/4\text{-}i\sin\frac{3\pi}{4}\right)$

B. $\sqrt{2}\left(\cos (3pi)/4 + i\sin\frac{3\pi}{4}\right)$

C. $\sqrt{2}\left(\cos (7pi)/4 + i\sin\frac{7\pi}{4}\right)$

D. $\sqrt{2}\left(\cos (7pi)/4\text{-}i\sin\frac{7\pi}{4}\right)$

Answer: B

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7. In any ΔABC, if

$\cos\theta = \frac{a}{b+c}, \cos\phi = \frac{b}{a+c}, \cos\Psi = \frac{c}{a+b}$ where θ, ϕ and Ψ lie between 0 and π, prive that

$$\tan^2\frac{\theta}{2} + \tan^2\frac{\phi}{2} + \tan^2\frac{\Psi}{2} = 1$$

A. 3

B. $-\frac{3}{2}$

C. 0

D. $\frac{3}{2}$

Answer: C

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8. The value of $(i+\sqrt{3})^{100}+(i-\sqrt{3})^{100}+2^{100}$ is

A. 1

B. -1

C. 0

D. 2

Answer: C

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9. Which of the following is not true ?

A. The number whose conjugate is $\frac{1}{1-i} is \frac{1}{1+i}$

B. if $\sin x+i\cos 2x$ and $\cos x-i\sin 2x$ are conjugate to each other then number of values of x is zero

C. if x+ 1+iy and 2 + 3i are conjugate of each other then the value of x + y is -2.

D. $2 + I > 3 + i$

Answer: D

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10. The complex numbers z_1, z_2 and z_3 satisfying $\frac{z_1 - z_3}{z_2 - z_3} = \frac{1 - i\sqrt{3}}{2}$ are the vertices of triangle which is (1) of area zero (2) right angled isosceles(3) equilateral (4) obtuse angled isosceles

A. Of area zero

B. Right angled isosceles

C. Equilateral

D. Obtuse angle isosceles

Answer: C

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11. Let $a = i^i$ and consider the following statements $S_1 : a = e^{-\frac{\pi}{2}}$, S_2:The value of $\sin(Ina) - 1$, $Im(a) + arg(a) = 0$ Now identify the correct combination of the true statements.

A. S_1, S_2 only

B. S_1, S_3 only

C. S_1, S_2, S_3

D. S_1 only

Answer: C

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12. If $z^2 + z + 1 = 0$ then the value of

$$\left(z + \frac{1}{z}\right)^2 + \left(z^2 + \frac{1}{z^2}\right)^2 + \left(z^3 + \frac{1}{z^3}\right)^2 + ... + \left(z^{21} + \frac{1}{z^{21}}\right)^2$$ is

equal to

A. 21

B. 42

C. 0

D. 11

Answer: B

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13. If ω is an imaginary fifth root of unity, then find the value of $loe_2\left|1+\omega+\omega^2+\omega^3-1/\omega\right|.$

A. 2

B. 0

C. 2

D. -1

Answer: A

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14. If $1, \alpha_1, \alpha_2, \alpha_3, \ldots\ldots\ldots, \alpha_{3n}$ be the roots of the eqution $x^{3n+1} - 1 = 0$, and w be an imaginary cube root of unity, then $\frac{(w^2-\alpha_1)(w^2-\alpha_2)\ldots.(w^{3n}-\alpha_{3n})}{(w-\alpha_1)(w2-\alpha)\ldots.(w-\alpha_{3n})}$

A. ω

B. $-\omega$

C. 1

D. ω^2

Answer: C

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15. If z_1, z_2, z_3, z_4 are two pairs of conjugate complex numbers, then $arg\left(\frac{z_1}{z_3}\right) + arg\left(\frac{z_2}{z_4}\right)$ is

A. 0

B. $\frac{\pi}{2}$

C. $\frac{3\pi}{4}$

D. π

Answer: A

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16. If $|z - 4 + 3i| \leq 2$ then the least and the greatest values of |z| are q

A. 3,7

B. 4,7

C. 3,9

D. 4,5

Answer: A

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17. If $|z_1| = 2, |z_2| = 3, |z_3| = 4$ and $|2z_1 + 3z_2 + 4z_3| = 4$ then the expression $|8z_2z_3 + 27z_3z_1 + 64z_1z_2|$ equals (A) 72 (B) 24 (C) 96 (D) 92

A. 72

B. 24

C. 96

D. 92

Answer: C

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18. If $z_1 = \cos\theta + i\sin\theta$ and $1, z_1, (z_1)^2, (z_1)^3, \ldots.., (z_1)^{n-1}$ are vertices of a regular polygon such that $\frac{Im(z_1)^2}{ReZ_1} = \frac{\sqrt{5}-1}{2}$, then the value n is

A. (a)20

B. (b)10

C. (c)18

D. (d)15

Answer: A

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19. The area of the triangle whose vertices are represented by the complex numbers O,z and `iz 'where z is (cos alpha + i sin alpha) is equial to -

A. $\frac{1}{2}|z|^2 \cos\theta$

B. $\frac{1}{2}|z|^2 \sin\alpha$

C. $\frac{1}{2}|z|^2 \sin\alpha\cos\alpha$

D. $\frac{1}{2}|z|^2$

Answer: B

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20. The maximum value of |z| where z satisfies the condition $\left|z+\left(\frac{2}{z}\right)\right|=2$ is

A. $\sqrt{3}-1$

B. $\sqrt{3}+1$

C. $\sqrt{3}$

D. $\sqrt{2}+\sqrt{3}$

Answer: B

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21. The value of $\frac{1-\tan^2 15^\circ}{1+\tan^2 15^\circ}$ is

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22. Both the roots of the equation $(x-b)(x-c)+(x-a)(x-c)+(x-a)(x-b)=0$ are always a. positive b. real c. negative d. none of these

A. $a+b\omega+c\omega^2=0$

B. $a+b\omega^2+c\omega=0$

C. $a^2+b^2+c^2-ab-bc-ca=0$

D. a+b+c=0

Answer: D

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23. If log $\sqrt{3}\left(\frac{|z|^2-|z|+1}{2+|z|}\right)>2$, then the locus of z is

A. |z|=5

B. |z|lt 5

C. |z| gt5

D. |z|=0

Answer: B

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24. If $arg z = \frac{\pi}{4}$,then

A. $Re(z^2) = 9lm(z^2)$

B. $lm(z^2 = 0$

C. $Re(z^2) = 0$

D. $Re(z) = 0$

Answer: C

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25. If $z^2 + z|z| + |z^2| = 0,$ then the locus z is a. a circle b. a straight line c. a pair of straight line d. none of these

A. Circle

B. Straight line

C. A pair of straight lines

D. None of these

Answer: C

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26. The least value of p for which the two curves $arg z = \frac{\pi}{6}$ and $|z - 2\sqrt{3}i| = p$ intersect is

A. $p = \sqrt{3}$

B. p=3

C. $p = \frac{1}{\sqrt{3}}$

D. $P = \frac{1}{3}$

Answer: B

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27. $Re\left(\frac{z+4}{2z-1}\right) = \frac{1}{2}$, then z is represented by a point lying on

A. A circle

B. An ellipse

C. A straight line

D. No real locus

Answer: C

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28. If $f(x)$ and $g(x)$ are two polynomials such that the polynomial $h(x) = xf(x^3) + x^2g(x^6)$ is divisible by $x^2 + x + 1$, then $f(1) = g(1)$ (b) $f(1) = 1g(1)$ $h(1) = 0$ (d) all of these

A. f(1)+g(1)=1

B. f(1)=-g(1)

C. f(1)=g(1) $\neq$ 0

D. $f(1) = \pm g(1)$

Answer: B

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29. If $\omega(\neq 1)$ is a cube root of unity, then $(1 - \omega + \omega^2)(1 - \omega^2 + \omega^4)(1 - \omega^4 + \omega^8)$...upto $2n$ is factors, is

A. $(x - 1)^{2n}$

B. $(x - 1)^{2n+1}$

C. $(x-1)^{2n-1}$

D. $(X-1)^{2n+2}$

Answer: A

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30. If $z=\frac{\sqrt{3}-i}{2}$, where $i=\sqrt{-1}$, then $\left(i^{101}+z^{101}\right)^{103}$ equals to

A. iz

B. z

C. $\bar{z}$

D. ωz, (ω is complex cube root of unity)

Answer: B

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31. The region of the complex plane for which $\left|\frac{z-a}{z+\vec{a}}\right| = 1, (Re(a) \neq 0)$ is

A. x-axis

B. y-axis

C. Straight line x=a

D. The straight line y=a

Answer: B

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32. If the imaginary part of $\frac{2z+1}{iz+1}$ is -2 , then show that the locus of the point respresenting z in the argand plane is a straight line.

A. A circle

B. A straight line

C. A parabola

D. An ellispse

Answer: B

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33. In z is a complex number stisfying |2008z-1|= 2008|z-2|, then locus z is

A. y-axis

B. x-axis

C. Cricle

D. A line parallel to y-axis

Answer: D

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34. The locus of the points z satisfying the condition arg $\left(\frac{z-1}{z+1}\right)=\frac{\pi}{3}$ is, a

A. A straight line

B. Circle

C. A parabola

D. Ellipse

Answer: B

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35. the locus of $z=i+2\exp\left(i\left(\theta+\frac{\pi}{4}\right)\right)$ is

A. A circle

B. An ellipse

C. A parabola

D. A hyperbola

Answer: A

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36. If one vertex and centre of a square are z and origin then which of the following cannot be the vertex of the square ?

A. iz

B. $-z$

C. $-iz$

D. 2z

Answer: D

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37. if the complex no z_1, z_2 and z_3 represents the vertices of an equilateral triangle such that $|z_1| = |z_2| = |z_3|$ then relation among z_1, z_2 and z_3

A. $z_1 + z_2 = z_3$

B. $z_1 + z_2 + z_3 = 0$

C. $z_1 z_2 = \frac{1}{z_3}$

D. $z_1 - z_2 = z_3 - z_2$

Answer: B

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38. If $|z - 2 - 3i| + |z + 2 - 6i| = 4$where $i = \sqrt{-1}$, then locus of P (z) is

A. An ellipse

B. A point

C. Segment joining the points (2 +3i) and (-2+6i)

D. Empty

Answer: D

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39. If z_1, z_2, z_3 and u,v,w are complex numbers representing the vertices of two triangles such that $z_3 = (1-t)z_1 + tz_2$ and $w = (1-u)u + tv$, where t is a complex number, then the two triangles

A. Have the same area

B. Are similar

C. Are congruent

D. Are equilateral

Answer: B

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40. If $|z-25i| \leq 15$. then $|\text{maximum } arg(z) - \text{minimum } arg(z)|$ equals

A. $\sin^{-1}\left(\frac{3}{5}\right) - \cos^{-1}\left(\frac{3}{5}\right)$

B. $\frac{\pi}{2} + \cos^{-1}\left(\frac{3}{5}\right)$

C. 2cos^(-1)(4/5)`

D. $\cos^{-1}\left(\frac{3}{5}\right)$

Answer: C

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41. For two complex numbers z_1 and z_2, we have $\left|\frac{z_1 - z_2}{1 - \bar{z}_1 z_2}\right| = 1$, then

A. both z_1 and z_2 lie on circle |z|=1

B. $arg\left(\frac{z_1}{z_2}\right) = \frac{\pi}{3}$

C. At least one of z_1 and z_2 lies on the circle |z|=1

D. $|z_1| = 2|z_2|$

Answer: A

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42. Let $\alpha, \text{ and } \beta$ are the roots of the equation $x^2 + x + 1 = 0$ then

A. $\alpha^2 + \beta^2 = 4$

B. $(\alpha - \beta)^2 = 3$

C. $\alpha^3 + \beta^3 = 2$

D. $\alpha^4 + \beta^4 = 1$

Answer: C

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43. If the ratio of the roots of the equation $lx^2 + nx + n = 0$ is $p : q$ prove that $\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}} + \sqrt{\frac{n}{l}} = 0$

A. $\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}} + \sqrt{\frac{n}{1}} = 1$

B. $\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}} + \sqrt{\frac{n}{l}} = 0$

C. $\sqrt{\frac{q}{p}} + \sqrt{\frac{p}{q}} + \sqrt{\frac{l}{n}} = 1$

D. $\sqrt{\frac{q}{p}} + \sqrt{\frac{p}{q}} + \sqrt{\frac{l}{n}} = 0$

Answer: B

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44. For the equation $|x^2| + |x| - 6 = 0$, the roots are

A. Real and equal

B. Real with sum 0

C. Real with sum 1

D. Real with product 0

Answer: B

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45. If $a+b+c=0$ and a, b, c are rational. Prove that the roots of the equation

$(b+c-a)x^2+(c+a-b)x+(a+b-c)=0$ are rational.

A. Rational

B. Irrational

C. Imaginary

D. Equal

Answer: A

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46. If $\sec\alpha$, $\tan\alpha$ are roots of $ax^2+bx+c=0$, then

A. $a^4-b^4+4ab^2c=0$

B. $a^4+b^4-4ab^2c=0$

C. $a^2-b^2=4ac$

D. $a^2+b^2=ac$

Answer: A

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47. If x is real then the values of $\dfrac{x^2+34x-71}{x^2+2x-7}$ does not lie in the interval

A. Lies between 4 and 7

B. Lies between 5 and 9

C. Has no value between 4 and 7

D. Has no value between 5 and 9

Answer: D

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48. if $\alpha \& \beta$are the roots of the quadratic equation $ax^2+bx+c=0$, then the quadratic equation $ax^2-bx(x-1)+c(x-1)^2=0$ has roots

A. $\frac{\alpha}{1-\alpha}, \frac{\beta}{1-\beta}$

B. $\frac{1-\alpha}{\alpha}, \frac{1-\beta}{\beta}$

C. $\frac{\alpha}{1+\alpha}$, beta/(1+beta)

D. $\frac{1+\alpha}{\alpha}, \frac{1+\beta}{\beta}$

Answer: C

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49. let α, β be roots of $ax^2+bx+c=0$ and γ, δ be the roots of $px^2+qx+r=0$and D_1 and D_2 be the respective equations .if $\alpha, \beta, \gamma, \delta$ in $A.P.$ then $\frac{D_1}{D_2}$ is

A. $\frac{a^2}{b^2}$

B. $\frac{a^2}{p^2}$

C. $\frac{b^2}{q^2}$

D. $\frac{c^2}{r^2}$

Answer: B

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50. The equation

$$\frac{a(x-b)(x-c)}{(a-b)(a-c)}+\frac{b(x-c)(x-a)}{(b-c)(b-a)}+\frac{c(x-a)(x-b)}{(c-a)(c-b)}=x$$ is

satisfied by

A. No value of x .

B. Exactly two values of x.

C. Exactly three values of x.

D. All values of x

Answer: D

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51. If $z_1 = 3 - 2i$, $z_2 = 2 - i$ and $z_3 = 2 + 5i$then find $z_1 + z_2 - 3z_3$

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52. If the equation $(k^2 - 3k + 2)x^2 + (k^2 - 5k + 4)x + (k^2 - 6k + 5) = 0$ is an identity then the value of k is

A. 1

B. 2

C. 3

D. 4

Answer: A

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53. The value of k if

A. The roots of $5x^2 + 13x + k = 0$ are let say a and b and they are reciprocal to each other is 5.

B. The roots of $x^2 + x + k = 0$ are consecutive integer is 1.

C. The roots of $x^2 - 6x + k = 0$ are in the ratio 2 : 1 is 7.

D. The roots of the equation $x^2 + kx - 1 = 0$ are real, equal in magnitude but opposite in sign is 1.

Answer: A

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54. if the difference of the roots of the equation $x^2 + ax + b = 0$ is equal to the difference of the roots of the equation $x^2 + bx + a = 0$,then

A. a + b =4

B. a = b = - 4

C. a -b = 4

D. a -b = - 4

Answer: B

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55. If the equations $px^2 + 2qx + r = 0$ and $px^2 + 2rx + q = 0$ have a common root then $p + q + 4r =$

A. 0

B. 1

C. 2

D. -2

Answer: A

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56. If the equations $ax^2 + bx + c = 0$ and $x^2 + x + 1 = 0$ has one common root then $a : b : c$ is equal to

A. $1 : 1 : 1$

B. $1 : 2 : 3$

C. $2 : 3 : 1$

D. $3 : 2 : 1$

Answer: A

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57. If 1,2,3 are the roots of the equation $x^3 + ax^2 + bx + c = 0$, then

A. a=1, b=2, c=3

B. a= -6,b =11 , c= - 6

C. a = 6, b=11, c= 6

D. a=6, b= 6 , c= 6

Answer: B

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58. Consider that $f(x) = ax^2 + bx + c, D = b^2 - 4ac$, then which of the following is not true ?

A. If $a > 0$ then minimum value of f(x) is $\frac{-D}{4a}$

B. If $a < 0$, then maximum value of f(x) is $\frac{-D}{4a}$

C. if $a > 0, D < 0$, then $f(x) > 0$ for all x $\in$ R

D. If $a > 0, D > 0$, then $f(x) > 0$ for alll $x \in R$

Answer: D

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59. If the minimum value of$x^2 + 2x + 3$ is m and maximum value of $-x^2 + 4x + 6$ is M then $m + M =$

A. 10

B. 11

C. 12

D. 13

Answer: C

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60. for all $x \in R$ if $mx^2 - 9mx + 5m + 1 > 0$ then m lies in the interval

A. $\left(-\frac{61}{4}, 0\right)$

B. $\left(\frac{4}{61}, \frac{61}{4}\right)$

C. $\left(0, \frac{4}{61}\right)$

D. $\left(\frac{-4}{61}, 0\right)$

Answer: C

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61. If one root of equation $(l - m)x^2 + lx + 1$ = 0 be double of the other and if l be real, show that $m \leq \frac{9}{8}$

A. $\frac{9}{8}$

B. $\frac{7}{8}$

C. $\frac{8}{9}$

D. $\frac{5}{9}$

Answer: A

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62. if p,q,r are real numbers satisfying the condition p + q +r =0 , then the roots of the quadratic equation $3px^2 + 5qx + 7r = 0$ are

A. positive

B. negative

C. Real and distinct

D. Imaginary

Answer: C

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63. The roots of the equation $x^3 - 2x^2 - x + 2 = 0$ are

A. 1,2,3

B. $-1, 1, 2$

C. $-1, 0, 1$

D. $-1, -2, 3$

Answer: B

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64. IF α, β are the roots of the equation $x^2 + 2ax + b = 0$, then the quadratic equation with rational coefficient one of whose roots is $\alpha + \beta + \sqrt{\alpha^2 + \beta^2}$ is

A. $x^2 + 4ax - 2b = 0$

B. $x^2 + 4ax + 2b = 0$

C. $x^2 - 4ax + 2b = 0$

D. $x^2 - 4ax - 2b = 0$

Answer: B

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65. The set of all values of $'a'$ for which the quadratic equation $3x^2 + 2(a^2 - 3a + 2) = 0$ possess roots of opposite sign, is

a.$(- \infty, 1)$ b. $(- \infty, 0)$ c. $(1, 2)$ d. $(3/2, 2)$

A. $1 < a < 2$

B. $a \in (2, \infty)$

C. $1 < a < 3$

D. $-1 < a < 0$

Answer: A

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66. Let $a, b, c \in R$ and $a \neq 0$ be such that $(a+c)^2 < b^2$,then the quadratic equation $ax^2 + bx + c = 0$ has

A. Imaginary roots

B. Real roots

C. Exactly one real root lying in the interval (-1,1)

D. Exactly two roots in (-1,1)

Answer: C

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67. If p + iq be one of the roots of the equation $x^3 + ax + b = 0$,then 2p is one of the roots of the equation

A. $x^3 + ax + b = 0$

B. $x^3 - ax - b = 0$

C. $x^3 + ax - b = 0$

D. $x^3 + bx + a = 0$

Answer: C

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68. If

$a_1, a_2, a_3, a_4, , \ldots\ldots, a_{n-1}, a_n$ are distinct non-zero real numbers such th
$+ \left(a_2^2 + a_3^2 + a_4^2 + \ldots\ldots + a_n^2\right) \leq 0$ then $a_1, a_2, a_3, \ldots\ldots, a_{n-1}, a_n$
are in

A. A.P.

B. G.P.

C. H.P.

D. A.G.P.

Answer: B

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69. If coefficients of the equation $ax^2 + bx + c = 0$, $a \neq 0$ are real and roots of the equation are non-real complex and $a + c < b$, then

A. $4a + c > 2b$

B. $4a + c < 2b$

C. $4a + c = 2b$

D. None of these

Answer: B

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70. If the sum of the roots of the quadratic equaion $ax^2 + bx + c = 0$ is equal to the sum of the squares of their reciprocals then prove that $\frac{a}{c}, \frac{b}{a}$ and $\frac{c}{b}$ are in HP

A. A.P.

B. G.P.

C. H.P.

D. None of these

Answer: C

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71. The number of irrational roots of the equation

$(x-1)(x-2)(3x-2)(3x+1)=21$ is

A. 0

B. 2

C. 3

D. 4

Answer: B

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72. If $\alpha \in \left(0, \frac{\pi}{2}\right)$, $then \sqrt{x^2 + x} + \frac{\tan^2 \alpha}{\sqrt{x^2 + x}}$ is always greater than or equal to $2 \tan \alpha \ 1 \ 2 \sec^2 \alpha$

A. S_1 only

B. S_2 only

C. S_3 only

D. S_1, S_2, S_3, S_4

Answer: D

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73. If a,b are real, then the roots of the quadratic equation $(a - b)x^2 - 5(a + b)x - 2(a - b) = 0$ are

A. Real and equal

B. Non-real complex

C. Real and unequal

D. None of these

Answer: C

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74. If α, β are the roots of the equation $ax^2 - bx + c = 0$ then equation $(a + cy)^2 = b^2 y$ has the roots

A. $\frac{1}{\alpha}, \frac{1}{\beta}$

B. α^2, β^2

C. $\frac{\alpha}{\beta}, \frac{\beta}{\alpha}$

D. $\frac{1}{\alpha^2}, \frac{1}{\beta^2}$

Answer: D

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75. If a, b, c are in GP, show that the equations $ax^2 + 2bx + c = 0$ and $dx^2 + 2ex + f = 0$ have a common root if $\frac{a}{d}, \frac{b}{e}, \frac{c}{f}$ are in HP

A. A.P.

B. G.P.

C. H.P.

D. ab = cd

Answer: A

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76. Find the least integral value of k for which the equation $x^2 - 2(k+2)x + 12 + k^2 = 0$ has two different real roots.

A. 0

B. 2

C. 3

D. 4

Answer: C

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77. The roots x_1 and x_2 of the equation $x^2 + px + 12 = 0$ are such that their differences is 1. then the positive value of p is

A. 1

B. 2

C. 3

D. 7

Answer: D

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78. If $a < b < c < d$, then for any real non-zero λ, the quadratic equation $(x-a)(x-c)+\lambda(x-b)(x-d)=0$,has real roots for

A. All roots real and distinct

B. All roots but not necessarily distinct

C. All root and negative

D. May be imaginary

Answer: A

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Assignment (Section -C) (objective Type Questions (more thena one options are correct)

1. If |3z-1|=3|z-2|, then z lies on

A. 6Re(z) =7

B. On the perpendicular bisector of line joining $\left(\frac{1}{3}, 0\right)$ and $(2, 0)$

C. A line parallel to x-axis

D. A line parallel to y-axis

Answer: A::B::D

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2. If $S=\sum_{k=1}^{10}\left(\sin\frac{2\pi k}{11}+i\cos\frac{2\pi k}{11}\right)$ then

A. $S+\overline{S}=0$

B. $S\overline{S}=1$

C. $\sqrt{S}=\pm\frac{1}{\sqrt{2}}(1+i)$

D. $S-\overline{S}=0$

Answer: A::B::C

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3. Let $\cos A+\cos B+\cos C=0$ and $\sin A+\sin B+\sin C=0$ then which of the following statement(s) is/are correct?

A. `sum cos (2A -B-C) =1

B. $\sum\cos(2A-B-C)=0$

C. $\sum\sin(2A-B-C)=0$

D. $\sum(2A-B-C)=3$

Answer: A::C

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4. The equation whose roots are nth power of the roots of the equation, $x^2-2x\cos\phi+1=0$ is given by

A. $(x+\cos n\phi)^2+\sin^2 n\phi=0$

B. $(x-\cos n\phi)^2+\sin^2 n\phi=0$

C. $X^2+2x\cos n\phi+1=0$

D. $x^2 - 2x\cos n\phi + 1 = 0$

Answer: B::D

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5. If $z(1+a) = b + icanda^2 + b^2 + c^2 = 1,$ then $[(1+iz)/(1-iz) = \frac{a+ib}{1+c}$ b. $\frac{b-ic}{1+a}$ c. $\frac{a+ic}{1+b}$ d. none of these

A. $\frac{b-ic}{1-ia}$

B. $\frac{a+ib}{1+c}$

C. $\frac{1-c}{a+ib}$

D. $\frac{1+a}{b+ic}$

Answer: B::C

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6. z_1, z_2, z_3, z_4 are distinct complex numbers representing the vertices of a quadrilateral $ABCD$ taken in order. If $z_1 - z_4 = z_2 - z_3$ and $\arg[(z_4 - z_1)/(z_2 - z_1)] = \pi/2$, the quadrilateral is

A. Rhombus

B. Square

C. Rectangle

D. A cyclic quadrilateral

Answer: C::D

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7. If α, β, γ are cube roots of $p < 0$, then for any x , y,z $\frac{\alpha^2 x^2 + \beta^2 y^2 + \gamma^2 z^2}{\beta^2 x^2 + \gamma^2 y^2 + \alpha^2 z^2}$ is

A. 1

B. $\frac{\alpha}{\gamma}$

C. $\frac{\beta}{\alpha}$

D. $\frac{\gamma}{\beta}$

Answer: B::C::D

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8. If z is a complex number satisfying $z + z^{-1} = 1$ then $z^n + z^{-n}, n \in N$, has the value

A. $2(-1)^n$ when n is a multiple of 3

B. $(-1)^{n-1}$, when n is not a multiple of 3

C. $(-1)^{n+1}$, when n is a mutliple of 3.

D. 0 when n is not a multiple of 3.

Answer: A::B

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9. If z satisfies $|z-1| < |z+3| \text{ then } \omega = 2z + 3 - i$ satisfies

A. $|\omega - 5 - i| < |\omega + 3 + i|$

B. $|\omega - 5| < |\omega + 3|$

C. $lm(i\omega) < 1$

D. $|arg(\omega - 1)| < \frac{\pi}{2}$

Answer: B::D

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10. If $|z+\omega|^2 = |z|^2 + |\omega|^2$, where z and ω are complex numbers , then

A. $\frac{z}{\omega}$ is purely real

B. $\frac{z}{\omega}$ is purely imaginary

C. $z\overline{\omega} + \overline{z}\omega = 0$

D. $amp\left(\frac{z}{\omega}\right) = \frac{\pi}{2}$

Answer: B::C::D

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11. Let z_1 and $z_2$be two complex numbers represented by points on circles $|z| = 1$ and $|z| = 2$ respectively, then

A. $\min |z_1 - z_2| = 1$

B. $\max |2z_1 + z_2| = 4$

C. $\left|z_2 + \frac{1}{z_1}\right| \leq 3$

D. $\min |z_1 - z_2| = 2$

Answer: A::B::C

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12. Let complex number z satisfy $\left|z - \frac{2}{z}\right| = 1$ then $|z|$ can take all values except

A. 1

B. 2

C. 3

D. 4

Answer: C::D

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13. If $z = x + iy$, then the equation $\left|\frac{2z - i}{z + 1}\right| = m$ does not represents a circle, when m is (a) $\frac{1}{2}$ (b). 1 (c). 2 (d). `3

A. $m = \frac{1}{2}$

B. m=1

C. m =2

D. m= 3

Answer: A::B::D

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14. If $\sqrt[3]{-1} = -1, -\omega, -\omega^2$, then roots of the equation $(x+1)^3 + 64 = 0$ are

A. $-1-4\omega$

B. $-1-4\omega^2$

C. -5

D. -4

Answer: A::B::C

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15. If $z_1 = p + iq$ and $z_2 = u = iv$ are complex numbers such that $|z_1| = |z_2| = 1$ and $Re(z_1, \bar{z}_2) = 0$ then the pair of complex number , $\omega_1 = p + iu$ and $\omega_2 = q + iv$ satisfies.

(1) $|\omega_1| = 1$ (2) $|\omega_2| = 1$

(3) $Re(\omega_1, \overline{\omega}_2) = 0$ (4) None of these

A. $|\omega_1| = 1$

B. $|\omega_2| = 1$

C. $Re(\omega_1\overline{\omega}_2) = 0$

D. $|\omega_1| = 2|\omega_2|$

Answer: A::B::C

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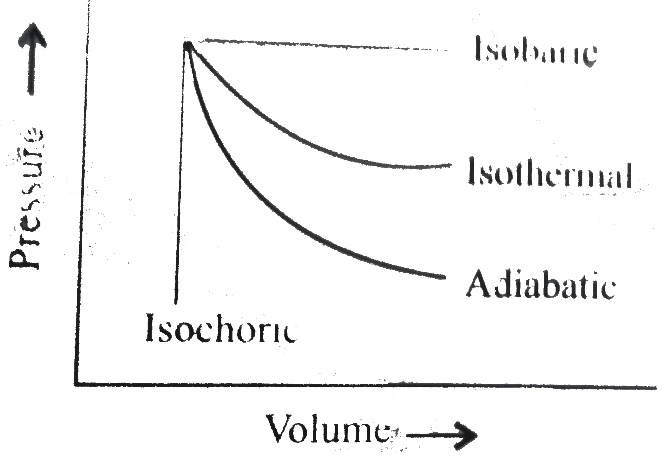
16. The pressure-volume of various thermodynamic process is shown in graphs:



Work is the mole of transference of energy. It has been observed that reversible work done by the system is the maximum obtainable work.

$w_{rev} > w_{irr}$

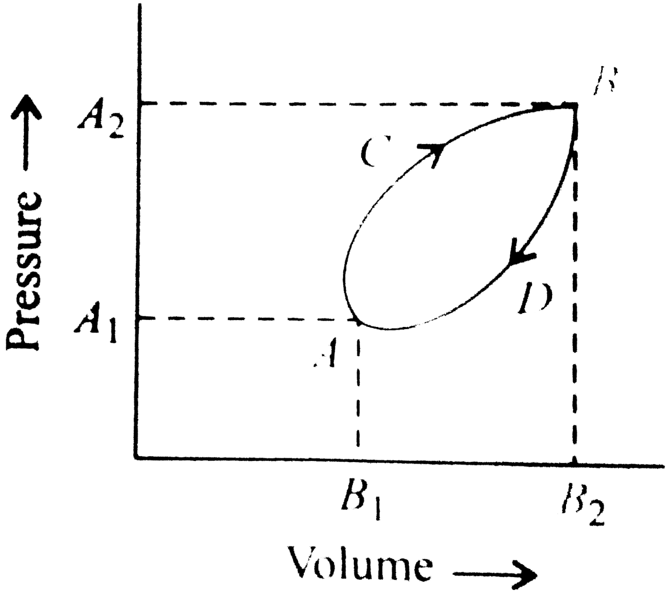
The works of isothermal and adiabatic processes are different from each other.

$$w_{\text{isothermal reversible}} = 2.303nRT\log_{10}\left(\frac{V_2}{V_1}\right)$$

$$= 2.303nRT\log_{10}\left(\frac{P_2}{P_1}\right)$$

$$w_{\text{adiabatic reversible}} = C_V(T_1 - T_2)$$

A thermodynamic system goes in a cyclic process as represented in the following $P - V$ diagram:



The net work done during the complete cycle is given by the area

A. |z|=5

B. |z|lt 5

C. |z| gt5

D. 2 lt |z| lt 3

Answer: B::D

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17. If z_1, z_2 be two complex numbers satisfying the equation $\left|\frac{z_1+z_2}{z_1-z_2}\right| = 1$, then

A. $z_1\bar{z} + z_2\bar{z}_1 = 1$

B. $\left(\frac{\bar{z}_1}{\bar{z}_2}\right) = -\frac{z_1}{z_2}$

C. $z_1\bar{z}_2 + z_2\bar{z}_1 = 0$

D. $Re(z_1\bar{z}_2) = 0$

Answer: B::C::D

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18. If $\sin\alpha, \cos\alpha$ are the roots of the equation $x^2 + bx + c = 0 (c \neq 0)$, then

A. $a^2 - b^2 + 2ac = 0$

B. $(a+c)^2 = b^2 + c^2$

C. $\frac{b}{a} \in |-\sqrt{2}, \sqrt{2}|$

D. $\frac{c}{a} \in \left[-\frac{1}{2}, \frac{1}{2}\right]$

Answer: A::B::C::D

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19. If α, β are the roots of the equation $ax^2 + 2bx + c = 0$ and $\alpha + h, \beta + h$ are the roots of the equation $Ax^2 + 2Bx + C = 0$ then

A. $h = \frac{b}{a} - \frac{B}{A}$

B. $\frac{b^2 - ac}{B^2 - AC} = \frac{a^2}{A^2}$

C. $h = \frac{Ac + aC}{A + a}$

D. $\frac{b^2 - aC}{B^2 - AC} = \frac{a}{A}$

Answer: A::B

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20. The solution set of the inequality $(x+3)^5-(x-1)^5 \geq 244$ is

A. $(-\infty, 2]$

B. $[0, \infty)$

C. $(-2, -1)$

D. (0,1)

Answer: A::B

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21. Let a,b,c be real numbers in G.P. such that a and c are positive , then the roots of the equation $ax^2+bx+c=0$

A. Are real and in the ratio b : ac

B. Are real

C. Are imaginary are in ration $1 : \omega$ is a non-real complex cubic root of constant

D. Are imaginary and are in the ration $\omega^2 : 1$ with usual notation

Answer: C::D

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22. Let $\cos\alpha$ be a root of the equation $25x^2 + 5x - 12 = 0 - 1 < x < 0$

,then the value of $\sin^2\alpha$ is

A. $\frac{20}{25}$

B. $-\frac{12}{25}$

C. $\frac{16}{25}$

D. $-\frac{24}{25}$

Answer: C

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23. If the quadratic equations $x^2 + pqx + r = 0$ and $z^2 + prx + q = 0$ have a common root then the equation containing their other roots is/are

A. $x^2 - p(q + r)x + p^2qr = 0$

B. $x^2p(q + r) + (q + r)x - pqr = 0$

C. $p(q + r)x^2 - (q + r)x + pqr = 0$

D. $x^2 + p(q + r)x - p^2qr = 0$

Answer: A::B

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24. The quadratic equation $x^2 - (m - 3)x + m = 0$ has

A. Real distinct roots if and only if m $\in (-\infty, 1) \cup (9, \infty)$

B. Both positive roots if and if and only if $m \in (9, \infty)$

C. Both negative roots if and only if $m \in (0, 1)$

D. No roots

Answer: A::B::C

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25. If both roots of the equation $x^2 - 2ax + a^2 - 1 = 0$ lie between -3 and 4 ,then [a] is/are , where [ ] represents the greatest ineger function

A. 1

B. -1

C. 2

D. 0

Answer: A::B::C::D

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26. Let

α, β the roots of $x^2 - 4x + A = 0$ and γ, δ be the roots of $x^2 - 36x +$

forms an increasing G.P. Then

A. B = 81A

B. A=3

C. B =243

D. A + B = 251

Answer: A::B::C

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27. For the equation $x^{\frac{3}{4}(\log x)^2 + \log_2 x - \frac{5}{4}} = \sqrt{2}$, which one of the following is true ?

A. Has at least one real solution

B. Has exactly three real solutions

C. Has exactly one irrational solutions

D. Has non-real complex roots

Answer: A::B::C

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28. If $f(x) = ax^2 + bx + c, g(x) = -ax^2 + bx + c$,where ac $\neq 0$, then prove that $f(x)g(x) = 0$ has at least two real roots.

A. At least three real roots

B. No real roots

C. At least two real roots

D. At most two imaginary roots

Answer: C::D

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29. Sum of the squares of all integral values of a for which the inequality $x^2 + ax + a^2 + 6a < 0$ is satisfied for all $x \in (1, 2)$ must be equal to

A. 90

B. 89

C. 80

D. 91

Answer: A::B::C

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30. If the roots of the equation $\frac{1}{x+p} + \frac{1}{x+q} = \frac{1}{r}$ are equal in magnitude but opposite in sign and its product is α

A. p + q =r

B. p +q =2r

C. $\alpha^2 = \frac{p^2 + q^2}{2}$

D. $\alpha = \frac{-p^2 + q^2}{2}$

Answer: B::C

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31. Find the integral values of a for which $(a+2)x^2 + 2(a+1)x + a = 0$ will have both roots integers

A. 0

B. -1

C. -2

D. -3

Answer: A::B::D

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32. If $(x-1)^2$ is a factor of ax^3+bx^2+c then roots of the equation $cx^3+bx+a=0$ may be

A. (a)1

B. (b)-1

C. (c)-2

D. (d)0

Answer: A::C

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33. If $b^2 \geq 4ac$ for the equation $ax^4+bx^2+c=0$ then all the roots of the equation will be real if

A. $b > 0, a < 0, c < 0$

B. $b > 0, a > 0, c > 0$

C. $b < 0, a > 0, c > 0$

D. $b > 0, a < 0, c < 0$

Answer: C::D

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34. If the difference between the roots of the equation $x^2 + ax + 1 = 0$ is less then $\sqrt{5}$, then find the set of possible value of a.

A. (-3,0)

B. (0,3)

C. (-3,3)

D. $(3, \infty)$

Answer: A::B::C

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35. The set of all real numbers a such that $a^2+2a, 2a+3, and a^2+3a+8$ are the sides of a triangle is_____

A. $\left(6, \frac{13}{2}\right)$

B. (5,7)

C. $(5, \infty)$

D. (0,5)

Answer: A::B::C

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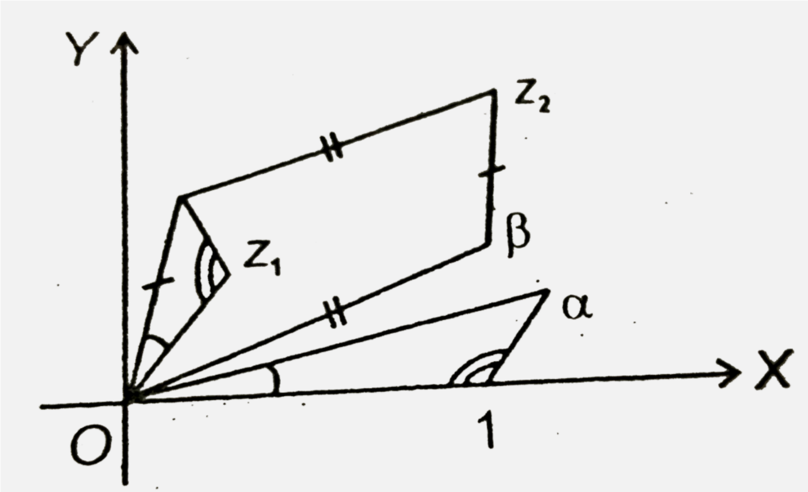
Assignment (Section -D) Linked comprehension Type Questions

1. Let z_1, α, β be complex numbers of which α and β constants and z_1 varies. If z_2 is given in terms of z_1 by one of the following equations, it is required to find z_2 corresponding to z_1 then

In the given figure



A. $z_2 = \alpha z_1 + \beta$

B. $z_2 = \frac{\alpha z_1}{\beta}$

C. $z_2 = \alpha \beta z_1$

D. $z_2 = \beta z_1$

Answer: D

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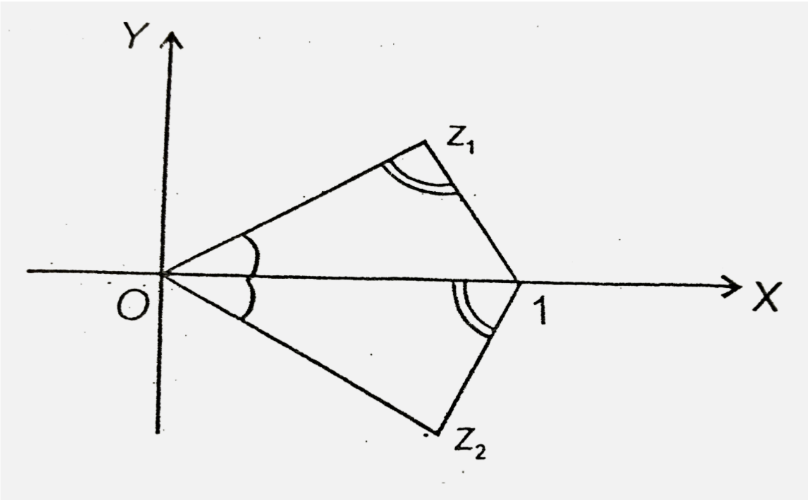
2. Let z_1, α, β be complex numbers of which α and β constants and z_1 varies. If z_2 is given in terms of z_1 by one of the following equations, it is required to find z_2 corresponding to z_1 then The given figure illustrates



A. $z_2 = 1 + z_1$

B. $z_2 = 2z_1$

C. $z_2 = \frac{1}{z_1}$

D. $z_2 = \frac{1}{z_1^2}$

Answer: C

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3. If x is the root of the equation $x^2 - ix - 1 = 0$, then

The value of x^{51} is

A. 1

B. -1

C. i

D. $-i$

Answer: C

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4. If x is the root of the equation $x^2 - ix - 1 = 0$, then

The value of $x^{20} + \frac{1}{x^{20}}$ may be

A. -1

B. 1

C. i

D. $-i$

Answer: A

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5. If x is the root of the equation $x^2 - ix - 1 = 0$, then $x^{2013} - \frac{1}{x^{2013}}$ may be

A. -1

B. 1

C. $-2i$

D. $-i$

Answer: C

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6. $(1+x)^n = a_0 + a_1x + a_2x^2 + \ldots\ldots + a_nx^n$ then

Find the sum of the series $a_0 + a_2 + a_4 + \ldots\ldots$

A. 2^n

B. 2^{n-1}

C. 2

D. 2^{n-2}

Answer: B

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7. The sum of the series $a_0 + a_4 + a_8 + a_{12} + \ldots\ldots$ is

A. $2^n \cos\frac{n\pi}{4}$

B. $2^{n-1} \cos\frac{n\pi}{4}$

C. $2^{n-1} \cos\frac{n\pi}{4}$

D. $2^{\frac{n}{2}} \cos\frac{n\pi}{4}$

Answer: D

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8. If $(1+x)^n = a_0 + a_1x + a_2x^2).....+a_nx^n$ The sum of the series $a_0 + a_4 + a_8 + a_{12} + ...$ is

A. $2^{n-1}\cos\frac{n\pi}{4}$

B. $2^{n-2} + 2^{\frac{n}{2}-1}\cos\frac{n\pi}{4}$

C. $2^{n-1} + 2^{\frac{n}{2}}\sin\frac{n\pi}{4}$

D. $2^{n-1}\sin\frac{n\pi}{4}$

Answer: B

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9. Let us consider an equation $f(x) = x^3 - 3x + k = 0$.then the values of k for which the equation has

Exactly one root which positive , then k belongs to

A. $(-\infty, -2)$

B. $(2, \infty)$

C. (0,2)

D. $(-2, 0)$

Answer: A

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10. Let us consider an equation $f(x) = x^3 - 3x + k = 0$.then the values of k for which the equation has

Exactly one root which is negative, then k belong

A. $(2, \infty)$

B. (0,2)

C. (-2,0)

D. $(-\infty, -2)$

Answer: A

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11. Let us consider an equation $f(x) = x^3 - 3x + k = 0$.then the values of k for which the equation has

One negative and two positive root if k belongs to

A. $(2, \infty)$

B. (0,2)

C. $(-2, 0)$

D. (2,3)

Answer: B

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12. Exactly two real roots, when k belongs to

A. $(-1, 1)$

B. $\left(-1, \frac{5}{4}\right)$

C. $(-\infty, -1) \cup \left(\frac{5}{4}, \infty\right)$

D. R

Answer: C

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13. The values of 'K' for which the equation $|x|^2\left(|x|^2-2k+1\right)=1-k^2$,

has No root, when k belongs to

A. $(-\infty, -1)$

B. (-1,1)

C. $\left(1, \frac{5}{4}\right)$

D. R

Answer: B

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14. Exactly two real roots, when k belongs to

A. {1,-1}

B. {0,1}

C. {0,-1}

D. {2,3}

Answer: A

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Assertion -Reason Type Questions

1. Statement-1 : let z_1 and z_2 be two complex numbers such that arg $(z_1) = \frac{\pi}{3}$ and $arg(z_2) = \frac{\pi}{6}$ then arg $(z_1 z_2) = \frac{\pi}{2}$

and

Statement -2 : $arg(z_1 z_2) = arg(z_1) + arg(z_2) + 2k\pi, k \in \{0, 1, -1\}$

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -1

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -1

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: A

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2. Statement-1 : The locus of z , if $arg\left(\frac{z-1}{z+1}\right)=\frac{\pi}{2}$ is a circle.

and

Statement -2 : $\left|\frac{z-2}{z+2}\right|=\frac{\pi}{2}$, then the locus of z is a circle.

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -2

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -2

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: D

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3. Statement-1 : If $e^{i\theta}=\cos\theta+i\sin\theta$ and the value of $e^{iA}.\, e^{iB}.\, e^{iC}$ is equal to -1, where A,B,C are the angles of a triangle.

and

Statement -2 : In any $\triangle ABC, A+B+C=180^{\circ}$

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -1

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -1

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: A

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4. Statement-1 : $z_1^2+z_2^2+z_3^2+z_4^2=0$ where z_1, z_2, z_3 and z_4 are the fourth roots of unity

and

Statement -2 : $(1)^{\frac{1}{4}}=(\cos 0^{\circ}+i\sin 0^{\circ})^{\frac{1}{4}}$

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -4

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -4

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: A

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5. Statement -1 : For any four complex numbers z_1, z_2, z_3 and z_4 , it is given that the four points are concyclic, then $|z_1| = |z_2| = |z_3| = |z_4|$

Statement -2 : Modulus of a complex number represents the distance form origin.

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -5

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -5

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: D

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6. Statement -1 : The expression $\left(\frac{2i}{1+i}\right)^n$ is a positive integer for all the values of n.

and

Statement -2 : Here n=8 is the least positive for which the above expression is a positive integer.

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -6

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -6

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: D

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7. Statement -1 : if $1-i, 1+i, z_1$ and z_2 are the vertices of a square taken in order in the anti-clockwise sense then z_1 is $i-1$ and Statement -2 : If the vertices are z_1, z_2, z_3, z_4 taken in order in the anti-clockwise sense,then $z_3 = iz_1 + (1+i)z_2$

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -7

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -7

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: A

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8. Statement-1 : IF $\left|z+\frac{1}{z}\right|$ =a , where z is a complex number and a is a real number, the least and greatest values of |z| are $\frac{\sqrt{a^2+4-a}}{2}$ and $\frac{\sqrt{a^2+4}+a}{2}$

and Statement -2 : For a equal ot zero the greatest and the least values of |z| are equal .

A. (a)Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -8

B. (b)Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -8

C. (c)Statement -1 is True, Statement -2 is False

D. (d)Statement -1 is Flase, Statement -2 is True

Answer: B

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9. Statement-1 : The locus of complex number z, satisfying $(z-2)^n = z^n$ is a straight line .

and

Statement -2 : The equation of the form ax + by+c =0 in x -y plane is the general equation of striaght line.

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -9

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -9

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: A

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10. Statement -1 : A root of the equation $(2^{10} - 3)x^2 - 2^{11}x + 2^{10} + 3 = 0$ is 1

and

Statement-2 : The sum of the coefficients of a quadratic equation is zero, then 1 is a root of the equation.

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -1

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -1

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: A

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11. Statement -1: The equation who roots are reciprocal of the roots of the equation $10x^2 - x - 5 = 0$ is $5x^2 + x - 10 = 0$

and

Statement -2 : To obtain a quadratic equation whose roots are reciprocal of the roots of the given equation $ax^2 + bx + c = 0$ change the coefficients a,b,c,to c,b,a. $(c \neq 0)$

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -11

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -11

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: A

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12. Statement-1 : The equation $x^2 - 2009x + 2008 = 0$ has rational roots

.

and

Statement -2 : The quadratic equation $ax^2 + bx + c = 0$ has rational roots iff $b^2 - 4ac$ is a prefect square.

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -12

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -12

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: C

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13. Statement -1 : one root of the equation $x^2 + 5x - 7 = 0$ lie in the interval (1,2).

and

Statement -2 : For a polynomial f(x),if f(p)f(q) lt 0, then there exists at least one real root of f(x) =0 in (p,q)

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -13

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -13

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: A

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14. Statement -1 : The quadratic equation $ax^2 + bx + c = 0$ has real roots if $(a+c)^2 > b^2, \forall, a, b, c \in R$.

and

Statement -2 : The quadratic equation $ax^2 + bx + c = 0$ has real roots if $b^2 - 4ac \geq 0$

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -14

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -14

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: D

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15. Statement -1 : There is just on quadratic equation with real coefficients, one of whose roots is $\frac{1}{3+\sqrt{7}}$

and

Statement -2 : In a quadratic equation with rational coefficients the irrational roots occur in pair.

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -15

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -15

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: D

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16. Statement -1 : The roots of $x^2 + 2\sqrt{2008}x + 501 = 0$ are irrational .

and

Statement -2: If the discriminant of the equation $ax^2 + bx + c = 0, a \ne 0, (a, b, c, \in R)$ is a prefect square, then the roots are rational.

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -16

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -16

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: C

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17. Statement -1 : if a,b,c not all equal and $a \neq 0, a^3 + b^3 + c^3 = 3abc$,then the equation $ax^2 + bx + c = 0$ has two real roots of opposite sign.

and

Statement -2 : If roots of a quadractic equation $ax^2 + bx + c = 0$ are real and of opposite sign then $ac < 0$.

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -17

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -17

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: D

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18. Statement -1 : There is just one quadratic equation with real coefficient one of whose roots is $\frac{1}{\sqrt{2}+1}$

and

Statement -2 : In a quadratic equation with rational coefficients the irrational roots are in conjugate pairs.

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -18

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -18

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: D

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19. Statement-1 : Let a quadratic equation has a root 3 - 9i then the sum of roots is 6.

and

Statement -2 : If one root of $ax^2 + bx + c = 0, a \neq 0, a, b, c \in R$ is $\alpha + i\beta, \alpha, \beta \in R$ then the other roots must be $\alpha - i\beta$

A. Statement -1 is True, Statement -2 is True, Statement -2 is a correct explanation for statement -19

B. Statement -1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement -19

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is Flase, Statement -2 is True

Answer: A

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Section-F (Matrix -Match type Question)

1. Match the following :

Column - I

(A) The smallest positive integer for which $(1+i)^n = (1-i)^n$ is

(B) If $\sqrt[3]{a+ib} = x+iy$ and $\frac{b}{y} - \frac{a}{x} = k(x^2+y^2)$ then k is equal to

(C) If $x = \frac{1+i}{\sqrt{2}}$, then the value of $1 + x^2 + x^4 + x^6 + x^8 + x^{10} + \ldots +$

(D) If the minimum value of $|z+1+i| + |z-1-i| + |2-z| + |3-z|$

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2. Let z_1 and z_2 be two given complex numbers. The locus of z such that

Column -I	Column
(A) $\lvert z-z_1\rvert + \lvert z-z_2\rvert =$ constant =k, where $k \neq \lvert z_1 - z_2\rvert$	(p) Cir
(B) $\lvert z-z_1\rvert - \lvert z-z_2\rvert =$ k where $k \neq \lvert z_1 - z_2\rvert$	(q) Cir
(C) $arg\left(\frac{z-z_1}{z-z_2}\right) = \pm\frac{\pi}{2}$	(r) Hyp
(D) If ω lies on $\lvert\omega\rvert = 1$ then	(s) Elli

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3. Match the following :

Column-I

(A) $|z-6i|+|z-8|=k$ will represent an ellipse for k equals to

(B) $||z-12i+3|-|z-2||=k$ will represent hyperbola if k equals to

(C) $|z=ki|+|z-4|=\sqrt{10k}$ will represent line segment if k equals to

(D) $\frac{z-k+2ki}{|z-2+4i|}=k$ will represent circle if k equals to

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4. Match the following

Column-I

(A) if the roots of the equation $x^2-2ax+a^2+a-3=0$ are real and les

(B) If the roots of the equation $x^2-2ax+a^2+a-3=0$ are real and

(C) If exactly one root of the above equation lies in the interval (1,3) then a

(D) IF the roots of the above equation are such that one root is greater tha

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5. Let $f(x)=|x-1|+|x-2|+|x-3|$, match the column I for the value of k column II.

Column - I	Column -II
(A) f(x) $=$ k has no solution	(p) 1
(B) f(x)$=$k has only one solution	(q) 2
(C) f(x) $=$ k has two solution of same sign	(r) 4
(D) f(x)$=$ k has two solution of opposite sign	(s) 5
	(t) 8

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6. For given equation $x^2 - ax + b = 0$, match conditions in column I with possible values in column II

column -I

(A) If roots differ by unity then a^2 is equal to

(B) If roots differ by unity then $1 + a^2$ is equal to

(C) If one of the root be twice the other then $2a^2$ is equal to

(D) If the sum of roots of the equation equal to the sum of squares of their

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7. If α, β, γ be the roots of the equation $x(1 + x^2) + x^2(6 + x) + 2 = 0$ then match the entries of column-I with those of column-II.

column-I

(A) $\alpha^{-1}+\beta^{-1}+\gamma^{-1}$ is equal to

(B) $\alpha^2+\beta^2+\gamma^2$ equals

(C) $\left(\alpha^{-1}+\beta^{-1}+\gamma^{-1}\right)-(\alpha+\beta+\gamma)$ is equal to

(D) $\left[\alpha^{-1}+\beta^{-1}+\gamma^{-1}\right]$ equals where $[.]$ denotes the greatest integer equa

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section-G(Integer Answer type Questions)

1. P is a point satisfying arf $z=\pi/4$,such that sum of its distance form two given point (0,1) and (0,2) is minimum, then P must be $\frac{k}{2}(1+i)$ then numerical value of k should be _______.

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2. $\sum_{r=1}^{2002+(2k-1)}\cos\left(\frac{2r\pi}{7}\right)+i\sin\left(\frac{2r\pi}{7}\right)=0$ then the non negative integtral values of k less than 10 may be

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3. If z = x + iy and roots $z\bar{z}^3 + \bar{z}z^3 = 30$ are the vertices of a rectangle and z_0 is centre of rectangle. Let d be distance of z_0 form the point on circle |z-3| $\leq$ 2 then maximum value of d is ______

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4. If the complex number $A(z_1), B(z_2)$ and origin forms an isosceles triangle such that $\angle(AOB) = \frac{2\pi}{3}$,then $\frac{z_1^2 + z_2^2 + 4z_1z_2}{z_1z_2}$ equals ______

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5. The area of the triangle formed by three point $\sqrt{3} + i, \ -1 + \sqrt{3}i$ and $\left(\sqrt{3} - 1\right) + \left(\sqrt{3} + 1\right)i$ is ______

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6. The number of values (s) of k , for which both the roots of the equation $x^2 - 6kx + 9(k^2 - k + 1) = 0$ are real, distinct and have values atmost 3 is ________

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7. The possible greates integral value of a for which the expression $\frac{ax^2 + 3x + 4}{x^2 + 2x + 2}$ is less than 5 for all real x is ______

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8. Let f(x) = $ax^2 + bx + c$ where a,b,c are real numbers. If the numbers 2a ,a +b and c are all integers ,then the number of integral values between 1 and 5 that f(x) can takes is______

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section-H (Multiple True-False Type Questions

1. Let A,B and C be three sets of complex numbers as defined below:

$A = \{z : Im(z) \geq 1\}$

$B = \{z : |z - 2 - i| = 3\}$

$C = \{z : Re(1 - i)z) = 3\sqrt{2} \text{where} i = \sqrt{-1}$

Let z be any point in $A \cap B \cap C$. Then, $|z + 1 - i|^2 + |z - 5 - i|^2$ lies between

A. TTT

B. T T F

C. T F T

D. F F F

Answer: A

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2. If $\alpha = e^{i2\pi/7} and f(x) = a_0 + \sum_{k=0}^{20} a_k x^k$, then prove that the value of $f(x) + f(\alpha x) + ... + f(\alpha^6 x)$ is independent of α.

A. F T T

B. F T F

C. F F F

D. T F T

Answer: A

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3. Statement -1 : Two regular polygons are inscribed in the same circle. The first polygon has 1982 sides and second has 2973 sides. If the polygons have a common vertex, then the number of vertex common to both of them is 991.

Statement -2 : The total number of complex numbers z. satisfying |z-1| = |z +1| =|z| is one

Statement -3 : The locus represented by |2011 z+1| = 2011 |z+1| is a striaght line

A. (a)T T T

B. (b)T F T

C. (c)F T T

D. (d)F F F

Answer: B

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4. Statement -1 : If x is real and $y = \frac{x^2 - x + 3}{x + 2}$, then $y \in (-\infty, \infty) - (-11, 1)$

Statement -2 : If [] represents the greatest integer function and f(x) =x -[x] then number of real roots of the equation f(x) +f$\left(\frac{1}{x}\right) = 1$ are infinite.

Statement -3 : if the difference of the roots of the equation $x^2 + hx + 7 = 0$ is 6, then , possible value (s) of h are -8 and 8.

A. T T T

B. T T F

C. T F F

D. F F F

Answer: A

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5. The solution of the equation $(3|x|-3)^2 = |x|+7$ which belongs to the domain of $\sqrt{x(x-3)}$ are given by

A. F F T

B. T T F

C. T F F

D. T T T

Answer: D

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section-I (Subjective Type Questions)

1. Ifα, β and γ are the roots of $X^3 - 3X^2 + 3X + 7 + 0$, find the value of $\frac{\alpha = 1}{\beta - 1} + \frac{\beta - 1}{\gamma - 1} + \frac{\gamma - 1}{\alpha - 1}$.

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2. A man walks a distance of 3 units from the origin towards the North-East $(N45^0E)$ direction.From there, he walks a distance of 4 units towards the North-West $(N45^0W)$ direction to reach a point P. Then, the position of P in the Argand plane is (a) $3e^{\frac{i\pi}{4}} + 4i$ (b) $(3 - 4i)e^{\frac{i\pi}{4}}$ $(4 + 3i)e^{\frac{i\pi}{4}}$ (d) $(3 + 4i)e^{\frac{i\pi}{4}}$

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3. Let z_1 and z_2 be two given complex numbers such that $\frac{z_1}{z_2} + \frac{z_2}{z_1} = 1$ and $|z_1| = 3$, then $|z_1 - z_2|^2$ is equal to

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4. The locus of the centre of a circle which touches the given circles $|z - z_1| = |3 + 4i|$ and $|z - z_2| = |1 + i\sqrt{3}|$ is a hyperbola, then the lenth of its transvers axis is ......

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5. If $|z| = 1 and z \neq \pm 1,$ then all the values of $\frac{z}{1 - z^2}$ lie on a line not passing through the origin $|z| = \sqrt{2}$ the x-axis (d) the y-axis

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6. If $|z_1 + z_2|^2 = |z_1|^2 + |z_2|^2$ the $\frac{6}{\pi} amp\left(\frac{z_1}{z_2}\right)$ is equal to ......

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7. For every real number $a \geq 0$, find all the complex numbers z that satisfy the equation $2|z| - 4az + 1 + ia = 0$

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8. Let z_1, z_2 be complex numbers with $|z_1| = |z_2| = 1$ prove that $|z_1 + 1| + |z_2 + 1| + |z_1 z_2 + 1| \geq 2.$

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9. If one root of the quadratic equation $ax^2 + bx + c = 0$ is equal to the n^{th} power of the other root , then show that $(ac^n)^{\frac{1}{n+1}} + (a^n c)^{\frac{1}{n+1}} + b = 0$

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10. Let α and β be the roots of the equation $x^2 - px + q = 0$ and $V_n = \alpha^n + \beta^n$, Show that $V_{n+1} = pV_n - qV_{n-1}$ find V_5

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11. If p,q are roots of the quadratic equation $x^2 - 10rx - 11s = 0$ and r, s are roots of $x^2 - 10px - 11q = 0$ then find the value of p+q +r+s.

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12. Solve for x: $4^{x+1.5} + 9^{x+0.5} = 10.6^x$.

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13. Let α and β be the values of x obtained form the equation $\lambda^2(x^2 - x) + 2\lambda x + 3 = 0$ and if λ_1, λ_2 be the two values of λ for which α and β are connected by the relation $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{4}{3}$. then find the value of $\frac{\lambda_1^2}{\lambda_2} + \frac{\lambda_2^2}{\lambda_1}$ and $\frac{\lambda_1^2}{\lambda_2^2} + \frac{\lambda_2^2}{\lambda_1^2}$

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14. The twice of the product of real roots of the equation $(2x+3)^2 - 3|2x+3| + 2 = 0$ is ________

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15. The equation $ax^2 + bx + c = 0$ and $x^3 - 4x^2 + 8x - 8 = 0$ have two roots in common. Then 2b + c is equal to ______.

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16. If $x = 3 + 3^{1/3} + 3^{2/3}$, then the value of the expression $x^3 - 9x^2 + 8x - 12$ is equal to ____

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section-J (Aakash Challengers Qestions)

1. All complex numbers $'z'$ which satisfy the relation $|z-|z+1||=|z+|z-1||$ on the complex plane lie on the

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2. Suppose p is a polynomial with complex coefficients and all even degreen. If all the roots of p are complex non-real numbers with modulus 1, prove that $p(1)\in R \Leftrightarrow p(-1)\in R$

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3. The point $A_1, A_2.....A_{10}$ are equally distributed on a circle of radius R (taken in order). Prove that $A_1A_4 - A_1A_2 = R$

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4. Let a and b be positive real numbers with $a^3 + b^3 = a - b$ and $k = a^2 + 4b^2$, then (1)$k < 1$ (2) $k > 1$ (3) $k = 1$(4) $k > 2$

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5. Let k be a real number such that the inequality $\sqrt{x-3} + \sqrt{6-x} \geq k$ has a solution then the maximum value of k is

$\sqrt{3}$ (2) $\sqrt{6} - \sqrt{3}$

(3) $\sqrt{6}$ (4) $\sqrt{6} + \sqrt{3}$

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6. If α and β be the roots of the equation $x^2 + px - 1/(2p^2) = 0$, where $p \in R$. Then the minimum value of $\alpha^4 + \beta^4$ is

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7. If the roots of the quadratic equation $x^2 - ax + 2b = 0$ are prime numbers, then the value of (a-b) is

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8. The number of real solutions of the equation $\sqrt[4]{97 - x} + \sqrt[4]{x} = 5$

(1) 0 (2) 1

(3) 2 (4) 4

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9. If f(x) is a polynomial of degree at least two with integral co-efficients then the remainder when it is divided by(x-a) (x-b) is , where $a \neq b$

(1) $x\left[\frac{f(a) - f(b)}{b - a}\right] + \frac{af(b) - bf(a)}{a - b}$ (2) $x\left[\frac{f(a) - f(b)}{a - b}\right] + \frac{af(b) - bf(a)}{a - b}$

(3) $x\left[\frac{f(b) - f(a)}{a - b}\right] + \frac{af(b) - bf(a)}{a - b}$ (4) $x\left[\frac{f(b) - f(a)}{a - b}\right] + \frac{bf(a) - af(a)}{a - b}$

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10. Let p (x) be a polynomial with real coefficient and $p(x) = x^2 + 2x + 1$. Find P (1).

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11. If x,y,z are three real numbers such that $x + y + z = 4$ and $x^2 + y^2 + z^2 = 6$,then

(1) $\frac{2}{3} \leq x, y, z \leq 2$ (2) $0 \leq x, y, z \leq 2$

(3) $1 \leq x, y, z \leq 3$ (4)$2 \leq x, y, z \leq 3$

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12. If unity is double repeated root of $px^3 + g(x^2 + x) + r = 0$, then

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13. The number of real solutions of the equation $4x^{99} + 5x^{98} + 4x^{97} + 5x^{96} + \ldots\ldots + 4x + 5 = 0$ is (1) 1 (2) 5 (3) 7 (4) 97

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