



MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

COMPLEX NUMBERS

Solved Examples And Exercises

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

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2. If $|z^2 - 1| = |z|^2 + 1$, then show that z lies on the imaginary axis.

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3. Solve the equation $|z + 1| = z + 2(1 + i)$.

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4. Solve the equation $z^2 = \bar{z}$

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5. Find a complex number z satisfying the equation $z + \sqrt{2}|z + 1| + i = 0$.

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6. Show that $\left| \frac{z - 2}{z - 3} \right| = 2$ represents a circle, find its centre and radius.

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7. If $z = x + iy$, then show that $z\bar{z} + 2(z + \bar{z}) + a = 0$, where $a \in \mathbb{R}$, represents a circle.

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8. If the real part of $\frac{z+2}{z-1}$ is 4, then show that the locus of the point representing z in the complex plane is a circle.

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9. For any complex number z prove that $|\operatorname{Re}(z)| + |\operatorname{Im}(z)| \leq \sqrt{2}|z|$

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10. Find the square roots of the following: i

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11. If $\left(\frac{1+i}{1-i}\right)^2 = x + iy$, find $x + y$.

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12. If for complex numbers z_1 and z_2 and $|1 - \bar{z}_1 z_2|^2 - |z_1 - z_2|^2 = k(1 - |z_1|^2)(1 - |z_2|^2)$ then k is equal to:

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13. If $\arg(z - 1) = \arg(z + 3i)$, then find $(x - 1) : y$, where $z = x + iy$

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14. Solve the equation $|z| = z + 1 + 2i$.

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15. If for complex numbers z_1 and z_2 , $\arg(z_1) - \arg(z_2) = 0$, then show that $|z_1 - z_2| = ||z_1| - |z_2||$

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16. What is the smallest positive integer n for which $(1 + i)^{2n} = (1 - i)^{2n}$?

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17. If $(1 + i)z = (1 - i)z$, then show that $z = -iz$.

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18. Write the conjugate of $\frac{2 - i}{(1 - 2i)^2}$.

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19. If $z (\neq -1)$ is a complex number such that $\frac{z-1}{z+1}$ is purely imaginary, then $|z|$ is equal to

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20. If z and w are two complex number such that $|zw| = 1$ and $\arg(z) - \arg(w) = \frac{\pi}{2}$, then show that $\bar{z}w = -i$.

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21. The value of $(1+i)^4 + (1-i)^4$ is

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22. If the complex number $z = x + iy$ satisfies the condition $|z+1| = 1$, then z lies on (a) x-axis (b) circle with centre $(-1, 0)$ and radius 1 (c) y-axis (d) none of these



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23. If $z = x + iy$ lies in III quadrant, then $\frac{\bar{z}}{z}$ also lies in III quadrant If:

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24. If $a = \cos \theta + i \sin \theta$, find the value of $\frac{1+a}{1-a}$.

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25. Let $z_1 = r_1(\cos \theta_1 + i \sin \theta_1)$ and $z_2 = r_2(\cos \theta_2 + i \sin \theta_2)$ be two complex numbers. Then prove that

$$|z_1 + z_2|^2 = r_1^2 + r_2^2 + 2r_1r_2 \cos(\theta_1 - \theta_2)$$

or

$$|z_1 + z_2|^2 = |z_1|^2 + |z_2|^2 + 2|z_1||z_2| \cos(\theta_1 - \theta_2)$$

$$|z_1 - z_2|^2 = r_1^2 + r_2^2 - 2r_1r_2 \cos(\theta_1 - \theta_2) \text{ or}$$

$$|z_1 - z_2|^2 = |z_1|^2 + |z_2|^2 - 2|z_1||z_2| \cos(\theta_1 - \theta_2)$$

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26. For a positive integer n , find the value of $(1 - i)^n \left(1 - \frac{1}{i}\right)^n$.

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27. If

$(1 + i)(1 + 2i)(1 + 3i)\dots\dots\dots (1 + ni) = a + ib$, then $2 \times 5 \times 10\dots (1 + n)$ is equal to $\sqrt{a^2 + b^2}$ (b) $\sqrt{a^2 - b^2}$ (c) $a^2 + b^2$ (d) $a^2 - b^2$ (e) $a + b$

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28. Perform the indicated operation and find the result in the form $a + ib$.

(i) $\frac{2 - \sqrt{-25}}{1 - \sqrt{-16}}$ (ii) $\frac{3 - \sqrt{-16}}{1 - \sqrt{-9}}$

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29. Let $z_1 = 2 - i$, $z_2 = -2 + i$. Find (i) $\operatorname{Re} \left(\frac{z_1 z_2}{\bar{z}_1} \right)$ (ii) $\operatorname{Im} \left(\frac{1}{z_1 \bar{z}_1} \right)$



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30. Which of the following is correct for any two complex numbers z_1 and z_2 ?

(a) $|z_1 z_2| = |z_1| |z_2|$ (b) $\arg(z_1 z_2) = \arg(z_1) \arg(z_2)$ (c)

$|z_1 + z_2| = |z_1| + |z_2|$ (d) $|z_1 + z_2| \geq |z_1| + |z_2|$



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31. If z_1 and z_2 are two complex numbers such that $|z_1| = |z_2|$ and $\arg(z_1) + \arg(z_2) = \pi$, then show that $z_1 = -z_2$.



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32. Evaluate $\sum_{n=1}^{13} (i^n + i^{n+1})$, where $n \in N$.



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33. Find the value of $1 + i^2 + i^4 + i^6 + \dots + i^{2n}$,

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34. Show that: $\left\{ i^{19} + \left(\frac{1}{i} \right)^{25} \right\}^2 = -4$ (ii) $\left\{ i^{17} - \left(\frac{1}{i} \right)^{34} \right\}^2 = 2i$ (iii)

$\left\{ i^{18} + \left(\frac{1}{i} \right)^{24} \right\}^3 = 0$ (iv) $i^n + i^{n+1} + i^{n+2} + i^{n+3} = 0$ for all $n \in \mathbb{N}$.

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35. Prove that the following complex numbers are purely real: (i)

$$\left(\frac{2 + 3i}{3 + 4i} \right) \left(\frac{2 - 3i}{3 - 4i} \right) \quad \text{(ii)} \quad \left(\frac{3 + 2i}{2 - 3i} \right) \left(\frac{3 - 2i}{2 + 3i} \right)$$

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36. Show that $1 + i^{10} + i^{20} + i^{30}$ is a real number.

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37. Find the values of following expressions: $i^{49} + i^{68} + i^{89} + i^{110}$ (ii)

$i^{30} + i^{80} + i^{120}$ (iii) $i + i^2 + i^3 + i^4$ (iv) $i^5 + i^{10} + i^{15}$ (v)

$\frac{i^{592} + i^{590} + i^{586} + i^{584}}{i^{582} + i^{580} + i^{576} + i^{574}}$ (vi) $1 + i^2 + i^4 + i^6 + i^8 + i^{20}$ (vii)

$(1 + i)^6 + (1 - i)^3$

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38. If $(a + ib)(c + id)(e + if)(g + ih) = A + iB$ prove that

$$(a^2 + b^2)(c^2 + d^2)(e^2 + f^2)(g^2 + h^2) = A^2 + B^2$$

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39. If z_1, z_2 are complex number such that $\frac{2z_1}{3z_2}$ is purely imaginary

number, then find $\left| \frac{z_1 - z_2}{z_1 + z_2} \right|$.

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40. If $x = -5 + 2\sqrt{-4}$, find the value of $x^4 + 9x^3 + 35x^2 - x + 4$.

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41. If z is a complex number such that $|z| = 1$, prove that $\frac{z-1}{z+1}$ is purely imaginary, what will be your conclusion if $z = 1$?

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42. If $z = x + iy$ and $w = \frac{1 - iz}{z - i}$, show that $|w| = 1$ is purely real.

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43. If $z = 2 - 3i$ show that $z^2 - 4z + 13 = 0$ and hence find the value of $4z^3 - 3z^2 + 169$.

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44. If $|z_1| = |z_2| = \dots = |z_n| = 1$, prove that

$$|z_1 + z_2 + z_3 + \dots + z_n| = \frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3} + \dots + \frac{1}{z_n}$$

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45. Find the non-zero complex numbers z satisfying $\bar{z} = iz^2$.

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46. Show that if $iz^3 + z^2 - z + i = 0$, then $|z| = 1$

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47. Solve the equation $z^2 + |z| = 0$, where z is a complex number.

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48. If z_1, z_2 and z_3, z_4 are two pairs of conjugate complex numbers, prove that $\arg\left(\frac{z_1}{z_4}\right) + \arg\left(\frac{z_2}{z_3}\right) = 0$.

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49. If $z_r = \cos\left(\frac{\pi}{3^r}\right) + i \sin\left(\frac{\pi}{3^r}\right)$, $r = 1, 2, 3, \dots$, prove that $z_1 z_2 z_3 z_\infty = i$.

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50. If $x_n = \cos\frac{\pi}{2^n} + i \sin\frac{\pi}{2^n}$, prove that $x_1 x_2 x_3 x_\infty = -1$.

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51. Find the square roots of the following: (i) $7 - 24i$ (ii) $5 + 12i$

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52. Find the square roots of $-15 - 8i$.

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53. Find the number of solutions of $z^2 + |z|^2 = 0$.

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54. If $\left(\frac{a^2 + 1}{2a - i}\right)^2 = x + iy$, find the value of $x^2 + y^2$.

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55. Let z_1 and z_2 be two complex numbers such that $(z_1)_1 + i(z_2)_2 = 0$ and $\arg(z_1 z_2) = \pi$. Then, find $\arg(z_1)$.

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56. If $|z - 5i| = |z + 5i|$, then the locus of z .

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57. If z_1 and z_2 both satisfy $z + \bar{z} = 2|z - 1|$ and $\arg(z_1 - z_2) = \frac{\pi}{4}$, then find $\text{Im}(z_1 + z_2)$.

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58. Show that the complex number z , satisfying $\frac{z - 1}{z + 1} = \frac{\pi}{4}$ lies on a circle.

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59. If $z = \frac{1 + 7i}{(2 - i)^2}$, then (a) $|z| = 2$ (b) $|z| = \frac{1}{2}$ (c) $\text{amp}(z) = \frac{\pi}{4}$ (d) $\text{amp}(z) = \frac{3\pi}{4}$

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60. The value of $\frac{i^5 + i^6 + i^7 + i^8 + i^9}{1 + i}$ is (a) $\frac{1}{2}(1 + i)$ (b) $\frac{1}{2}(1 - i)$ (c) 1
(d) $\frac{1}{2}$

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61. Write the least positive integral value of n for which $\left(\frac{1 + i}{1 - i}\right)^n$ is real.

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62. If $f(z) = \frac{7 - z}{1 - z^2}$, where $z = 1 + 2i$, then $|f(z)|$ is (a) $\frac{|z|}{2}$ (b) $|z|$ (c) $2|z|$ (d) none of these

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63. If z_1, z_2, z_3 are complex numbers such that $|z_1| = |z_2| = |z_3| = \left|\frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3}\right| = 1$ then $|z_1 + z_2 + z_3|$ is equal

to



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64. What is the locus of z , if amplitude of $(z - 2 - 3i)$ is $\frac{\pi}{4}$?



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65. Write the sum of the series $i + i^2 + i^3 + \dots$ upto 1000 terms.



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66. The sum and product of two complex numbers are real if and only if they are conjugate of each other.



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

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68. Write the value of $\arg(z) + \arg(\bar{z})$.

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69. Find the conjugate of $\frac{1 - i}{1 + i}$

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70. Find the conjugate of $\frac{1}{3 + 4i}$.

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71. If $\frac{a + ib}{c + id} = x + iy$, prove that

$$\frac{a - ib}{c - id} = x - iy \text{ and } \frac{a^2 + b^2}{c^2 + d^2} = x^2 + y^2.$$

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72. Find real values of x and y for which the complex numbers $-3 + ix^2$ and $x^2 + y + 4i$ are conjugate of each other.

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73. Find the real values of x and y for which

$$(1 + i)y^2 + (6 + i) = (2 + i)x$$

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74. Find the real values of x and y , if $(3x - 7) + 2iy = -5y + (5 + x)i$

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75. If $(x + iy)^{1/3} = a + ib$, $x, y, a, b \in \mathbb{R}$. Show that

$$\frac{x}{a} + \frac{y}{b} = 4(a^2 - b^2) \quad \text{(ii)} \quad \frac{x}{a} - \frac{y}{b} = -2(a^2 + b^2)$$

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76. If $a + ib = \frac{c + i}{c - i}$, where c is real, then $a^2 + b^2$

A. 0

B. 1

C. 2

D. c

Answer: B

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77. Evaluate the following: i^{135}



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78. Evaluate the following: i^{19}



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79. Evaluate the following: i^{-999}



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80. Evaluate the following: $(-\sqrt{-1})^{4n+3}, n \in \mathbb{N}$



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81. Evaluate the following: i^{457}



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82. Evaluate the following: i^{528}

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83. Evaluate the following: $\frac{1}{i^{58}}$

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84. Evaluate the following: $\left(i^{41} + \frac{1}{i^{257}}\right)^9$

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85. Evaluate the following: $(i^{77} + i^{70} + i^{87} + i^{414})^3$

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86. Evaluate the following: $i^{30} + i^{40} + i^{60}$



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87. Evaluate the following: $i^{49} + i^{68} + i^{89} + i^{110}$



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88. Compute the following: $\sqrt{-144}$



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89. Compute the following: $\sqrt{-4} \times \sqrt{\frac{-9}{4}}$



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90. Compute the following: $\sqrt{-25} + 3\sqrt{-4} + 2\sqrt{-9}$

A. $-17i$

B. -17

C. 17i

D. 17

Answer: C

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91. A student writes the formula $\sqrt{ab} = \sqrt{a} \sqrt{b}$. Then he substitutes $a = -1$ and $b = -1$ and finds $1 = -1$. Explain where is he wrong?

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92. Is the following computation correct? If not give the correct computation:
$$\left[\sqrt{(-2)} \sqrt{(-3)} \right] = \sqrt{(-2)(-3)} = \sqrt{6}$$

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93. If $(a + b) - i(3a + 2b) = 5 + 2i$, find a and b .

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94. Find the multiplicative inverse of $z = 3 - 2i$.

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95. Express the following in the form $a + ib$: $(-5i)\left(\frac{1}{8}i\right)$

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96. Express the following in the form $a + ib$: $(5i)\left(-\frac{3}{5}i\right)$

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97. Express the following in the form $a + ib$: i^{-39}



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98. Express the following in the form $a + ib$: $(-i)(2i)\left(-\frac{1}{8}i\right)^3$



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99. Express the following in the form $a + ib$: $i^9 + i^{19}$



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100. Express the following in the form $a + ib$: $(1 - i)^4$



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101. Express each of the following in the form

$a + ib$: $3(7 + 7i) + i(7 + 7i)$



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102. Express each of the following in the form

$$a + ib: \left(\frac{1}{5} + \frac{2}{5}i\right) - \left(4 + \frac{5}{2}i\right)$$

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103. Express each of the following in the form

$$a + ib: (1 - i) - (-1 + 6i)$$

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104. Express each of the following in the form

$$a + ib: \left\{ \left(\frac{1}{3} + \frac{7}{3}i\right) + \left(4 + \frac{1}{3}i\right) \right\} - \left(-\frac{4}{3} + i\right)$$

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105. Express each of the following in the form $a + ib: \left(\frac{1}{3} + 3i\right)^3$



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106. Express each of the following in the form $a + ib$: $(5 - 3i)^2$

A. $16 - 30i$

B. $16 + 30i$

C. $34 - 30i$

D. $34 + 30i$

Answer: A



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107. Express each of the following in the form $a + ib$: $\left(-2 - \frac{1}{3}i\right)^3$



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108. Express each of the following in the form

$$a + ib: (-\sqrt{3} + \sqrt{-2})(2\sqrt{3} - i)$$

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109. Express the following in the standard form $a + ib$: $\frac{1}{3 - 4i}$

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110. Express the following in the standard form $a + ib$: $\frac{(3 - 2i)(2 + 3i)}{(1 + 2i)(2 - i)}$

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111. Express the following in the standard form $a + ib$: $\frac{5 + 4i}{4 + 5i}$

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112. Express the following in the standard form $a + ib$: $\frac{1}{-2 + \sqrt{-3}}$

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113. Express the following in the standard form

$$a + ib: \frac{(3 + i\sqrt{5})(3 - i\sqrt{5})}{(\sqrt{3} + \sqrt{2}i) - (\sqrt{3} - i\sqrt{2})}.$$

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114. Express the following in the standard form $a + ib$: $\frac{(1 + i)^2}{3 - i}$

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115. Express the following in the standard form

$$a + ib: \left(\frac{1}{1 - 2i} + \frac{3}{1 + i} \right) \left(\frac{3 + 4i}{2 - 4i} \right)$$

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116. Express the following in the standard form

$$a + ib: \frac{1}{1 - \cos \theta + 2i \sin \theta}$$



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117. Express $(1 - 2i)^{-3}$ in the standard form $a + ib$.



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118. Perform the indicated operation and find the result in the form

$$a + ib: \frac{2 - \sqrt{-25}}{1 - \sqrt{-16}}$$



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119. Perform the indicated operation and find the result in the form

$$a + ib: \frac{3 - \sqrt{-16}}{1 - \sqrt{-9}}$$



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120. Multiply $3 - 2i$ by its conjugate.

A. $\sqrt{13}$

B. 13

C. $\sqrt{-13}$

D. -13

Answer: B



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121. Find the real numbers x and y , if $(x - iy)(3 + 5i)$ is the conjugate of $-6 - 24i$.



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122. Find the multiplicative inverse of the complex number: $3 + 2i$



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123. Find the multiplicative inverse of the following complex number:

$$(2 + \sqrt{3}i)^2$$



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124. If $a + ib = \frac{(x + i)^2}{2x^2 + 1}$, prove that $a^2 + b^2 = \frac{(x^2 + 1)^2}{(2x^2 + 1)^2}$



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125. If $x + iy = \sqrt{\frac{a + ib}{c + id}}$ prove that $(x^2 + y^2)^2 = \frac{a^2 + b^2}{c^2 + d^2}$



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126. Find the least positive value of n if $\left(\frac{1+i}{1-i}\right)^n = 1$.

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127. Find real θ such that $\frac{3 + 2i \sin \theta}{1 - 2i \sin \theta}$ is purely real.

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128. If $(1+i)(1+2i)(1+3i)(1+ni) = (x+iy)$, Show that $2.5.10 \dots \cdot (1+n^2) = x^2 + y^2$.

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129. Find the value of $x^3 + 7x^2 - x + 1$, when $x = 1 + 2i$.

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130. Prove that: $x^4 + 4 = (x + 1 + i)(x + 1 - i)(x - 1 + i)(x - 1 - i)$

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131. Show that a real value of x will satisfy the equation

$$\frac{1 - ix}{1 + ix} = a - ib \quad \text{if} \quad a^2 + b^2 = 1, \text{ when } a, b \text{ are real.}$$

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132. If α and β are different complex numbers with $|\beta| = 1$, then find

$$\left| \frac{\beta - \alpha}{1 - \bar{\alpha}\beta} \right|.$$

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133. Find non zero integral solutions of $|1 - i|^x = 2^x$.

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134. Express the following complex numbers in the standard form

$$a + ib: (1 + i)(1 + 2i)$$

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135. Express the following complex numbers in the standard form

$$a + ib: \frac{1}{(2 + i)^3}$$

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136. Express the following complex numbers in the standard form

$$a + ib: \frac{(2 + i)^3}{2 + 3i}$$

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137. Express the following complex numbers in the standard form

$$a + ib: (1 + 2i)^{-3}$$

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138. Express the following complex numbers in the standard form

$$a + ib: \left(\frac{1}{1 - 4i} - \frac{2}{1 + i} \right) \left(\frac{3 - 4i}{5 + i} \right)$$

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139. Express the following complex numbers in the standard form

$$a + ib: \frac{3 + 2i}{-2 + i}$$

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140. Express the following complex numbers in the standard form

$$a + ib: \frac{1 - i}{1 + i}$$

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141. Express the following complex numbers in the standard form

$$a + ib: \frac{(1 + i)(1 + \sqrt{3}i)}{1 - i}$$

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142. Express the following complex numbers in the standard form

$$a + ib: \frac{3 - 4i}{(4 - 2i)(1 + i)}$$

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143. Express the following complex numbers in the standard form

$$a + ib: \frac{5 + \sqrt{2}i}{1 - \sqrt{2}i}$$

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144. Find the real values of x and y , if : $(x + iy)(2 - 3i) = 4 + i$

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145. Find the real values of x and y , if : $\frac{(1 + i)x - 2i}{3 + i} + \frac{(2 - 3i)y + i}{3 - i} = i$

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146. Find the real values of x and y , if : $(3x - 2iy)(2 + i)^2 = 10(1 + i)$

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147. Find the real values of x and y , if : $(1 + i)(x + iy) = 2 - 5i$

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148. Find the conjugates of the following complex number: $4 - 5i$

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149. Find the conjugates of the following complex number: $\frac{1}{3 + 5i}$

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150. Find the conjugates of the following complex number: $\frac{1}{1 + i}$

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151. Find the conjugates of the following complex number:

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

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152. Find the conjugates of the following complex number: $\frac{(3 - i)^2}{2 + i}$

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153. Find the conjugates of the following complex number:

$$\frac{(3 - 2i)(2 + 3i)}{(1 + 2i)(2 - i)}$$

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154. Find the multiplicative of the following complex number: $1 - i$

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155. Find the multiplicative of the following complex number: $4 - 3i$

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156. Find the multiplicative of the following complex number: $(1 + i\sqrt{3})^2$

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157. Find the multiplicative of the following complex number: $\sqrt{5} + 3i$

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158. If $z_1 = 2 - i$, $z_2 = 1 + i$, find $\left| \frac{z_1 + z_2 + 1}{z_1 - z_2 + i} \right|$.

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159. If $z_1 = 2 - i$, $z_2 = -2 + i$, find : $Re\left(\frac{z_1 z_2}{z_1}\right)$

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160. If $z_1 = 2 - i$, $z_2 = -2 + i$, find : $Im\left(\frac{1}{z_1 \overline{z_1}}\right)$.



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161. Find the modulus of $\frac{1+i}{1-i} - \frac{1-i}{1+i}$



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162. If $x + iy = \frac{a + ib}{a - ib}$ prove that $x^2 + y^2 = 1$



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163. Write the least positive integral value of n for which $\left(\frac{1+i}{1-i}\right)^n$ is real.



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164. Find the real values of θ for which the complex number $\frac{1 + i \cos \theta}{1 - 2i \cos \theta}$ is purely real.



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165. Find the smallest positive integer value of n for which $\frac{(1+i)^n}{(1-i)^{n-2}}$ is a real number.



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166. If $\left(\frac{1+i}{1-i}\right)^3 - \left(\frac{1-i}{1+i}\right)^3 = x + iy$, find (x, y)



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167. If $\left(\frac{1-i}{1+i}\right)^{100} = a + ib$, find (a, b)



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168. Evaluate the following: $2x^3 + 2x^2 - 7x + 72$, when $x = \frac{3-5i}{2}$



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169. Evaluate $x^4 - 4x^3 + 4x^2 + 8x + 44$, when $x = 3 + 2i$

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170. Evaluate the following:

$x^4 + 4x^3 + 6x^2 + 4x + 9$, when $x = -1 + i\sqrt{2}$

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171. Evaluate the following: $x^6 + x^4 + x^2 + 1$, when $x = \frac{1+i}{\sqrt{2}}$

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172. Evaluate the following:

$2x^4 + 5x^3 + 7x^2 - x + 41$, when $x = -2 - \sqrt{3}i$

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173. If z_1 is a complex number other than -1 such that $|z_1| = 1$ and $z_2 = \frac{z_1 - 1}{z_1 + 1}$, then the real parts of z_2 is .

- A. 0
- B. 1
- C. Real part of z_1
- D. None of these

Answer: A

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174. Solve the system of equations $Re(z^2) = 0$, $|z| = 2$

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175. If $|z + 1| = z + 2(1 + i)$, find z .

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176. Find the square root of the following complex number: $-5 + 12i$

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177. Find the square roots of the following: $8 - 6i$

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178. Find the square root of the following complex number: $1 + 4\sqrt{-3}$

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179. Find the square root of the following complex number: $-7 - 24i$



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180. Find square root of $8 - 15i$



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181. Find the square root of the following complex number: $1 - i$



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182. Find the square root of the following complex number:

$$-11 - 60\sqrt{-1}$$



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183. Find the square root of the following complex number: $-i$



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184. Find the modulus and argument of each of the following complex number: $1 + i\sqrt{3}$



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185. Find the modulus and argument of each of the following complex number: $-\sqrt{3} - i$



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186. Find the modulus and argument of each of the following complex number: $-2 - 2i\sqrt{3}$



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187. Find the modulus and argument of each of the following complex number: $2\sqrt{3} - 2i$

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188. Find the modulus and argument of the following complex number:

$$\frac{1 + i}{1 - i}$$

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189. Find the modulus and argument of the following complex number:

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

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190. Write the following complex numbers in the polar form:

$$-3\sqrt{2} + 3\sqrt{2}i$$





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191. Write the following complex numbers in the polar form: $-1 - i$



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192. Write the following complex numbers in the polar form: $1 + i$



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193. Write the following complex numbers in the polar form: $1 - i$



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194. Find the modulus and principal argument of $(1 + i)$ and hence express it in the polar form.



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195. Find the modulus and principal argument of $-2i$

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196. Find the modulus and principal argument of -4 .

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197. Express the following complex number in the polar form: $\frac{1+i}{1-i}$

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198. Express the following complex number in the polar form: $\frac{2+6\sqrt{3}i}{5+\sqrt{3}i}$

A. $2\left(\cos \frac{\pi}{4} + i \sin \frac{\pi}{4}\right)$

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

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

D. None of these

Answer: B

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199. Put the complex number $\frac{1 + 7i}{(2 - i)^2}$ in the form $r(\cos \theta + i \sin \theta)$,

where r is a positive real number and $-\pi < \theta \leq \pi$.

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200. Find the modulus and argument of the following complex number

and convert them in polar form: $\frac{1 + 2i}{1 - 3i}$

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201. Find the modulus and argument of the following complex number

and convert them in polar form: $\frac{1 + 3i}{1 - 2i}$



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202. Find the modulus and argument of the following complex number

and convert them in polar form: $\frac{i - 1}{\cos\left(\frac{\pi}{3}\right) + i \sin\left(\frac{\pi}{3}\right)}$



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203. For any two complex number z_1 and z_2 prove that:

$$|z_1 + z_2| \leq |z_1| + |z_2|$$



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204. For any two complex number z_1 and z_2 prove that:

$$|z_1 - z_2| \leq |z_1| + |z_2|$$



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205. For any two complex number z_1 and z_2 prove that:

$$|z_1 + z_2| \geq |z_1| - |z_2|$$



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206. For any two complex number z_1 and z_2 prove that:

$$|z_1 - z_2| \geq |z_1| - |z_2|$$



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207. Find the modulus and argument of the following complex number and hence express them in the polar form: $1 + i$



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208. Find the modulus and argument of the following complex number and hence them in the polar form: $1 - i$

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209. Find the modulus and argument of the following complex number and hence them in the polar form: $\frac{1}{1 + i}$

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210. Find the modulus and argument of the following complex number and hence express them in the polar form: $\sin 120^\circ - i \cos 120^\circ$

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211. Find the modulus and argument of the following complex number and hence express them in the polar form: $\sqrt{3} + i$





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212. Find the modulus and argument of the following complex number

and hence express them in the polar form: $\frac{1 - i}{1 + i}$



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213. Find the modulus and argument of the following complex number

and hence express them in the polar form: $\frac{1 + 2i}{1 - 3i}$



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214. Find the modulus and argument of the following complex number

and hence express them in the polar form: $\frac{-16}{1 + i\sqrt{3}}$



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215. Write $(i^{25})^3$ in polar form.



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216. Write the values of the square root of i .



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217. Write the values of the square root of $-i$.



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218. If $x + iy = \sqrt{\frac{a + ib}{c + id}}$, then write the value of $(x^2 + y^2)^2$.



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219. If π



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220. If n is any positive integer, write the value of $\frac{i^{4n+1} - i^{4n-1}}{2}$.



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221. Write the value of $\frac{i^{592} + i^{590} + i^{588} + i^{586} + i^{584}}{i^{582} + i^{580} + i^{578} + i^{576} + i^{574}}$.



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222. Write $1 - i$ in polar form.



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223. Write $-1 + i\sqrt{3}$ in polar form.



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224. Write the argument of i .

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225. Find the principal argument of $(1 + i\sqrt{3})^2$.

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226. Find z , if $|z| = 4$ and $\arg(z) = \frac{5\pi}{6}$.

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227. Write the value of $\sqrt{-25} \times \sqrt{-9}$.

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228. Write the value of $\arg(z) + \arg(z)$.



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229. If $|z + 4| \leq 3$ then find the greatest and least values of $|z + 1|$.



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230. For any two complex numbers z_1 and z_2 and any two real numbers a, b find the value of $|az_1 - bz_2|^2 + |az_2 + bz_1|^2$.



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231. If $n \in \mathbb{N}$, then find the value of $i^n + i^{n+1} + i^{n+2} + i^{n+3}$.



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232. Find the real value of a for which $3i^3 - 2ai^2 + (1 - a)i + 5$ is real.



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233. If $|z| = 2$ and $\arg(z) = \frac{\pi}{4}$, find z .

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234. Write the argument of $(1 + i\sqrt{3})(1 + i)(\cos \theta + i \sin \theta)$.

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235. The value of $(1 + i)(1 + i^2)(1 + i^3)(1 + i^4)$ is a. 2 b. 0 c. 1 d. i

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236. If $\frac{3 + 2i \sin \theta}{1 - 2i \sin \theta}$ is a real number and $0 < \theta < 2\pi$, then θ is
a. π b. $\frac{\pi}{2}$ c. $\frac{\pi}{3}$ d. $\frac{\pi}{6}$

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237. If $\sqrt{a + ib} = x + iy$,

then possible value of $\sqrt{a - ib}$ is

a. $x^2 + y^2$

b. $\sqrt{x^2 + y^2}$

c. $x + iy$

d. $x - iy$

e. $\sqrt{x^2 - y^2}$



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238. If $z = \cos\left(\frac{\pi}{4}\right) + i \sin\left(\frac{\pi}{6}\right)$, 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. $|z| = \frac{\sqrt{3}}{2}, \arg(z) = \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$



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239. The polar form of $(i^{25})^3$ is

A. $\cos\left(\frac{\pi}{2}\right) + i \sin\left(\frac{\pi}{2}\right)$

B. $\cos \pi + i \sin \pi$

C. $\cos \pi - i \sin \pi$

D. $\cos\left(\frac{\pi}{2}\right) - i \sin\left(\frac{\pi}{2}\right)$

Answer: D



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240. If $i^2 = -1$,

then the sum $i + i^2 + i^3 + \dots$ upto 1000 terms is equal to

a. 1

b. -1

c. i

d. 0



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241. If $z = \frac{-2}{1 + i\sqrt{3}}$

, then the value of $\arg(z)$ is

- a. π
- b. $\frac{\pi}{4}$
- c. $\frac{\pi}{3}$
- d. $\frac{2\pi}{3}$

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242. If $a = \cos \theta + i \sin \theta$, then $\frac{1+a}{1-a}$ is

- a. $\cot\left(\frac{\theta}{2}\right)$
- b. $\cot \theta$
- c. $i \cot\left(\frac{\theta}{2}\right)$
- d. $i \tan\left(\frac{\theta}{2}\right)$

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243. If $(1 + i)(1 + 2i)(1 + 3i)\dots(1 + ni) = a + ib$,

then $2 \cdot 5 \cdot 10 \cdot 17 \dots (1 + n^2) =$

a. $a - ib$

b. $a^2 - b^2$

c. $a^2 + b^2$

d. none of these



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244. If $\frac{(a^2 + 1)^2}{2a - i} = x + iy$, then $x^2 + y^2$ is equal to a. $\frac{(a^2 + 1)^4}{4a^2 + 1}$ b. $\frac{(a + 1)^2}{4a^2 + 1}$ c. $\frac{(a^2 - 1)^2}{(4a^2 - 1)^2}$ d. none of these



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245. The principal value of the argument of $(1 + i)$ is

A. π

B. $\frac{\pi}{12}$

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

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246. The least positive integer n such that $\left(\frac{2i}{1+i}\right)^n$ is a positive integer is a. 16 b. 8 c. 4 d. 2

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247. If z is a non zero complex, number then $\left|\frac{|\bar{z}|^2}{z\bar{z}}\right|$ is equal to

a. $\left|\frac{\bar{z}}{z}\right|$

b. $|z|$

c. $|\bar{z}|$

d. none of these

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248. If $a = 1 + i$, then a^2 equals

A. $1 - i$

B. $2i$

C. $(1 + i)(1 - i)$

D. $(i - 1)$



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249. If $(x + iy)^{1/3} = a + ib$, then $\frac{x}{a} + \frac{y}{b}$ is

a. 0 b. 1 c. -1 d. none of these



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250. $(\sqrt{-2})(\sqrt{-3})$ is equal to

A. $\sqrt{6}$

B. $-\sqrt{6}$

C. $i\sqrt{6}$

D. none of these



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251. The argument of $\frac{1 - i\sqrt{3}}{1 + i\sqrt{3}}$ is a. 60° b. 120° c. 210° d. 240°



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252. If $z = \left(\frac{1+i}{1-i}\right)$, then z^4 equals a. 1 b. -1 c. 0 d. non of these



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253. If $z = \frac{1+2i}{1-(1-i)^2}$, then $\arg(z)$ equals a. 0 b. $\frac{\pi}{2}$ c. π d. non of

these



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254. If $z = \frac{1}{(2 + 3i)^2}$, then $|z|$ is
a. $\frac{1}{13}$ b. $\frac{1}{5}$ c. $\frac{1}{12}$ d. none of these

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255. If $z = \frac{1}{(1 - i)(2 + 3i)}$, then $|z|$ is a. 1 b. $\frac{1}{\sqrt{26}}$ c. $\frac{5}{\sqrt{26}}$ d. non of these

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256. If $z = 1 - \cos \theta + i \sin \theta$, then $|z|$ is a. $2 \sin\left(\frac{\theta}{2}\right)$ b. $2 \cos\left(\frac{\theta}{2}\right)$ c. $2 \left| \sin\left(\frac{\theta}{2}\right) \right|$ d. $2 \left| \cos\left(\frac{\theta}{2}\right) \right|$

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257. If $x + iy = (1 + i)(1 + 2i)(1 + 3i)$, then $x^2 + y^2$ is a. 0 b. 1 c. 100
d. none of these



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258. If $z = \frac{1}{1 - \cos \theta - i \sin \theta}$, then $Re(z)$ is a. 0 b. $\frac{1}{2}$ c. $\cot\left(\frac{\theta}{2}\right)$ d. $\frac{1}{2}\cot\left(\frac{\theta}{2}\right)$



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259. If $x + iy = \frac{3 + 5i}{7 - 6i}$, then y is

A. $\frac{9}{85}$

B. $-\frac{9}{85}$

C. $\frac{53}{85}$

D. None of these

Answer: C



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260. The amplitude of $\frac{1}{i}$ is equal to-

A. 0

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

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

D. π

Answer: C



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261. The argument of $\frac{1-i}{1+i}$ is-

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

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

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

D. $\frac{5\pi}{2}$

Answer: A

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262. The amplitude of $\frac{1 + i\sqrt{3}}{\sqrt{3} + i}$ is a. $\frac{\pi}{3}$ b. $-\frac{\pi}{3}$ c. $\frac{\pi}{6}$ d. $-\frac{\pi}{6}$

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263. $\frac{1 + 2i + 3i^2}{1 - 2i + 3i^2}$ equals a. i b. -1 c. $-i$ d. 4

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264. The value of $\frac{i^{592} + i^{590} + i^{588} + i^{586} + i^{584}}{i^{582} + i^{580} + i^{578} + i^{576} + i^{574}} - 1$ is a. -1 b. -2 c. -3
d. -4

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265. A real value of x satisfies the equation

$$\frac{3 - 4ix}{3 + 4ix} = a - ib (a, b \in \mathbb{R}), \quad \text{if } a^2 + b^2 = \text{a. } 1 \text{ b. } -1 \text{ c. } 2 \text{ d. } -2$$

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266. The complex number which satisfies the condition $\left| \frac{i+z}{i-z} \right| = 1$ lies on a. circle $x^2 + y^2 = 1$ b. the x-axis c. the y-axis d. the line $x + y = 1$

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267. If z is a complex number, then a. $|z|^2 > |z^2|$ b. $|z|^2 = |z^2|$ c. $|z|^2 < |z^2|$ d. $|z|^2 \geq |z^2|$

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Others

1. If z, z_1 and z_2 are complex numbers, prove that: $\arg(z) = -\arg(z)$ '



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