# MATHS

# BOOKS - V PUBLICATION

# COMPLEX NUMBERS AND QUADRATIC EQUATIONS

## Question Bank

**1.** For what value of x and y

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

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**2.** Express the following in the form of a+ib:

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

(ii) $(-i)$

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

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**3.** Express $\left(-\sqrt{3}+\sqrt{-2}\right)\left(2\sqrt{3}-i\right)$ in the form of $a+ib$

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

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**5.** Find the multiplicative inverse of the following,

$2-3i$

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**6.** Express the following in the form a+ib

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

(ii) $(i)^{-35}$

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**7.** Express the following complex numbers in a+ib form. (a) (5i)$\left(-\frac{3}{5}i\right)$

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**8.** Express the following complex numbers in a+ib form. (b) $i^9 + i^{19}$

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**9.** Express the following complex numbers in a+ib form. (c ) $i^{-39}$

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**10.** Express the following in $a + ib$ form

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

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**11.** Express the following in $a + ib$ form

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

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**12.** Express the following in $a + ib$ form

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

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**13.** Express the following in a+ib form.

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

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

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**15.** Express the following in $a+ib$ form

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

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

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**17.** Find the multiplicative inverse of the following complex number 4-3i

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**18.** Express each of the complex number given in the question $\sqrt{5} + 3i$

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**19.** Express each of the complex number given in the question $-(i)$

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**20.** Express the following expression in form of $a + ib$: $\frac{\left(3 + i\sqrt{5}\right)\left(3 - i\sqrt{5}\right)}{\left(\sqrt{3} + \sqrt{2}(i)\right) - \left(\sqrt{3} - i\sqrt{2}\right)}$

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**21.** Represent the complex number $z = 1 + i\sqrt{3}$ in the polar form.

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**22.** Convert the complex number $\frac{-16}{1+i\sqrt{3}}$ into polar form.

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**23.** Find the modulus and argument of the following complex number $z = -1 - i\sqrt{3}$

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**24.** Represent each of the following numbers in polar form. $-\sqrt{3} + i$

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**25.** Convert the following complex numbers into polar form 1 - i

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**26.** Convert the following complex numbers into polar form -1 + i

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**27.** Convert the following complex numbers into polar form -1 -i

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**28.** Convert the following complex numbers into polar form -3

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**29.** Write polar form of the complex number $z = \sqrt{3} + i$

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**30.** express the complex number $i$ in the polar form.

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**31.** Solve $x^2 + 2 = 0$

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**32.** Solve: $x^2 + x + 1 = 0$

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**33.** Solve: $\sqrt{5}x^2 + x + \sqrt{5} = 0$

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**34.** Solve $x^2 + 3 = 0$

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**35.** Solve $2x^2 + x + 1 = 0$

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**36.** b^(2)-4 a c=1^(2)-4 xx 2 xx 1=1-8=-7'

'therefore' The solutions are given by 'x=(-1 pm sqrt(-7))/(2 xx 2)=(-1 pm sqrt(7) i)/(4)'.

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**37.** Solve: $-x^2 + x - 2 = 0$

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**38.** Solve $x^2 + 3x + 5 = 0$

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**39.** Solve: $x^2 - x + 2 = 0$

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**40.** Solve: $\sqrt{2}x^2 + x + \sqrt{2} = 0$

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**41.** Solve the equation $\sqrt{3}x^2 - \sqrt{2}x + 3\sqrt{3} = 0$

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**42.** Solve: $x^2 + x + \frac{1}{\sqrt{2}} = 0$

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**43.** Solve: $x^2 + \frac{x}{\sqrt{2}} + 1 = 0$

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**44.** Find the modulus and argument of the complex numbers:

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

(ii) $\frac{1}{1+i}$

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**45.**

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

A. $\pi$

B. $n\pi$

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

D. $2n\pi$

**Answer: B**

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**47.** Consider the complex number

$$\frac{i-1}{\cos\frac{\pi}{3}+i\sin\frac{\pi}{3}}$$

Convert into polar form.

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

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**49.** For any two complex numbers $z_1$ and $z_2$ prove that

$$Re(z_1 z_2) = Re(z_1)Re(z_2) - Im(z_1)Im(z_2)$$

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**50.** 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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**51.** 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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**52.** Convert the following in to the polar form $\frac{1 + 7i}{(2 - i)^2}$

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**53.** Solve the following equations

$$3x^2 - 4x + \frac{20}{3} = 0$$

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**54.** Solve the following equations

$$x^2 - 2x + \frac{3}{2} = 0$$

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**55.** Solve $27x^2 - 10x + 1 = 0$

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**56.** Solve the equation $21x^2 - 28x + 10 = 0$

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**57.** If $(z)_1 = 2 - i, \quad (z)_2 = 1 + i,$ find $\left| \frac{(z)_1 + (z)_2 + 1}{(z)_1 - (z)_2 + 1} \right|$

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**58.** 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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**59.** Let $z_1=2-i, z_2=-2+i$. Find Re $\left(\frac{z_1 z_2}{\bar{z}_1}\right)$

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**60.** Find the modulus and argument of the complex number $\frac{1+2i}{1-3i}$

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

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

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

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

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**65.** Find the number of non zero integral solutions of the equation $|1-i|^x = 2^x$

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**66.** If (a+ib) (c+id) (e+if) (g+ih) = A+iB, then show that

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

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

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

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**69.** Find the modulus of the following complex numbers

i) $1 + i \tan \alpha$

ii) $\tan \alpha - i$

iii) $1 - \sin \alpha + i \cos \alpha$

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**70.** Show that the images of the given complex numbers $3 + 2i, 5i, -3 + 2i$ and $-i$ form a square.

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**71.** Given that for any complex number z, $|z|^2 = z\bar{z}$ . Prove that $|z_1 + z_2|^2 + |z_1 - z_2|^2 = 2\left[|z_1|^2 + |z_2|^2\right]$ where $z_1$ and $z_2$ are any two complex numbers.

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**72.** Which of the following is true?

i) a) $|(z)_1 + (z)_2| \leq |(z)_1| + |(z)_2|$

b) $|(z)_1 - (z)_2| < |(z)_1| - |(z)_2|$

c) $|(z)_1 - (z)_2| > |(z)_1| + |(z)_2|$

ii) Find the product $(z)_1 \cdot (z)_2$ if $(z)_1 = 2 + 3i, (z)_2 = 3 + 2i$

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**73.** Represent the complex number $z = 1 + i$ in the polar form.

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**74.** If $\frac{5 + 6i}{3 + 4i} = x + iy$, then find the value of $x - y$.

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**75.** 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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**76.** If $z_1$ and $z_2$ are non -zero complex numbers, then show that $(z_1z_2)^{-1}=z_1^{-1}z_2^{-1}$

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**77.** If $|z+i| = |z-i|$, find $z$

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

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**79.** Convert the following complex numbers into polar form -1 -i

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**80.** Solve the quadratic equation $2x^2 - 4x + 3 = 0$ by using the general expression for the roots of a quadratic equation.