MATHS

BOOKS - MODERN PUBLICATION

COMPLEX NUMBERS

Example

1. Evaluate the following:

i^9.

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2. Evaluate the following:

i^{342}.

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3. Evaluate the following:

i^{998}.

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4. Evaluate the following:

i^{-63}.

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5. Evaluate the following:

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

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6. Evaluate the following:

$$\sqrt{-25} \times \sqrt{-81}.$$

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7. Evaluate the following:

$$\sqrt{-36} \times \sqrt{16}.$$

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8. Evaluate the following:

$4\sqrt{-4}+5\sqrt{-9}-3\sqrt{-16}.$

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9. Prove that : $1+i^{10}+i^{100}-i^{1000}=0.$

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10. Prove that : $i^{107}+i^{112}+i^{117}+i^{122}=0.$

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11. Prove that : $\left(1+i^{14}+i^{18}+i^{22}\right)$ is a real number .

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12. Prove that : $\left\{i^{17}-\left(\frac{1}{i}\right)^{34}\right\}^2=2i.$

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13. Prove that $i^n+i^{n+1}+i^{n+2}+i^{n+3}=0$, for all $n\in N$.

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14. Evaluate the following:

i^7.

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15. Write the following as complex numbers :

$\sqrt{-16}$.

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16. Write the following as complex numbers :

$-1-\sqrt{-5}$.

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17. Write the following as complex numbers :

$-b+\sqrt{-4ac}, (a, c > 0)$.

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18. Write the real and imaginary parts of the following complex numbers :

$7 + 3i.$

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19. Write the real and imaginary parts of the following complex numbers :

$0 + 7i.$

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20. Write the real and imaginary parts of the following complex numbers :

$\sqrt{5} + 0i.$

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21. Given : $a + ib = 2 - 3i$, find a and b.

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22. Find x and y such that 2x + 3iy and 2 + 9i represent the same complex number.

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23. Find x and y when : $(2y + 7) + (4 - 3x)i = 0$.

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24. Represent the following complex numbers in the complex plane : 1 + 2i.

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25. Represent the following complex numbers in the complex plane : 5- 7i.

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26. Represent the following complex numbers in the complex plane : 0+0i.

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27. Represent the following complex numbers in the complex plane : i.

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28. Write the complex numbers that represent the following points in the plane : (2, 3).

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29. Write the complex numbers that represent the following points in the plane : (0, 2).

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30. Write the complex numbers that represent the following points in the plane : $\left(-\frac{1}{2}, -\frac{1}{2}\right)$.

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31. Can two different points in the complex plane represent the same complex number ? Give reasons for your answer.

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32. If $z_1 = 2 + 3i$ and $z_2 = 3 + i$, plot the number $z_1 + z_2$.

Also show that : $|z_1| + |z_2| > |z_1 + z_2|$.

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33. Perform the indicated operations and write the result in the form x + iy :

$(-3-2i)+(-6+3i)$.

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34. Perform the indicated operations and write the result in the form x + iy :

$\left(\frac{1}{2}+\frac{7}{2}i\right)-\left(4+\frac{5}{2}i\right)$.

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35. Perform the indicated operations and write the result in the form x + iy :

$(1-2i)-i+(4-7i)-2i+(5i+3)$.

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36. Prove that $|z| = |-z|$

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37. Find real and imaginary parts of $\frac{1-i}{1+i}$.

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38. Write the following in the form x + iy :

$(3+2i)(2-i)$.

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39. Write the following in the form x + iy :

$$\frac{3+4i}{2-4i}.$$

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40. Simplify: $2i^2 + 6i^3 + 3i^{16} - 6i^{19} + 4i^{25}$

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41. Write the following in the form x + iy :

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

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42. Write the following in the form x + iy :

$$\frac{1}{-2+\sqrt{-5}}.$$

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43. Write the following in the form x + iy :

$$\frac{1}{1-\cos\theta+2i\sin\theta}.$$

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44. Change the complex number $\frac{1+7i}{(2-i)^2}$ into polar form.

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45. Reduce $\frac{1}{1-4i} - \frac{2}{1+i}$ in the form a + ib.

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46. Perform the indicated operation and give your answer in the form x + iy, where x and y are real numbers and $i = \sqrt{-1}$.

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

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47. Perform the indicated operation and give your answer in the form x + iy, where x and y are real numbers and $i = \sqrt{-1}$.

$\frac{5+2i}{-1+\sqrt{3}i}$.

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48. Perform the indicated operation and give your answer in the form x + iy, where x and y are real numbers and $i = \sqrt{-1}$.

$(\sqrt{5} - 7i)(\sqrt{5} - 7i)^2 + (-2 + 7i)^2$.

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49. Prove that :

$\left[\left(\frac{3 + 2i}{2 - 5i}\right) + \left(\frac{3 - 2i}{2 + 5i}\right)\right]$ is rational .

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50. Prove that :

$\left[\left(\frac{2 - 3i}{3 - 4i}\right)\left(\frac{2 + 3i}{3 + 4i}\right)\right]$ is real .

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51. Simplify : $(-1+2i)+\left(\frac{1}{2}-i\right)-\left(-2-\sqrt{-25}\right)$.

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52. If $\left(\frac{1+i}{1-i}\right)^{m}=1$, then find the least positive integral value of m.

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

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54. 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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55. Show that a real value of x will satisfy the equation $\frac{1 - ix}{1 + ix} = a - ib$ if $a^2 + b^2 = 1$, where a, b are real.

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56. If $y = \sqrt{x^2 + 6x + 8}$, then show that $(1 + iy)^{1/2} + (1 - iy)^{1/2} = \sqrt{2(x + 4)}$.

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57. If $a + ib = \frac{c+i}{c-i}$, where c is real, prove that $a^2 + b^2 = 1$ and $\frac{b}{a} = \frac{2c}{c^2-1}$.

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58. If $\frac{a+ib}{c+id} = x + iy$, show that : $x^2 + y^2 = \frac{a^2+b^2}{c^2+d^2}$.

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59. Find the conjugate and modules of complex number 7 -24i.

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60. Find the conjugate of $\frac{(3-2i)(2+3i)}{(1+2i)(2-i)}$.

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61. Prove that for any complex number z, the product $z\bar{z}$ is always a non-negative real number.

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62. Write the additive inverse of the complex number $-2+3i$.

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63. Find the additive inverse and reciprocal of complex number 3 -4i.

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64. Find the multiplicative inverse of the following : $3 + 2i$.

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65. Find the multiplicative inverse of the following : $(5 - 7i)^2$.

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66. Find the multiplicative inverse of $\frac{3 + 4i}{4 - 5i}$ and write it in the form a + ib.

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67. Find the value of $\sqrt{3 - 4i}$.

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68. Find the square roots of $-48-14i$.

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69. Find the square roots of : $\left(\frac{2+3i}{5-4i}+\frac{2-3i}{5+4i}\right)$.

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70. Find the square roots of : $x^2+\frac{1}{x^2}-\frac{4}{i}\left(x-\frac{1}{x}\right)-6$.

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

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

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73. If $z_1 = 3 + 4i$ and $z_2 = 12 - 5i$, verify : $|-z_1| = |z_1|$.

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74. If $z_1 = 3 + 4i$ and $z_2 = 12 - 5i$, verify : $|z_1 + z_2| < |z_1| + |z_2|$.

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75. If $z_1 = 3 + 4i$ and $z_2 = 12 - 5i$, verify : $|z_1 z_2| = |z_1||z_2|$.

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76. If z_1, z_2 are comples numbers 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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77. If z = x + iy and $w = \frac{1 - iz}{z - i}$, show that : $|w| = 1 \Rightarrow z$ is purely real.

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78. If $(1 + i)(1 + 2i)(1 + 3i).....(1 + ni) = (x + iy)$, then Show that : 2.5 .10 ..... $\left(1 + n^2\right) = x^2 + y^2$

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79. If α and β are different complex numbers with $|\beta| = 1$, then find $\left|\frac{\beta - \alpha}{1 - \overline{\alpha}\beta}\right|$.

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80. Express the following in polar form : $3 + 4i$.

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81. Express the following in polar form : $-4 + 4\sqrt{3}i$.

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82. Convert the following in the polar form : $\frac{1 + 7i}{(2 - i)^2}$.

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83. Express $\sin 50^\circ + i\cos 50^\circ$ in the polar form. Also find r and θ.

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84. Give the following product in polar form : $[2(\cos 0^\circ + i\sin 0^\circ)][4(\cos 90^\circ + i\sin 90^\circ)]$.

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85. Divide $12(\cos 150^\circ + i\sin 150^\circ)$ by $3(\cos 60^\circ + i\sin 60^\circ)$.

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86. Show that $arg.\ \bar{z} = 2\pi - arg.\ z$.

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87. Solve $x^2 + 3 = 0$

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88. Solve $x^2 + 3x + 5 = 0.$

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89. Solve the equation given below:- $27x^2 - 10x + 1 = 0$

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90. Solve $\sqrt{5}x^2 + x + \sqrt{5} = 0$

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91. Solve $x^2 - 7ix - 12 = 0$.

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92. Solve $ix^2 - x + 12i = 0$.

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93. Solve the equation : $x^2 - \left(3\sqrt{2} + 2i\right)x + 6\sqrt{2}i = 0$

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94. Solve the equation : $x^2 - (5 - i)x + (18 + i) = 0$

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Exercise

1. Evaluate the following:

i^{51}.

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2. Evaluate the following:

$\frac{1}{i}$.

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3. Evaluate the following:

i^{-71}.

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4. Evaluate the following:

$\left(i^{37}+\frac{1}{i^{67}}\right)$.

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5. Evaluate the following:

$\left[i^{18}+\left(\frac{1}{i}\right)^{25}\right]^{3}$.

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6. Evaluate the following:

$\sqrt{-81}$.

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7. Evaluate the following:

$\left(\sqrt{-2}\right)^6$.

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8. Evaluate the following:

$\sqrt{-25} \times \sqrt{-49}$.

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9. Evaluate the following:

$$\frac{2}{3} \times \sqrt{\frac{-9}{16}}.$$

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10. Evaluate the following:

$$\sqrt{\frac{-49}{25}} \times \sqrt{\frac{-1}{9}}.$$

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11. Evaluate the following:

$$\sqrt{-16} + 3\sqrt{-25} + \sqrt{-36} - \sqrt{-625}.$$

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12. Simplify : $\sqrt{\frac{-x}{16}} + \sqrt{\frac{-x}{25}} - \sqrt{\frac{-x}{36}}$, where x is a positive real number.

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13. Prove that :

$1 + i^2 + i^4 + i^6 = 0.$

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14. Prove that :

$i^{12} + i^{13} + i^{14} + i^{15} = 0.$

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15. Prove that :

$i^{104} + i^{109} + i^{114} + i^{119} = 0.$

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16. Prove that :

$\frac{1}{i} - \frac{1}{i^2} + \frac{1}{i^3} - \frac{1}{i^4} = 0.$

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17. Prove that :

$6i^{54} + 5i^{37} - 2i^{11} + 6i^{68} = 7i.$

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18. Prove that :

$$\frac{i^{592}+i^{590}+i^{588}+i^{586}+i^{584}}{i^{582}+i^{580}+i^{578}+i^{576}+i^{574}}=-1.$$

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19. Prove that :

$$(1-i)^2=-2i.$$

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20. Prove that :

$$(1+i)^4\times\left(1+\frac{1}{i}\right)^4=16.$$

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21. Find the value of $\left[i^{19}+\left(\frac{1}{i}\right)^{25}\right]^{2}$

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22. Prove that :

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

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

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24. Show that $\left(-\sqrt{-1}\right)^{4n+3} = i$, where n is a positive integer.

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25. Write the following as complex numbers :

$\sqrt{-27}$.

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26. Write the following as complex numbers :

$\sqrt{x}, (x > 0)$.

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27. Write the following as complex numbers :

$1 + \sqrt{-1}$.

Watch Video Solution

28. Write the following as complex numbers :

$4 - \sqrt{-5}$.

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29. Write the following as complex numbers :

$\frac{\sqrt{3}}{2} - \frac{\sqrt{-2}}{7}$.

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30. Write the real and imaginary parts of the following complex numbers :

7.

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31. Write the real and imaginary parts of the following complex numbers :

3i .

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32. Write the real and imaginary parts of the following complex numbers :

$\frac{\sqrt{5}}{7}i.$

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33. Write the real and imaginary parts of the following complex numbers :

$2 - \sqrt{2}i.$

Watch Video Solution

34. Write the real and imaginary parts of the following complex numbers :

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

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35. Write the real and imaginary parts of the following complex numbers :

$\sqrt{3} + \frac{\sqrt{2}}{76} i.$

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36. Write the real and imaginary parts of the following complex numbers :

$\sqrt{37} + \sqrt{-19}.$

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37. Write the real and imaginary parts of the following complex numbers :

$\frac{\sqrt{17}}{2} + \frac{2}{\sqrt{70}} i.$

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38. Find real numbers x and y such that $3x + 2iy - ix + 5y = 7 + 5i.$

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39. Find x and y such that 2x + 4iy and 2i represent the same complex number.

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40. Find x and y, if (3y - 2) +i(7-2x) = 0.

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41. Find the values of x and y if :

$3x + (2x - y)i = 6 - 3i.$

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42. Find the values of x and y if :

$3x + 5iy = 5i.$

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43. Find the values of x and y if :

$4x + i(3x - y) = 3 + i(-6).$

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44. Find the values of x and y if :

$$\left(\frac{3}{\sqrt{5}}x - 5\right) + 2\sqrt{5}yi = \sqrt{2}.$$

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45. Find the modulus and amplitude of the following :

$-1 + i.$

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46. Find the modulus and amplitude of the following :

$-1 - i\sqrt{3}.$

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47. Find the modulus and amplitude of the following :

$-\sqrt{3}+i.$

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48. Find the modulus and amplitude of the following :

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

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49. Find the modulus and amplitude of the following :

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

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50. If two complex numbers z_1, z_2 are such that $|z_1| = |z_2|$, is it then necessary that $z_1 = z_2$?

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51. Write the complex numbers that represent the following points in the plane : (0,0) .

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52. Write the complex numbers that represent the following points in the plane : (3,0) .

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53. Write the complex numbers that represent the following points in the plane : (- 1, 0).

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54. Write the complex numbers that represent the following points in the plane : (0, - 1).

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55. Write the complex numbers that represent the following points in the plane : (1, - 2).

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56. Write the complex numbers that represent the following points in the plane : (4, -1).

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57. Write the complex numbers that represent the following points in the plane : $\left(-\frac{1}{3}, \frac{1}{5}\right)$.

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58. Plot the following numbers on a complex number plane and find their absolute values :

1.

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59. Plot the following numbers on a complex number plane and find their absolute values :

5.

Watch Video Solution

60. Plot the following numbers on a complex number plane and find their absolute values :

2i.

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61. Plot the following numbers on a complex number plane and find their absolute values :

$\sqrt{-3}$.

Watch Video Solution

62. Plot the following numbers on a complex number plane and find their absolute values :

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

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63. Plot the following numbers on a complex number plane and find their absolute values :

$4-3i.$

Watch Video Solution

64. Plot the following numbers on a complex number plane and find their absolute values :

$-3+5i.$

Watch Video Solution

65. Plot the following numbers on a complex number plane and find their absolute values :

$-\frac{1}{2}-3i.$

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66. Plot the following numbers on a complex number plane and find their absolute values :

$\frac{\sqrt{3}}{2}+\frac{1}{2}i.$

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67. Plot all the complex numbers in the complex number plane whose absolute value is 4.

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68. For any complex number z, prove that : $-|z| \leq R_e(z) \leq |z|$.

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69. For any complex number z, prove that : $-|z| \leq I_m(z) \leq |z|$.

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70. Let $z_1 = 2 - 3i$ and $z_2 = 5 + 12i$, verify that :

$|z_1 + z_2| < |z_1| + |z_2|$.

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71. Let $z_1 = 2 - 3i$ and $z_2 = 5 + 12i$, verify that :

$|z_2 - z_1| > |z_2| - |z_1|$.

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72. In the following perform the indicated operations and write the result in the form x + iy:

$(5 + 4i) + (5 - 4i)$.

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73. In the following perform the indicated operations and write the result in the form x + iy:

$$-2i + \left(\frac{3}{2} - 4i\right).$$

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74. In the following perform the indicated operations and write the result in the form x + iy:

$$(4 + 3i) - (3 + 4i).$$

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75. In the following perform the indicated operations and write the result in the form x + iy:

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

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76. In the following perform the indicated operations and write the result in the form x + iy:

$$-(-1+i)+7i-5.$$

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77. Express the complex number given below in the form $a+ib$:- $(1-i)-(-1+i6)$

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78. Express the complex number given below in the form $a + ib$:- $3(7 + i7) + i(7 + i7)$

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79. In the following perform the indicated operations and write the result in the form x + iy:

$(7 - 2i) - (3 + 2i) + (7 + 8i)$.

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80. In the following perform the indicated operations and write the result in the form x + iy:

$(8+3\sqrt{8}i)+(5+2\sqrt{2}i)-(5+\sqrt{2}i)$.

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81. In the following perform the indicated operations and write the result in the form x + iy:

$3-4i+2i-(8+7i)$.

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82. In the following perform the indicated operations and write the result in the form x + iy:

$(7-2i)-(4+i)+(-3+5i)$.

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83. Express the complex number given below in the form $a + ib$:- $\left[\left(\frac{1}{3} + i\frac{7}{3}\right) + \left(4 + i\frac{1}{3}\right)\right] - \left(-\frac{4}{3} + i\right)$

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84. In the following perform the indicated operations and write the result in the form x + iy:

$\sqrt{3} + (\sqrt{3} - 2i) - (3 - 2i).$

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85. In the following perform the indicated operations and write the result in the form x + iy:

$i^3 + (6 + 3i) - (20 + 5i) + (14 + 3i).$

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86. Find the sum of : $\frac{2}{3}+\frac{5}{3}i,\ -\frac{2}{3}i$ and $\frac{-5}{4}-i$.

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87. Write the following in the form x + iy :

$(2i)^3$.

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88. Write the following in the form x + iy :

i^{-35}.

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89. Write the following in the form x + iy :

i^{-39}.

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90. Write the following in the form x + iy :

$(-i)(2i)\left(-\frac{1}{8}i\right)^3$.

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91. Write the following in the form x + iy :

$i^9 + i^{19}$.

Watch Video Solution

92. Write the following in the form x + iy :

$(5i)\left(\frac{-3}{5}i\right)$.

Watch Video Solution

93. Write the following in the form x + iy :

$(-5i)\left(\frac{1}{8}i\right)$.

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94. Write the following in the form x + iy :

$i + i^2 + i^3 + i^4$.

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95. Write the following in the form x + iy :

$i^4 + i^8 + i^{12} + i^{16}.$

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96. Write the following in the form x + iy :

$i + i^5 + i^9 + i^{13}.$

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97. Write the following in the form x + iy :

$i^9 + i^{10} + i^{11} + i^{12}.$

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98. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$(7 + 5i)(7 - 5i)$.

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99. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$(-5 + 3i)(8 - 7i)$.

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100. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real

numbers $i = \sqrt{-1}$:

$(-\sqrt{3} + \sqrt{-2})(2\sqrt{3} - i)$.

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101. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$(\sqrt{6} + 5i)\left(\sqrt{6} - \frac{i}{5}\right)$.

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102. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$(\sqrt{2} - \sqrt{3}i)^2$.

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103. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$(5 - 3i)^3$.

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104. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$(1 - i)^4$.

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105. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

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

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106. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

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

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107. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$3i^3\left(15i^6\right)$.

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108. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$(2 + 7i)^3$.

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109. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

Square of $\left(\frac{i}{1+i}\right)$.

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110. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

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

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111. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\left(-2 - \frac{i}{3}\right)^3.$$

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112. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$3(7 + 7i) + i(7 + 7i).$$

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113. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$(1 - i) - (-1 + 6i)$.

Watch Video Solution

114. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

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

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115. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\left[\left(\frac{1}{3} + \frac{7}{3}i\right) + \left(4 + \frac{i}{3}\right)\right] - \left(\frac{-4}{3} + i\right).$$

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116. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\frac{2 - 3i}{4 - i}.$$

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117. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\frac{2+3i}{-5-4i}.$$

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118. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\frac{1+i}{3+i}.$$

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119. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\frac{3+2i}{4-3i}.$$

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120. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\frac{5-3i}{6+i}.$$

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121. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

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

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122. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$(5+9i) \div (-3+4i).$$

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123. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\frac{-2-5i}{3-6i}.$$

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124. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\left[\left(\sqrt{5}+\frac{i}{2}\right)\left(\sqrt{5}-2i\right)\right] \div (6+5i).$$

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125. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

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

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126. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

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

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127. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\frac{1}{i^7}.$$

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128. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\frac{5 + \sqrt{2}i}{1 - \sqrt{2}i}.$$

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129. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

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

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130. Perform the following by the indicated operations. Express the result in the form x + iy,where x, y are real numbers $i = \sqrt{-1}$:

$$\frac{\left(3+\sqrt{5}i\right)\left(3-\sqrt{5}i\right)}{\left(\sqrt{3}+\sqrt{2}i\right)-\left(\sqrt{3}-\sqrt{2}i\right)}.$$

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131. Simplify : $\left(\sqrt{5}+7i\right)\left(\sqrt{5}-7i\right)^{3}$.

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132. Simplify : $(1+i)(2+3i)(3+4i)(4+5i)$.

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133. Simplify : $\left(1+i^{2}\right)+i^{4}+i^{6}$.

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134. Prove that $\left[\frac{\sqrt{7}+i\sqrt{3}}{\sqrt{7}-i\sqrt{3}}+\frac{\sqrt{7}-i\sqrt{3}}{\sqrt{7}+i\sqrt{3}}\right]$ is real.

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135. Compute : $\sqrt{-49}\left(2+\sqrt{-9}\right)$.

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136. Compute : $\left[2+\sqrt{-25}\right]-\left[3-\sqrt{-16}\right]+\left[1-\sqrt{-9}\right]$.

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

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138. Write the conjugates of the following :

$3 + i.$

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139. Write the conjugates of the following :

$3 - i.$

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140. Write the conjugates of the following :

$-\sqrt{5} - \sqrt{7}i.$

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141. Write the conjugates of the following :

$-\sqrt{5}i.$

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142. Write the conjugates of the following :

$\frac{4}{5}.$

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143. Write the conjugates of the following :

$49 - \frac{i}{7}.$

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144. Write the conjugates of the following :

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

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145. Write the conjugates of the following :

$(1+i)^2$.

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146. Write the conjugates of the following :

$(2+5i)^2$.

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147. Write the conjugates of the following :

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

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

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

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150. Find the reciprocal of : $7 + \sqrt{7}i$.

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151. Find the reciprocal of : $i - 5$.

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152. Find the complex number which when multiplied by

5 + 3i shall give 3 - 4i.

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153. Prove that : $z = \bar{z}$ iff z is real.

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154. Prove that : $z = -\bar{z}$ iff z is either zero or purely imaginary.

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155. Prove that:

$$R_e z = \frac{z + \bar{z}}{2}, I_m z = \frac{z - \bar{z}}{2i}.$$

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156. Prove that : the sum of a complex number and its conjugate is real.

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157. Prove that : the product of a complex number and its conjugate is real.

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158. Give an example to show that subtraction of complex numbers is not commutative.

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159. Find te sum and product of the complex numbers $z_1 = -\sqrt{3} + \sqrt{-2}, z_2 = 2\sqrt{3} - i.$

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160. If z_1, z_2 are $1-i, \ -2+4i$ respectively, find $I_m\left(\frac{z_1 z_2}{\overline{z_1}}\right)$.

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161. Find the values of x and y if :

$(x+iy)(1+i) = 1-i$ where $i = \sqrt{-1}$

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162. Find the values of x and y if :

$$\frac{(1+i)x-2i}{3+i} + \frac{(2-3i)y+i}{3-i} = i,$$

where $i = \sqrt{-1}$

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163. If $1+4\sqrt{3}i=(a+ib)^2$, prove that : $a^2-b^2=1$ and $ab=2\sqrt{3}$.

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164. Show that if a, b,c, d $\in$ R, $\overline{(a+ib)(c+id)}=(a-ib)(c-id)$.

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

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

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

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

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169. If $(x + iy)^3 = u + iv$, then show that : $\frac{u}{x} + \frac{v}{y} = 4\left(x^2 - y^2\right)$.

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170. Define addition and multiplication of two complex numbers z_1 and z_2. Hence show that :

$R_e(z_1 + z_2) = R_e(z_1) + R_e(z_2)$.

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171. Define addition and multiplication of two complex numbers z_1 and z_2. Hence show that :

$I_m(z_1 + z_2) = I_m(z_1) + I_m(z_2)$.

Watch Video Solution

172. Define addition and multiplication of two complex numbers z_1 and z_2. Hence show that :

$R_e(z_1 z_2) = R_e(z_1)R_e(z_2) - I_m(z_1)I_m(z_2)$.

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173. Define addition and multiplication of two complex numbers z_1 and z_2. Hence show that :

$I_m(z_1 z_2) = R_e(z_1) I_m(z_2) - I_m(z_1) R_e(z_2)$.

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174. Find the additive inverse of the complex number :

$-5 + 7i$.

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175. Find the additive inverse of the complex number :

$(\sqrt{6} + 5i)\left(\sqrt{6} - \frac{1}{5}i\right)$.

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176. Find the difference of the complex numbers : $z_1 = -3 + 2i$ and $z_2 = 13 - i$.

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177. Find the multiplicative inverse of the following complex numbers :

$4 - 3i$.

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178. Find the multiplicative inverse of the following complex numbers :

$2 - 3i.$

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179. Find the multiplicative inverse of the following complex numbers :

$7 + 11i.$

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180. Find the multiplicative inverse of the following complex numbers :

$-i.$

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181. Find the multiplicative inverse of the following complex numbers :

$\sqrt{5}+3i.$

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182. Find the multiplicative inverse of the following complex numbers :

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

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183. Find the multiplicative inverse of the product of complex numbers : $3+4i, 5-12i.$

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184. If z is any non-zero complex number, prove that the multiplicative inverse of z is $\frac{\bar{z}}{|z|^2}$. Hence express the following numbers in the form x + iy, where x , y $\in$ R : $\left(4-\sqrt{-9}\right)^{-1}$.

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185. If z is any non-zero complex number, prove that the multiplicative inverse of z is $\frac{\bar{z}}{|z|^2}$. Hence express the following numbers in the form x + iy, where x , y $\in$ R : $\frac{-3+2i}{4-5i}$.

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186. Find the square roots of the following :

$-32.$

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187. Find the square roots of the following :

$-32.$

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188. Find the square roots of the following :

$-36.$

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189. Find the square roots of the following :

$-144.$

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190. Find the square roots of the following :

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

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191. Find the square roots of the following :

$$-\frac{8}{729}.$$

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192. Explain the fallacy

$$-1 = i \times i = \sqrt{-1} \times \sqrt{-1} = \sqrt{(-1) \times (-1)} = \sqrt{1} = 1.$$

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193. Find the square roots of the following :

2i.

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194. Find the square roots of the following :

i.

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195. Find the square root of i.

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196. Find the square roots of the following :

$7 + 24i.$

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197. Find the square roots of the following :

$7 - 24i.$

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198. Find the square roots of the following :

$-7 - 24i.$

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199. Find the square roots of the following :

$-7+24i.$

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200. Find the square roots of the following :

$1-i.$

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201. Find the square roots of the following :

$1+i.$

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202. Find the square roots of the following :

$-3+5i.$

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203. Find the square roots of the following :

$-8-6i.$

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204. Find the square roots of the following :

$-4-3i.$

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205. Find the square roots of the following :

$-15-8i.$

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206. Find the square roots of the following :

$-8-6i.$

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207. Find the square roots of the following :

$5-12i.$

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208. Find the square roots of the following :

$3 - 4\sqrt{7}i.$

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209. Find the square roots of the following :

$4 + 6\sqrt{-5}.$

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210. Find the square roots of the following :

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

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211. Prove that $\left[4+3\sqrt{-20}\right]^{1/2}+\left[4-3\sqrt{-20}\right]^{1/2}=6.$

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212. Evaluate : x^2+4x+7 when $x=-2+\sqrt{-3}.$

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213. Evaluate : $2x^3-9x^2-10x+13$ when $x=3+\sqrt{5}.$

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214. Evaluate : $x^4-3x^3+3x^2+99x-95$ when $x=3-4i.$

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215. If $z_1 = 5 + 7i$ and $z_2 = 7 - 9i$,verify : $|-z_1| = |z_1|$.

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216. If $z_1 = 5 + 7i$ and $z_2 = 7 - 9i$,verify : $|z_1^2| = |z_1|^2$.

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217. If $z_1 = 5 + 7i$ and $z_2 = 7 - 9i$,verify : $|z_1 + z_2| < |z_1| + |z_2|$.

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218. If $z_1 = 5 + 7i$ and $z_2 = 7 - 9i$,verify : $|z_2 - z_1| > |z_2| - |z_1|$.

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219. If $z_1 = 5 + 7i$ and $z_2 = 7 - 9i$,verify : $|z_1 z_2| = |z_1||z_2|$.

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220. If $z_1 = 5 + 7i$ and $z_2 = 7 - 9i$,verify : $\left|\frac{z_1}{z_2}\right| = \frac{|z_1|}{|z_2|}$.

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221. If z is any complex number, prove that : $|z|^2 = |z^2|$.

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222. If $iz^3 + z^2 - z + i = 0$, then show that |z|=1.

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

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224. If $|z_1| = |z_2| = ...|z_n| = 1$, prove that : $|z_1 + z_2 + ... z_n| = \left|\frac{1}{z_1} + \frac{1}{z_2} + ... + \frac{1}{z_n}\right|$.

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225. If |z|=1, prove that $\frac{z-1}{z+1}(z \neq -1)$ is purely imaginary number. What will you conclude if z=1?

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226. If z_1 and $z_2(\neq 0)$ are two complex numbers, prove that : $|z_1 z_2| = |z_1||z_2|$.

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227. If z_1 and $z_2(\neq 0)$ are two complex numbers, prove that : $\left|\frac{z_1}{z_2}\right| = \frac{|z_1|}{|z_2|}, z_2 \neq 0.$

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228. Convert the following complex numbers in polar form :

$1 - i.$

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229. Convert the given complex number in polar form $-1 + i$

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230. Convert the following complex numbers in polar form :

$-1 - i.$

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231. Find the given complex number in polar form : -3

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232. Convert the complex numbers given below in the polar form: $\sqrt{3}+i$

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233. Express $1+i\sqrt{3}$ in polar form.

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234. Convert the following complex numbers in polar form :

i.

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235. Convert the following in the polar form: $\frac{1+3i}{1-2i}$

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236. Find the absolute values and arguments of following complex numbers :

$3(\cos 60^\circ + i\sin 60^\circ)$.

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237. Find the absolute values and arguments of following complex numbers :

$i\cos\frac{\pi}{6} + \sin\frac{\pi}{6}$.

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238. Find the absolute values and arguments of following complex numbers :

$1 - \cos\theta + i\sin\theta.$

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239. If two complex numbers z_1, z_2 are such that $|z_1| = |z_2|$, is it then necessary that $z_1 = z_2$?

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240. Give the following in polar form :

$\sin 120^\circ - i\cos 120^\circ.$

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241. Give the following in polar form :

$[2(\cos 210^\circ + i\sin 210^\circ)][4(\cos 120^\circ + i\sin 120^\circ)].$

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242. Give the following in polar form :

$[3(\cos 225^\circ + i\sin 225^\circ)][6(\cos 45^\circ + i\sin 45^\circ)].$

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243. Give the following quotients in polar form :

$$\frac{9(\cos 90^\circ + i\sin 90^\circ)}{3(\cos 45^\circ + i\sin 45^\circ)}.$$

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244. Give the following quotients in polar form :

$$\frac{7(\cos 135^\circ + i\sin 135^\circ)}{14(\cos 90^\circ + i\sin 90^\circ)}.$$

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245. Express the following in the polar form :

$1 + i.$

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246. Express the following in the polar form :

$-1 - i.$

Watch Video Solution

247. Express $1 + i\sqrt{3}$ in polar form.

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248. Express the following in the polar form :

$$\frac{-16}{1+\sqrt{3}i}.$$

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249. Show that for z $\in$ C, |z|=0 if and only if z=0.

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250. If z= x + iy, x, y real, prove that : $|x| + |y| \leq \sqrt{2}|z|$.

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251. Define addition and multiplication of two complex numbers z_1 and z_2. Hence show that :

$R_e(z_1 z_2) = R_e(z_1)R_e(z_2) - I_m(z_1)I_m(z_2)$.

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252. Define addition and multiplication of two complex numbers z_1 and z_2. Hence show that :

$I_m(z_1 z_2) = R_e(z_1)I_m(z_2) - I_m(z_1)R_e(z_2)$.

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253. If $z_1, z_2 \in C$, show that $(z_1 + z_2)^2 = z_1^2 + 2z_1 z_2 + z_2^2$.

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254. Prove that $|z_1 + z_2|^2 = |z_1|^2 + |z_2|^2$ if and only if $\left(\frac{z_1}{z_2}\right)$ is purely imaginary.

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255. Solve the following equation : $x^2 + 2 = 0$.

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256. Solve the following equation : $x^2 + x + 1 = 0$.

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257. Solve the following equation :- $2x^2 + x + 1 = 0$

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258. Solve the following equation :- $-x^2 + x - 2 = 0$

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259. Solve the following equation :- $x^2 + 3x + 5 = 0$

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260. Solve the following equation :- $x^2 - x + 2 = 0$

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261. Solve the following equation : $\sqrt{2}x^2 + x + \sqrt{2} = 0.$

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262. Solve the following equation : $\sqrt{3}x^2 - \sqrt{2}x + 3\sqrt{3} = 0.$

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263. Solve the following equation : $\sqrt{5}x^2 + x + \sqrt{5} = 0.$

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264. Solve the following equation :- $x^2 + x + \frac{1}{\sqrt{2}} = 0$

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265. Solve the following equation :- $x^2 + \frac{x}{\sqrt{2}} + 1 = 0$

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266. Solve the following equation : $x^2 + \frac{x}{2} + 1 = 0.$

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267. Solve the following equation : $x^2 - x + 1 + i = 0.$

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268. Solve the following equation : $x^2 - (2 + i)x = 1 - 7i.$

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269. Solve the following equation : $2x^2 + 3ix + 2 = 0.$

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270. Solve the following equation : $x^2 + 4ix - 4 = 0.$

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271. Solve the following equation : $x^2 - \left(3\sqrt{2} + 2i\right)x + 6\sqrt{2}i = 0.$

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272. Solve the following equation :

$x^2 - (3\sqrt{2} - 2i)x - 6\sqrt{2}i = 0.$

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273. Solve the following equation :

$2x^2 - (3 + 7i)x + (9i - 3) = 0.$

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274. Reduce $\left(\frac{1}{1-4i} - \frac{2}{1+i}\right)\left(\frac{3-4i}{5+i}\right)$ to the standard form .

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275. Convert the following in the polar form : $\frac{1+7i}{(2-i)^2}$.

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276. Convert the following in the polar form: $\frac{1+3i}{1-2i}$

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

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

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

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

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281. Find the modulus and argument of $\frac{1+2i}{1-3i}$.

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282. Convert $z=\frac{i-1}{\cos\frac{\pi}{3}+i\sin\frac{\pi}{3}}$ in polar form.

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

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284. If $(a+ib)(c+id)(e+\quad \text{if} \quad)(g+ih) = A+iB$, then show 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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285. If $z_1 = -3i$, $z_2 = 3+4i$ and $z_3 = 2-3i$, verify that $z_1(z_2+z_3) = z_1z_2 + z_1z_3$.

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

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287. If $a^2 + b^2 = 1$, prove that $\frac{1 + b + ia}{1 + b - ia} = b + ia$.

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288. Solve the equation given below:- $3x^2 - 4x + \frac{20}{3} = 0$

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289. Solve the equation given below:- $x^2 - 2x + \frac{3}{2} = 0$

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290. Solve the equation given below:- $27x^2 - 10x + 1 = 0$

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291. Solve the equation given below:- $21x^2 - 28x + 10 = 0$

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