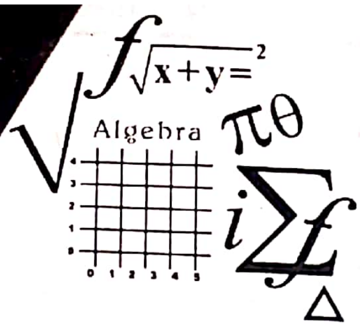


UNIT 1

NUMBER SYSTEMS

KEY POINTS

Rational Number:

A **rational number** is a number which can be put in the form $\frac{p}{q}$ where $p, q \in \mathbb{Z}$ and $q \neq 0$, e.g $\sqrt{16}, 5, \frac{1}{3}$

Set Builder Notation:

$$Q = \left\{x \mid x = \frac{p}{q} \text{ where } p, q \in \mathbb{Z} \wedge q \neq 0\right\}$$

Irrational Number:

Irrational numbers are those numbers which can not be put into the form of $\frac{p}{q}$ where $p, q \in \mathbb{Z}$ and $q \neq 0$ i.e $Q' = \left\{x \mid x \neq \frac{p}{q}, p, q \in \mathbb{Z} \wedge q \neq 0\right\}$

Terminating Decimals:

A decimal which has only a finite number of digits in its decimal part is called terminating decimal like 2.012 and 18.0932.

> Terminating decimal represents a rational number.

Recurring /Periodic Decimal:

A type of decimals in which one or more digits repeat indefinitely is called recurring decimal.
e.g. 1.232323… ….0.5555…etc.

> Every recurring decimal represents a rational number.

Non-Recurring, Non-terminating decimals:

A non-terminating, non-recurring decimal is a decimal which neither terminates nor it is recurring.
e.g. 3.141628732…
0.125289314…

> A non-terminating and non-recurring decimal always represents an irrational number.

> π is an irrational number.

> $\pi = \dfrac{\text{Circumference of any circle}}{\text{Length of diameter}}$

The Cartesian Plane:

The members of a cartesian product are **ordered pairs.**
The Cartesian products $\mathbb{R} \times \mathbb{R}$ where $\mathbb{R}$ is the set of real numbers is called the **cartesian plane.**

The Real Plane or The Coordinate Plane:

The geometrical plane on which coordinate system has been specified is called the **real plane** or the **coordinate plane**.

Note:

There is a (1 – 1) correspondence between $\mathbb{R}\times\mathbb{R}$ and the points of the plane. If a point A of the coordinate plane corresponds to the order pair (a,b) then a,b are called coordinates of A. a is called x-coordinate or abscissa and b is called y-coordinate or ordinate.

Complex Number:

A number of the form '$a+ib$' is called the Complex Number where 'a' is real part and 'b' is imaginary part and both are real numbers.

i.e $z=a+bi,\ a,b\in\mathbb{R}$

> Every real number is a complex number with 0 as its imaginary part.

Properties of the Fundamental operations on complex numbers:

If $z=(a,b)$ be a complex number, then

(i) $(0,0)$ is called the additive identity in z.

(ii) $(-a,-b)$ is called the additive inverse in z.

(iii) $(1,0)$ is called the multiplicative identity in z.

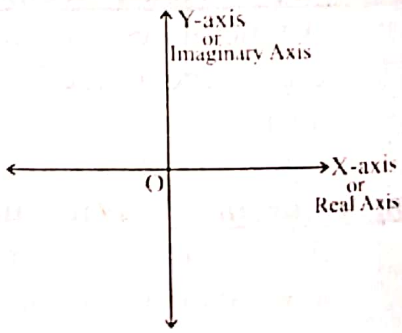
(iv) $\left(\dfrac{a}{a^2+b^2},\dfrac{-b}{a^2+b^2}\right)$ is called the multiplicative inverse of z.

Note:

There is a (1 – 1) correspondence between the elements (ordered pairs) of the Cartesian plane $\mathbb{R}\times\mathbb{R}$ and the complex numbers. Therefore, there is a (1 – 1) correspondence between the points of the coordinate plane and complex numbers.

The Complex Plane:

The components of the complex numbers will be the coordinates of the point representing it. In this representation the x-**axis** is called the **real axis** and the y-**axis** is called the **imaginary axis**. The coordinate plane itself is called the **complex plane** or z-**plane**.



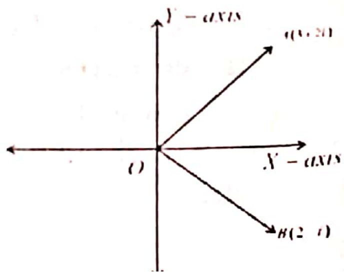
Conjugate Complex Numbers:

Complex number of the form $(a+bi)$ and $(a-bi)$ which have the same real parts and whose imaginary parts differ in sign only are called **conjugate** of each other.

> A real number is a self conjugate.

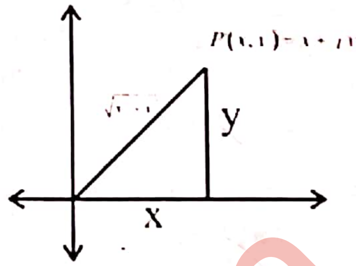
Argand Diagram:

The figure representing one or more than one complex numbers in complex plane is called **Argand diagram**.



Modulus of Complex Number:

The modulus of a complex number is the distance from the origin to the point representing the number.



$z = x + iy \quad\quad x, y \in \mathbb{R}$

$\Rightarrow |z| = \sqrt{x^2 + y^2}$

$|z| = \sqrt{\{Re(z)\}^2 + \{\text{Im}(z)\}^2}$

Theorems:

$\forall z \in C$

(i) $|-z| = |z| = |\bar{z}| = |-\bar{z}|$

(ii) $\bar{\bar{z}} = z$

(iii) $z.\bar{z} = |z|^2$

$\forall z_1, z_2 \in C$

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

(v) $\overline{\left(\frac{z_1}{z_2}\right)} = \frac{\bar{z}_1}{\bar{z}_2} \quad ; \quad z_2 \neq 0$

(vi) $|z_1.z_2| = |z_1||z_2|$ i.e. the modulus of the product of two complex numbers is equal to the product of their moduli.

(vii) $|z_1| - |z_2| \le |z_1 + z_2| \le |z_1| + |z_2|$ i.e. the modulus of the sum of two complex numbers is less than or equal to sum of the moduli of the numbers and grater then equal then to difference of the moduli of the numbers.

Note:

$|z_1 + z_2| \le |z_1| + |z_2|$ is the triangular inequality for complex numbers

Polar Form of a Complex Number:

Consider adjoining diagram representing the complex number $z = x + iy$. From the diagram, we see that

$x = r\cos\theta$ and $y = r\sin\theta$ where $r = |z|$

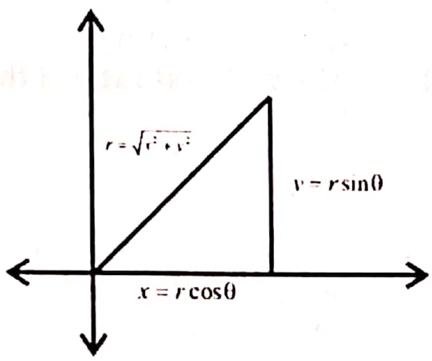
and θ is called argument of z.

Hence,

$x + iy = r(\cos\theta + i\sin\theta)$

Where

$r = \sqrt{x^2 + y^2}$ and $\theta = \tan^{-1}\left(\frac{y}{x}\right)$



De Moivre's Theorem:

$(\cos\theta + i\sin\theta)^n = \cos n\theta + i\sin n\theta, \ \forall n \in \mathbb{Z}$

Where θ is the argument of complex number.

TOPICAL MULTIPLE CHOICE QUESTIONS

Topic No 1.1 - 1.3

Introduction, Rational and Irrational Numbers, Properties of Real Numbers

(1) **The solution of the equation $x+a=b, \forall a>b\in Z$ lies in**
(a) Positive integers (b) Natural numbers
(c) Negative integers (d) Whole numbers

(2) **The solution of the equation $x+2=2$ is not contained in the set of**
(a) Integers (b) Rational numbers
(c) Natural numbers (d) Whole numbers

(3) **Zero is a/an**
(a) Odd integer (b) Irrational number
(c) Natural number (d) Even number

(4) $\sqrt{\frac{5}{16}}$ **is a/an**
(a) Rational number (b) Irrational number
(c) Real number (d) Integer

(5) **A number which can be written in the form of $\frac{p}{q}$ where $p, q\in Z$ and $q\neq 0$, is called**
(a) Rational number (b) Irrational number
(c) Real number (d) Complex number

(6) **The solution of the equation $x^2=2$ always lies in**
(a) Integers (b) Real number
(c) Irrational numbers (d) Rational number

(7) **Every recurring decimal represents**
(a) Rational number (b) Irrational number
(c) Non-terminating (d) Integer

(8) **Every non-terminating and non-recurring decimal represents**
(a) Rational number (b) Irrational number
(c) Real number (d) Complex number

(9) 2.3333.... **represents a/an**
(a) Rational number (b) Irrational number
(c) Real number (d) Complex number

(10) π **is __________ number**
(a) a rational (b) an irrational
(c) a terminating (d) a natural

(11) **The constant ratio of the circumference of any circle to the length of its diameter is**
(a) 2.7182 (b) π
(c) e (d) $\frac{7}{22}$

(12) 1.4142135 ... **is a/an __________ number.**
(a) Rational (b) Irrational
(c) Natural (d) Odd

(13) **If n is a perfect square, then $\sqrt{n}$ is**
(a) An irrational number (b) A rational number
(c) Always an even integer (d) Always an odd integer

(14) $\sqrt{n}$**, where n is prime, is a / an __________ number.**
(a) Rational (b) Irrational
(c) Real (d) Complex

(15) **Which of the following are binary operations?**

(a) $+ , \times$ (b) $+, \sqrt{\ }$

(c) $\times, \int$ (d) $+$, derivative

(16) $\forall a,b \in \mathbb{R} \Rightarrow a+b \in \mathbb{R}$, **the property used is**

(a) Closure (b) Associative

(c) Commutative (d) Reflexive

(17) **Which of the following sets has closure property with respect to addition?**

(a) $\{-1, 1\}$ (b) $\{-1\}$

(c) $\{1\}$ (d) $\{0\}$

(18) **Which of the following sets has closure property w.r.t multiplication?**

(a) $\{-1, 1\}$ (b) $\{-1\}$

(c) $\{-1, 0\}$ (d) $\{0, 2\}$

(19) $\forall a,b,c \in R,\ a+(b+c)=(a+b)+c$ **is called**

(a) Closure property (b) Associative property

(c) Commutative property (d) Distributive property

(20) **The additive inverse of a non – zero real number 'a' is**

(a) a (b) 0

(c) $-a$ (d) $\frac{1}{a}$

(21) **The multiplicative inverse of a non-zero real number 'a' is**

(a) 0 (b) a

(c) –a (d) $\frac{1}{a}$

(22) $\forall a,b \in R,\ \Rightarrow\ a+b=b+a$, **is called**

(a) Closure property (b) Associative property

(c) Commutative property (d) Distributive property

(23) $a(b-c)=ab-ac$ **is called**

(a) Multiplicative property

(b) Associative property with respect to multiplication

(c) Trichotomy property

(d) Distributive property of multiplication over subtraction

(24) **The left distributive property of real numbers is** $\forall a,b,c \in R$

(a) $a(b+c)=abc$ (b) $(a+b)c=ac+bc$

(c) $(b+c)a=ba+ca$ (d) $a(b+c)=ab+ac$

(25) **The reflexive property of equality of real numbers is** $\forall a \in R$

(a) $a=a$ (b) $a \neq a$

(c) $a<a$ (d) $a>b$

(26) $\forall a,b \in \mathrm{R}\quad a=b \Rightarrow b=a$, **the property used is**

(a) Reflexive (b) Symmetric

(c) Transitive (d) Trichotomy

(27) **The transitive property of equality of real numbers is** $\forall a,b,c \in R$

(a) $a=b \wedge b=c \Rightarrow a=c$ (b) $a=b \wedge b=c \Rightarrow a=-c$

(c) $a=b \wedge b=c \Rightarrow b=c$ (d) $a=b \wedge b=c \Rightarrow a=-b$

(28) **The cancellation property w.r.t. multiplication of equality of real numbers is** $\forall a,b,c \in R$

(a) $ac=bc \Rightarrow a=b, c \neq 0$ (b) $ac=bc \Rightarrow a=b, c=0$

(c) $ac=bc \Rightarrow a=c, c \neq 0$ (d) $ac=bc \Rightarrow a=c, c=0$

(29) $\forall\, a,b \in R$ either $a=b$ or $a>b$ or $a<b$, the property used is

(a) Transitive
(b) Trichotomy
(c) Reciprocal
(d) Reflexive

(30) The order additive property of real numbers is $\forall a,b,c \in R$

(a) $a<b \Rightarrow a+c<b$
(b) $a<b \Rightarrow a=b$
(c) $a<b \Rightarrow a+c<b+c$
(d) $a>b \Rightarrow a+c<b+c$

(31) $\forall a,b,c,d \in R$ a,b,c,d are all positive $a>b \wedge c>d \Rightarrow ac>bd$ is called

(a) Trichotomy property
(b) Transitive property
(c) Additive property
(d) Multiplicative property

(32) $\forall\, a,b \in R,\ a<b \Rightarrow \frac{1}{a} > \frac{1}{b}$ the property used is

(a) Trichotomy
(b) Inverse
(c) Reciprocal
(d) All

(33) $\forall a,b,c \in R$ and $c<0$, if $a>b \Rightarrow$

(a) $ac>bc$
(b) $ab<bc$
(c) $ac<bc$
(d) $ac=bc$

(34) $\forall a,b \in R,\ a>b \Rightarrow$

(a) $a<b$
(b) $-a \geq -b$
(c) $-a<-b$
(d) $\frac{1}{a} > \frac{1}{b}$

(35) If $-3<-2 \Rightarrow 0<1$ then property used is

(a) Reflexive property
(b) Transitive property
(c) Additive property
(d) All

(36) $\frac{a}{b} = \frac{c}{d} \Leftrightarrow ad=bc$ is called

(a) principle for equality of fractions
(b) rule for product of fractions
(c) golden rule of fractions
(d) rule for quotient of fractions

(37) $\frac{a}{b} = \frac{ka}{kb}, k \neq 0\ \forall\, a,b \in R$

(a) Principle of equality of fractions
(b) Rule for product of fractions
(c) Golden rule of fractions
(d) Quotient rule of fractions

(38) For all $a,b,c,d \in R, b \neq 0, d \neq 0, \frac{a}{b} + \frac{c}{d} =$

(a) $\frac{ac+bd}{bd}$
(b) $\frac{ab+cd}{bd}$
(c) $\frac{ad+bc}{bd}$
(d) $abcd$

Topic No 1.4

Complex Numbers

(39) The numbers of the form $x+iy$, where $x,y \in R$ and $i=\sqrt{-1}$ are called

(a) Complex numbers
(b) Natural numbers
(c) Real numbers
(d) Rational number

(40) In $z=a+ib \Rightarrow a,b \in$

(a) Q
(b) Q'
(c) Z
(d) R

(41) Every real number is a complex number with imaginary part as

(a) i (b) 0

(c) -1 (d) $-i$

(42) The real part of $\frac{2-5i}{7}$ is

(a) 2 (b) -5

(c) $\frac{-5}{7}$ (d) $\frac{2}{7}$

(43) The imaginary part of complex number $3+5\sqrt{-1}$ is

(a) $5\sqrt{-1}$ (b) 5

(c) $-5\sqrt{-1}$ (d) 3

(44) The real part of complex number $\frac{2-7i}{4+5i}$ is

(a) $-\frac{27}{41}$ (b) $-\frac{41}{27}$

(c) $\frac{27}{41}$ (d) $\frac{1}{2}$

(45) The imaginary part of i is

(a) 0 (b) i

(c) 1 (d) -1

(46) Which of the following does not satisfy the order axioms?

(a) Complex numbers (b) Real numbers

(c) Rational numbers (d) Integers

(47) For complex numbers $5+3i$ and $3+5i$, which of the following is true?

(a) $5+3i<3+5i$ (b) $5+3i>3+5i$

(c) $5+3i=3+5i$ (d) $|5+3i|=|3+5i|$

(48) Any complex number 'ai' can be written in ordered pair form as

(a) $(i,0)$ (b) $(0,a)$

(c) $(a,0)$ (d) $(a,1)$

(49) i can be written as

(a) $(1,0)$ (b) $(0,1)$

(c) $(-1,0)$ (d) $(0,-1)$

(50) $i^5=?$

(a) 1 (b) -1

(c) i (d) $-i$

(51) $(-1)^{\frac{-21}{2}}=?$

(a) i (b) $-i$

(c) -1 (d) 1

(52) $(7,9)+(3,-5)=$

(a) 14 (b) $(10,4)$

(c) $(10,-5)$ (d) $(4,10)$

(53) Product of a complex number and its conjugate is

(a) Real number (b) Complex number

(c) 0 (d) 1

(54) $(2,6)\ (3,7) =$

(a) $(32,36)$
(b) $(15,-9)$
(c) $(-36,32)$
(d) $(10,4)$

(55) The conjugate of a complex number $5\sqrt{-1}$ is

(a) $5\sqrt{-1}$
(b) $-5\sqrt{-1}$
(c) $5\sqrt{1}$
(d) -5

(56) Additive identity in complex numbers is

(a) $(0, 1)$
(b) $(0, -1)$
(c) $(1, 0)$
(d) $(0, 0)$

(57) For complex number (a,b) and $(c,d) \Rightarrow (a,b)+(c,d)=(0,0)$ then (a,b) and (c,d) are

(a) Additive inverse
(b) Conjugate
(c) Reciprocal
(d) Multiplicative inverse

(58) Which of the following is additive inverse of $(-8,5)$?

(a) $(8,-5)$
(b) $(8,5)$
(c) $(-8,-5)$
(d) $(-8,5)$

(59) Which of the following is multiplicative identity in complex numbers?

(a) $(0, 1)$
(b) $(0,-1)$
(c) $(1, 0)$
(d) $(-1,0)$

(60) The multiplicative inverse of (a,b) is

(a) $\left(\frac{a}{a^2+b^2}, \frac{b}{a^2+b^2}\right)$
(b) $\left(\frac{-a}{a^2+b^2}, \frac{-b}{a^2+b^2}\right)$
(c) $\left(\frac{a}{a^2+b^2}, \frac{-b}{a^2+c^2}\right)$
(d) $\left(\frac{a}{a^2+b^2}, \frac{-b}{a^2+b^2}\right)$

(61) The multiplicative inverse of $(-4,7)$ is

(a) $\left(\frac{-4}{65}, \frac{7}{65}\right)$
(b) $\left(\frac{-4}{65}, \frac{-7}{65}\right)$
(c) $\left(\frac{4}{65}, \frac{-7}{65}\right)$
(d) $\left(\frac{4}{65}, \frac{7}{65}\right)$

(62) Factors of a^2+4b^2 are

(a) $(a+2b)\ (a-2b)$
(b) $(a+2i)\ (a-2i)$
(c) $(a+2bi)\ (a-2bi)$
(d) $(a+2b)^2$

(63) For complex numbers the property used is
$(a,b)[(c,d)+(e,f)]=(a,b)(c,d)+(a,b)(e,f)$

(a) Multiplicative
(b) Distributive
(c) Associative
(d) Additive

Topic No 1.5 – 1.6

Real line & Geometrical Representation of Complex Numbers

(64) **If a point A of the coordinate plane corresponds to the ordered pair (a,b) then a, b are called**
(a) Abscissa (b) Ordinates
(c) Coordinates (d) All of these

(65) **The figure used to represent the complex number or complex plane is called**
(a) Real diagram (b) Argand diagram
(c) Complex diagram (d) Polar diagram

(66) **The modulus of complex number is the distance from __________ to the point representing the number.**
(a) Real axis (b) Imaginary axis
(c) Origin (d) Conjugate axis

(67) **If $z = x + iy$, then modulus of z is**
(a) $x^2 + y^2$ (b) $x^2 - y^2$
(c) $\sqrt{x^2 + y^2}$ (d) $\sqrt{x^2 - y^2}$

(68) **If $z = 3 + 4i$, then $|z| =$**
(a) 25 (b) 5
(c) -25 (d) -5

(69) **For complex number $z = \frac{2+i}{3+i}$, then $|z| =$**
(a) $\frac{5}{9}$ (b) $\frac{4}{9}$
(c) $\frac{1}{2}i$ (d) $\frac{1}{\sqrt{2}}$

(70) $\forall z \in C$, then $z.\bar{z} =$
(a) $|z|$ (b) $\bar{z}$
(c) $|z|^2$ (d) z^2

(71) **For complex numbers z_1 and z_2, $|z_1.z_2|$**
(a) $<|z_1||z_2|$ (b) $>|z_1||z_2|$
(c) $=|z_1||z_2|$ (d) All of these

(72) **Which of the following is triangular inequality in complex numbers?**
(a) $|z_1 + z_2| \le |z_1| + |z_2|$ (b) $|z_1 - z_2| \le |z_1| - |z_2|$
(c) $|z_1 + z_2| < |z_1| + |z_2|$ (d) $|z_1 - z_2| < |z_1| - |z_2|$

(73) **The polar form for complex number $z = x + iy$**
(a) $r\cos\theta + i\sin\theta$ (b) $r(\cos\theta + i\sin\theta)$
(c) $r(\sin\theta + i\cos\theta)$ (d) $r(\cos\theta - i\sin\theta)$

(74) **If $z = x + iy$, then Arg $(z) =$**
(a) $\tan\theta$ (b) $\frac{y}{x}$
(c) $\tan^{-1}\frac{y}{x}$ (d) $\tan^{-1}\frac{x}{y}$

(75) The argument of $(1,0)$ is

(a) 0 (b) π

(c) $\frac{\pi}{2}$ (d) $-\pi$

(76) The argument of i is

(a) 0° (b) π

(c) $\frac{\pi}{2}$ (d) $-\pi$

(77) The polar form of $1+\sqrt{3}i$ is

(a) $2(\cos 30^{\circ} + i\sin 30^{\circ})$ (b) $2(\cos 60^{\circ} + i\sin 60^{\circ})$

(c) $\cos 120^{\circ} + \sin 120^{\circ}$ (d) $2\left(\frac{1}{2} - \frac{\sqrt{3}\,i}{2}\right)$

(78) If $z = r^n(\cos\theta + i\sin\theta)^n$, $n \in Z$, then by De Moivre's theorem, $z =$

(a) $r^n(\cos n\theta - i\sin n\theta)$ (b) $r(\cos n\theta + i\sin n\theta)$

(c) $r^n(\cos n\theta + i\sin n\theta)$ (d) $r^n(\sin n\theta + i\cos n\theta)$

(79) The imaginary part of complex number $(\sqrt{3}+i)^3$ is

(a) 8 (b) -8

(c) 0 (d) $8i$

(80) $\forall z \in C, \bar{z} = z$ iff

(a) z is real (b) z is imaginary

(c) $z = 0$ (d) $a = 0,\ b = 0$

KIPS EXERCISE

(1) $\sqrt{2}$ is a/an ________ number

(a) Rational (b) Irrational

(c) Real (d) Complex

(2) $\forall a \in R, \exists 0 \in R$, such that $a + 0 = 0 + a = a$, then 0 is called

(a) Multiplicative identity (b) Identity

(c) Additive identity (d) Additive inverse

(3) $\forall a \in R, \exists -a \in R$ such that $a + (-a) = (-a) + a = 0$ then $-a$ is called

(a) Conjugate (b) Additive identity

(c) Additive inverse (d) Inverse

(4) $\forall a, b \in R, a.b \in R$ is called

(a) Closure law (b) Associative law

(c) Commutative law (d) Distributive law

(5) $\frac{a}{b}\frac{c}{d} = \frac{ac}{bd}$ is called

(a) Principle for equality of fraction (b) Rule for product of fractions

(c) Golden rule of fractions (d) Rule for quotient of fractions

(6) Which of the following sets is closed under addition and multiplication?

(a) $\{0\}$ (b) $\{1\}$

(c) $\{0, 1\}$ (d) $\{1, -1\}$

(7) $\dfrac{\frac{a}{b}}{\frac{c}{d}} = \dfrac{ad}{bc}$ is called

(a) Principle for equality of fraction
(b) Rule for product of fractions
(c) Golden rule of fractions
(d) Rule for quotient of fractions

(8) **Which of the following statements is true where $\mathbb{C}$ & $\mathbb{R}$ are sets of complex numbers and real numbers?**

(a) $C \supseteq R$
(b) $R \supseteq C$
(c) $C \subset R$
(d) $C \supset R$

(9) $i^{100} = ?$

(a) -1
(b) 1
(c) i
(d) $-i$

(10) **If $z = x + iy$ is a complex number then its conjugate is a number**

(a) Whose real part differ in sign by z
(b) Whose imaginary part differ in sign by z
(c) Whose both imaginary and real parts differ in sign by z
(d) Whose magnitude differ in sign by $|z|$

(11) **The product of two complex numbers $(8,-9)(5,6) =$**

(a) $(94,3)$
(b) $(-94,3)$
(c) $(94,-3)$
(d) $(94,-3)$

(12) **The non-zero complex number $(-8,-6)$ has its multiplicative inverse**

(a) $\left(-\dfrac{8}{100}, -\dfrac{6}{100}\right)$
(b) $\left(\dfrac{8}{100}, \dfrac{6}{100}\right)$
(c) $\left(-\dfrac{4}{50}, -\dfrac{3}{50}\right)$
(d) $\left(-\dfrac{4}{50}, \dfrac{6}{100}\right)$

(13) **Which of the following properties does not hold good in complex numbers?**

(a) Equality
(b) Order property
(c) Additive property
(d) Multiplicative property

(14) **For complex numbers $(a,b)(c,d) = (1,0)$ then (a,b) and (c,d) are**

(a) Multiplicative inverse of each other
(b) Conjugate of each other
(c) Absolute value of each other
(d) All of these

(15) **The polar form of complex no $\sqrt{3} + i$ is**

(a) $\cos 60^\circ + i \sin 60^\circ$
(b) $2\cos\theta + 2i\sin\theta$
(c) $2\cos 30^\circ + i2\sin 30^\circ$
(d) $2(\cos 60^\circ + i\sin 60^\circ)$

(16) **The multiplicative inverse of $(\sqrt{2}, -\sqrt{5})$ is**

(a) $\left(\dfrac{\sqrt{2}}{\sqrt{7}}, \dfrac{\sqrt{5}}{\sqrt{7}}\right)$
(b) $\left(\dfrac{\sqrt{2}}{\sqrt{7}}, \dfrac{-\sqrt{5}}{\sqrt{7}}\right)$
(c) $\left(\dfrac{\sqrt{2}}{7}, \dfrac{\sqrt{5}}{7}\right)$
(d) $(-\sqrt{2}, \sqrt{5})$

(17) $\frac{4}{2-2i} =$

(a) $1 - i$
(b) $1 + i$
(c) $-2i$
(d) i

(18) If $z = a + ib$, then $|\bar{z}| =$

(a) $\sqrt{a^2 - b^2}$
(b) $\sqrt{a^2 + (ib)^2}$
(c) $a^2 + b^2$
(d) $\sqrt{a^2 + b^2}$

(19) Modulus of complex number $3 - 4i$ is

(a) 4
(b) 5
(c) -5
(d) 0

(20) Which of the following is an expression for $\sqrt{-64} + \sqrt{-36}$ in the form $a + ib$, where a and b are real

(a) $0 + \sqrt{117}i$
(b) $0 + \sqrt{15}i$
(c) $0 + 3i$
(d) $0 + 14i$

(21) Geometrically, the modulus of a complex number represents its distance from the point

(a) (1, 0)
(b) (0, 1)
(c) (1, 1)
(d) (0, 0)

(22) If $z_1 = a + ib,\ z_2 = c + id$, then $|z_1 - z_2| =$

(a) $\sqrt{(a-b)^2 + (c-d)^2}$
(b) $\sqrt{(a-c)^2 + (b-d)^2}$
(c) $\sqrt{(a-d)^2 + (b-c)^2}$
(d) $\sqrt{(a-c)^2 - (b-d)^2}$

(23) $|-z| =$

(a) z
(b) $-z$
(c) $|z|$
(d) $-|z|$

(24) $\forall z_1, z_2 \in C, |z_1 + z_2|$

(a) $> |z_1| + |z_2|$
(b) $\leq |z_1| + |z_2|$
(c) $\leq z_1 + z_2$
(d) $> z_1 + z_2$

(25) $(5, -4) \div (-3, -8) =$

(a) $\left(\frac{73}{17}, \frac{73}{52}\right)$
(b) $\left(\frac{52}{73}, \frac{17}{73}\right)$
(c) $\left(\frac{17}{73}, \frac{52}{73}\right)$
(d) $(-15, 32)$

(26) $4a^2 + b^2 =$

(a) $(2a + b)(2a - b)$
(b) $(a + 2b)(a - 2b)$
(c) $(a + b)(a - b)$
(d) $(2a + ib)(2a - ib)$

(27) $\left|-\frac{1}{2} + \frac{\sqrt{3}i}{2}\right| =$

(a) 3
(b) 2
(c) 1
(d) 0

(28) $\frac{2-7i}{4+5i}=$

(a) $\frac{27}{41}+\frac{38i}{41}$
(b) $\frac{27}{41}-\frac{38i}{41}$
(c) $\frac{-27}{41}-\frac{38i}{41}$
(d) $2a+7i$

(29) If $z_1=1+2i,\ z_2=2+i$, then $Re(z_1+z_2)=$

(a) 4
(b) 3
(c) 2
(d) 1

(30) If $z_1=1+2i,\ z_2=2+i$, then $Img(z_1+z_2)=$

(a) 3
(b) $3i$
(c) 2
(d) $2i$

(31) $\forall a,b,c\in R,\ a=b\wedge b=c\Rightarrow a=c$ is called

(a) Reflexive property
(b) Symmetric property
(c) Transitive property
(d) Additive property

(32) $\forall a,b,c\in R, a<b\wedge b<c\Rightarrow a<c$ is called

(a) Trichotomy property
(b) Transitive property
(c) Additive property
(d) Multiplicative property

(33) $\forall a,b\in R,\ a>b\Rightarrow a+c>b+c$ is called

(a) Trichotomy propergy
(b) Transitive property
(c) Additive property
(d) Multiplicative property

(34) The solution of the equation $bx=a$, where $a,b\in Z$ and $b>1$ is possible in set of

(a) Rational numbers
(b) Integers
(c) Whole numbers
(d) Natural numbers

(35) $Q\cup Q'=$

(a) Z
(b) Q
(c) R
(d) Q'

(36) The property used in the inequality $-5<-4\Rightarrow 20>16$ is

(a) Additive property
(b) Multiplicative property
(c) Trichotomy property
(d) Transitive property

(37) $(0,3)(0,5)=$

(a) (0, 10)
(b) $(-15,0)$
(c) (10, 0)
(d) (0, 15)

(38) If $z=(1,0)$, then $|-\bar{z}|=$

(a) 1
(b) i
(c) -1
(d) $2i$

(39) $\forall z\in C$, then $\bar{\bar{z}}=$

(a) z
(b) z^{-2}
(c) $\frac{1}{z}$
(d) z^2

(40) The complex number $-5-6i$ lies in ________ quadrant

(a) 1st
(b) 2nd
(c) 3rd
(d) 4th

MULTIPLE CHOICE QUESTIONS
(From Past Papers 2012-2017)
(Lahore + Gujranwala Board)

(1) $\frac{22}{7}$ is (LHR 2012)
(a) Natural number (b) Whole number
(c) Rational number (d) Irrational number

(2) Multiplicative inverse of $-3i$ is (LHR 2012)
(a) $3i$ (b) $\frac{1}{3}i$
(c) $-\frac{1}{3}i$ (d) $-3i$

(3) $\sqrt{3}$ is a/an ________ number (LHR 2012)
(a) Rational (b) Irrational
(c) Prime (d) Even

(4) If $z=3+4i$, then $|z|=$ ______ (LHR 2012)
(a) 25 (b) 5
(c) -25 (d) -5

(5) $\sqrt{-1}$ is (GRW 2012)
(a) Real number (b) Natural number
(c) Rational number (d) Imaginary number

(6) $\left(z+\bar{z}\right)^2$ is (GRW 2012)
(a) Complex number (b) Real number
(c) Rational number (d) Irrational number

(7) $a>0\Rightarrow$ (LHR 2013)
(a) $-a<0$ (b) $2a<0$
(c) $\frac{1}{a}>0$ (d) $\frac{-1}{a}>0$

(8) Multiplicative inverse of $(1,0)$ is: (LHR 2013)
(a) $(-1,0)$ (b) $(0,-1)$
(c) $(0,1)$ (d) $(1,0)$

(9) $\{1,-1\}$ is closed with respect to: (GRW 2013)
(a) Addition (b) Multiplication
(c) Subtraction (d) None of these

(10) $\sqrt{-5}$ belongs to set of : (LHR 2014)
(a) Real number (b) Prime number
(c) Even number (d) Complex number

(11) Multiplicative inverse of -1 is; (LHR 2014)
(a) $-i$ (b) $-i$
(c) i (d) -1

(12) The additive inverse of 2 is (GRW 2014)
(a) 0 (b) 1
(c) -2 (d) $\frac{1}{2}$

(13) **Number** $0.1010010001\ldots$ **is a/an ________ number** (GRW 2014)
(a) Rational (b) Irrational
(c) Integer (d) Real terminating

(14) $(-i)^{19}$ **is equal to:** (LHR 2015)
(a) i (b) $-i$
(c) 1 (d) -1

(15) **Modulus of complex number** $3-4i$ **is:** (LHR 2015)
(a) 4 (b) 5
(c) -5 (d) 0

(16) **If** n **is a prime number than** $\sqrt{n}$ **is:** (GRW 2015)
(a) Rational number (b) Whole number
(c) Natural number (d) Irrational number

(17) **If** $z=1-i$ **than** $|z|=$ (LHR 2016)
(a) 2 (b) -2
(c) $-\sqrt{2}$ (d) $\sqrt{2}$

(18) **Multiplicative inverse of complex number** $(0,1)$ **is:** (LHR 2016)
(a) $(0,-1)$ (b) $(-1,0)$
(c) $(1,0)$ (d) $(1,1)$

(19) **The property** $\forall a \in \mathbb{R}, a=a$ **is called ….. property** (GRW 2016)
(a) Reflexive (b) Symmetric
(c) Transitive (d) Commutative

(20) **If** $z=3-4i$**, then** $|\bar{z}|$ **is:** (LHR 2017)
(a) 4 (b) 5
(c) -5 (d) 1

(21) $|a+bi|$ **is equal to:** (LHR 2017)
(a) $\sqrt{a^2+b^2}$ (b) $\sqrt{a^2-b^2}$
(c) $\sqrt{-a^2-b^2}$ (d) $\sqrt{b^2-a^2}$

(22) **If** Z **is a complex number then** $|z|^2$ **equals** (GRW 2017)
(a) z^2 (b) z^{-2}
(c) $z.\bar{z}$ (d) z

MULTIPLE CHOICE QUESTIONS
(From Past Papers 2012-2017)
(Faisalabad + Sargodha + Rawalpindi Board)

(1) **Conjugate of** $-2+3i$ **is** (FSD 2012)
(a) $-2-3i$ (b) $2-3i$
(c) $2+3i$ (d) $-2+3i$

(2) **The set** $\{0,1\}$ **is closed under** (FSD 2012)
(a) Addition (b) Multiplication
(c) Subtraction (d) Division

(3) $\sqrt{3}$ **is a/an ________ number.** (FSD 2013)

(4) Golden rule of fractions is that for $k \neq 0, \frac{a}{b} =$: (FSD 2014)

(a) $\frac{ab}{k}$ (b) $\frac{k}{ab}$

(c) $\frac{kb}{ka}$ (d) $\frac{ka}{kb}$

(5) If n is prime number, then $\sqrt{n}$ is: (FSD 2015)

(a) Integers (b) Natural number

(c) Rational number (d) Irrational number

(6) i^{17} is equal to: (FSD 2016)

(a) -1 (b) 1

(c) i (d) $-i$

(7) If $z = x + iy$ then $\tan\theta$ is (SGD 2012)

(a) $\frac{y}{x}$ (b) $\frac{x}{y}$

(c) $x + y$ (d) xy

(8) The multiplicative inverse of $(1,2)$ is (SGD 2012)

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

(c) $\frac{-1}{1+2i}$ (d) None of these

(9) If k is any real number than $k(a,b) =$ (SGD 2012)

(a) (ka, kb) (b) $\left(\frac{a}{k}, \frac{b}{k}\right)$

(c) (a,b) (d) $\left(\frac{k}{a}, \frac{k}{b}\right)$

(10) If $z = 3 + 4i$, then $|z|$ (SGD 2013)

(a) 5 (b) -5

(c) 25 (d) -25

(11) i^{101} is equal to: (SGD 2014)

(a) 1 (b) -1

(c) i (d) $-i$

(12) If $\sqrt{x}$ be an irrational number, then x belongs to the set of (SGD 2014)

(a) Natural number (b) Prime number

(c) Odd number (d) Even number

(13) For all $a,b,c \in \mathbb{R}, a = b \wedge b = c \Rightarrow a = c$ is called: (SGD 2015)

(a) Reflexive property (b) Symmetric property

(c) Transitive property (d) Additive property

(14) $\sqrt{2}$ is a/an ..... number: (SGD 2015)

(a) Rational (b) Irrational

(c) Prime (d) Complex

(15) The multiplicative inverse of complex number $(0,-1)$ is equal to: (SGD 2016)

(a) $(1,0)$ (b) $(0,1)$

(c) $(-1,0)$ (d) $(0,0)$

(16) Set of rational numbers is denoted by (RWP 2012)
(a) R (b) N
(c) Q (d) Q'

(17) Modulus of complex number $a+ib$ is (RWP 2012)
(a) a^2+b^2 (b) $\sqrt{a^2+b^2}$
(c) a^2-b^2 (d) $\sqrt{a^2-b^2}$

(18) $\sqrt{-1}$ belongs to set of (RWP 2013)
(a) Real numbers (b) Complex numbers
(c) Prime numbers (d) Even numbers

(19) The multiplicative inverse of non zero real no 'a' is (RWP 2014)
(a) 0 (b) a
(c) $-a$ (d) $\frac{1}{a}$

(20) Multiplicative inverse of $(1,0)$ is: (RWP 2015)
(a) $(-1,0)$ (b) $(0,1)$
(c) $(0,-1)$ (d) $(1,0)$

(21) If z is a complex number, then $|z|^2$ is: (RWP 2016)
(a) z^2 (b) $(\bar{z})^2$
(c) $z.\bar{z}$ (d) $\frac{z}{\bar{z}}$

(22) Modulus of $5-3i$ is: (FSD 2017)
(a) 4 (b) 16
(c) 34 (d) $\sqrt{34}$

(23) $\sqrt{-1}$ belongs to the set of (SGD 2017)
(a) Real (b) Complex
(c) Prime (d) Even

(24) $(z,+)$ has no identity other that: (RWP 2017)
(a) 1 (b) -1
(c) i (d) 0

(25) $\left|-\frac{1}{2}+\frac{\sqrt{3}}{2}i\right|$ equals: (RWP 2017)
(a) 3 (b) 2
(c) 1 (d) 0

MULTIPLE CHOICE QUESTIONS

(From Past Papers 2012-2017)

(D.G Khan + Bahawalpur/R.Y Khan + Multan Board + Sahiwal Board)

(1) The number $\frac{22}{7}$ is called a (MLT 2012)
(a) Irrational number (b) Rational number
(c) Integer (d) Natural number

(2) 'π' is a/an (MLT 2012)
(a) Rational number (b) Irrational number
(c) Integer (d) None of these

(3) **Every recurring and terminating decimal is:-** **(MLT 2013)**
(a) Rational number (b) Irrational number
(c) Integer (d) None of these

(4) **The additive identity of real numbers is:** **(MLT 2013)**
(a) 0 (b) 1
(c) 2 (d) 3

(5) **If $z = 3 - 4i$ then $|\bar{z}|$ is** **(MLT 2014)**
(a) 4 (b) 5
(c) –5 (d) 1

(6) $\left|-\frac{1}{2}+\frac{\sqrt{3}}{2}i\right| =$ **(MLT 2014)**
(a) 3 (b) 2
(c) 1 (d) 0

(7) **If n is a prime number than $\sqrt{n}$ is:** **(MLT 2015)**
(a) Rational number (b) Irrational number
(c) Prime number (d) Complex number

(8) **Modulus of complex number $a + ib$ equals:** **(MLT 2015)**
(a) $a^2 + b^2$ (b) $\sqrt{a^2 + b^2}$
(c) $a^2 - b^2$ (d) $\sqrt{a^2 - b^2}$

(9) **Modulus of $5 - 3i$ is:** **(MLT 2016)**
(a) 4 (b) 16
(c) 34 (d) $\sqrt{34}$

(10) **Modulus of $1 - i\sqrt{3}$ is equal to:** **(MLT 2016)**
(a) –2 (b) 2
(c) $-\sqrt{2}$ (d) $\sqrt{10}$

(11) $\forall\, a, b \in R$ **(Set of real numbers) $\Rightarrow$ $ab \in R$ is called** **(D.G.K 2012)**
(a) Closure law (b) Commutative law
(c) Associative law (d) Distributive law

(12) $(i)^{-10}$ **is equal to** **(D.G.K 2012)**
(a) 1 (b) $-i$
(c) –1 (d) i

(13) **The left distributive property of real number is that $\forall a, b, c \in R$** **(D.G.K 2013)**
(a) $a(b+c) = abc$ (b) $(a+b)c = ac + bc$
(c) $a(b+c) = 1$ (d) $a(b+c) = ab + ac$

(14) **i can be written as:** **(D.G.K 2013)**
(a) (1, 0) (b) (0, 1)
(c) $(-1, 0)$ (d) $(0, -1)$

(15) **The additive inverse of 2 is** **(D.G.K 2013)**
(a) 0 (b) 1
(c) –2 (d) $\frac{1}{2}$

(16) **Number .1010010001… is a/an** **(D.G.K 2014)**
(a) Rational (b) Irrational
(c) Integer (d) Real terminating

(17) **The additive inverse of 2 is** **(D.G.K 2014)**

(a) 0 (b) 1

(c) -2 (d) $\frac{1}{2}$

(18) **The multiplicative identity of real numbers is:** **(D.G.K 2015)**

(a) 0 (b) 1

(c) 2 (d) 3

(19) **The set $\{1,-1\}$ possess closure property under:** **(D.G.K 2016)**

(a) Addition (b) Multiplication

(c) Subtraction (d) Negation

(20) **Every non-recurring non terminating decimals represents:** **(D.G.K 2016)**

(a) Rational number (b) Irrational number

(c) Natural number (d) Whole number

(21) **Name the property which is used in inequality $-3<-2 \Rightarrow 0<1$** **(BWP 2012)**

(a) Additive property (b) Multiplicative property

(c) Both a and b (d) Reflexive

(22) **Modules of complex number $-5i$ is** **(BWP 2012)**

(a) ± 5 (b) -5

(c) $\sqrt{5}$ (d) 5

(23) **Union of set of Rational and Irrational Numbers is set of:** **(BWP 2013)**

(a) Whole Numbers (b) Complex Numbers

(c) Real Numbers (d) Natural Numbers

(24) **i^{14} equal to:** **(BWP 2014)**

(a) 1 (b) -1

(c) i (d) $-i$

(25) $(0,1)^2 =$ **(BWP 2015)**

(a) $(1,0)$ (b) $(-1,0)$

(c) $(0,1)$ (d) $(0,-1)$

(26) **Which of the following is not binary operation:** **(BWP 2016)**

(a) Addition (b) Division

(c) Multiplication (d) Square root

(27) a^2+b^2 has factors (SWL 2016)

(a) $(a+b)(a-b)$
(b) $(a+b)(a-ib)$
(c) $(a+ib)(a-ib)$
(d) $(a+ib)(a-b)$

(28) i^{14} equals to: (MLT 2017)

(a) 1
(b) -1
(c) i
(d) $-i$

(29) π is a: (MLT 2017)

(a) Whole number
(b) Natural number
(c) Rational number
(d) Irrational number

(30) If n is a prime number then $\sqrt{n}$ is equal to (D.G.K 2017)

(a) Rational
(b) Irrational
(c) Prime number
(d) Complex number

(31) $|Z|^2 =$ $\forall Z \in C$ (D.G.K 2017)

(a) Z^2
(b) $Z.\overline{Z}$
(c) $(\overline{Z})^2$
(d) Z

(32) $(-i)^{19}$ is equal to (B.W.P 2017)

(a) $-i$
(b) i
(c) 1
(d) -1

(33) Number $\frac{1}{\pi}$ is (S.W.L 2017)

(a) Rational
(b) Irrational
(c) Prime
(d) Whole

ANSWER KEYS

(Topical Multiple Choice Questions)

1	c	11	b	21	d	31	d	41	b	51	b	61	b	71	c
2	c	12	b	22	c	32	c	42	d	52	b	62	c	72	a
3	d	13	b	23	d	33	c	43	b	53	a	63	b	73	b
4	b	14	b	24	d	34	c	44	a	54	c	64	c	74	c
5	a	15	a	25	a	35	c	45	c	55	b	65	b	75	a
6	c	16	a	26	b	36	a	46	a	56	d	66	c	76	c
7	a	17	d	27	a	37	c	47	d	57	a	67	c	77	b
8	b	18	a	28	a	38	c	48	b	58	a	68	b	78	c
9	a	19	b	29	b	39	a	49	b	59	c	69	d	79	a
10	b	20	c	30	c	40	d	50	c	60	d	70	c	80	a

(KIPS Exercise)

1	b	11	a	21	d	31	c
2	c	12	d	22	b	32	b
3	c	13	b	23	c	33	c
4	a	14	a	24	b	34	a
5	b	15	c	25	c	35	c
6	a	16	c	26	d	36	b
7	d	17	b	27	c	37	b
8	d	18	d	28	c	38	a
9	b	19	b	29	b	39	a
10	b	20	d	30	a	40	c

(From Past Papers 2012-2017)
(Lahore + Gujranwala Board)

1	c	6	b	11	a	16	d	21	a
2	b	7	a	12	c	17	d	22	c
3	b	8	d	13	b	18	a		
4	b	9	b	14	a	19	a		
5	d	10	d	15	b	20	b		

(From Past Papers 2012-2017)
(Faisalabad + Sargodha + Rawalpindi Board)

1	a	6	c	11	c	16	c	21	c
2	b	7	a	12	b	17	b	22	d
3	b	8	a	13	c	18	b	23	b
4	d	9	a	14	b	19	d	24	d
5	d	10	a	15	b	20	d	25	c

(From Past Papers 2012-2017)
(D.G Khan + Bahawalpur/R.Y Khan + Multan Board)

1	b	6	c	11	a	16	b	21	a	26	d	31	b
2	b	7	b	12	c	17	c	22	d	27	c	32	b
3	a	8	b	13	d	18	b	23	b	28	b	33	b
4	a	9	d	14	b	19	b	24	b	29	d		
5	b	10	b	15	c	20	b	25	b	30	b		

KIPS SHORT QUESTIONS

Q.1 What are Rational and Irrational numbers?
Q.2 Define Terminating decimals.
Q.3 Define Recurring decimals.
Q.4 Define non-recurring and non-terminating decimals.
Q.5 Define Real numbers.
Q.6 State Closure property w.r.t Addition and Multiplication.
Q.7 State Associative law of Addition and Multiplication.
Q.8 State the Distributive property.
Q.9 State the Transitive property of equality.
Q.10 State the Trichotomy property.
Q.11 What is Field?
Q.12 State the Golden rule of fractions.
Q.13 Does the set $A=\{1,-1\}$ is closed w.r.t. addition and multiplication.
Q.14 Prove by Rules of addition $\frac{a}{c}+\frac{b}{c}=\frac{a+b}{c}$
Q.15 Simplify $\frac{4+16x}{4}$ by justifying each step.
Q.16 Prove that $a.0=0\ \forall a,b\in R$.
Q.17 Prove that $(-a)(b)=-ab$
Q.18 Prove the Rule for product of fractions.
Q.19 Define Complex numbers.
Q.20 What is conjugate of a Complex number?
Q.21 Find the sum, difference and product of the complex numbers (8, 9) and (5, −6).
Q.22 Simplify $(-1)^{\frac{-21}{2}}$
Q.23 Simplify $(-ai)^4, a\in R$.
Q.24 Simplify i^{100}
Q.25 Simplify (0, 3) (0, 5)
Q.26 Simplify $(5,-4)\div(-3,-8)$
Q.27 Find the multiplicative inverse of $(\sqrt{2},-\sqrt{5})$
Q.28 Find multiplicative inverse of complex number (−4, 7)
Q.29 Factorize: $9a^2+16b^2$
Q.30 Separate into real and imaginary parts $\frac{2-7i}{4+5i}$
Q.31 Separate into real and imaginary parts $\frac{(-2+3i)^2}{1+i}$
Q.32 Define Real and Complex coordinate system.
Q.33 What is meant by modulus of a Complex number?
Q.34 What is Argand diagram?
Q.35 Find the modulus of the Complex number $1-\sqrt{3}i$
Q.36 Prove that for Complex numbers $\overline{z_1+z_2}=\overline{z_1}+\overline{z_2}$
Q.37 Prove that for Complex numbers $\overline{\left(\frac{z_1}{z_2}\right)}=\frac{\overline{z_1}}{\overline{z_2}}, z_2\neq 0$.

Q.38 What is meant by Polar form of a Complex number?
Q.39 State De Moivre's theorem for Polar form of Complex numbers?
Q.40 Graph the Complex number $z=\frac{3}{5}-\frac{4}{5}i$ on the Complex plane.
Q.41 Show that $\left(z-\bar{z}\right)^2$ is a real number.
Q.42 Prove that $\bar{z}=z$ iff z is real.
Q.43 Express $\frac{3}{\sqrt{6}-\sqrt{-12}}$ in the form of $a+ib$.
Q.44 Show that $\forall z\in C,\ z^2+\bar{z}^2$ is a real number.
Q.45 Express the complex number $1-i\sqrt{3}$ in polar form.
Q.46 State triangular inequality of complex numbers.
Q.47 Simplify $(a+ib)^{-2}$.
Q.48 Find the real and imaginary parts of $\left(\sqrt{3}+i\right)^3$.
Q.49 Simplify $(a+bi)^2$.
Q.50 Simplify $\left(\frac{-1}{2}+\frac{\sqrt{3}}{2}i\right)^3$.

SHORT QUESTIONS

(From Past Papers 2013-2017)
(Lahore + Gujranwala Board)

(1) Name the properties used in the following equations:
(a) 4 + 9 = 9 + 4 (b) 1000 × 1 = 1000 **(LHR 2013)**
(2) Factorize: $9a^2+16b^2$. **(LHR 2013)**
(3) Prove that: $\frac{a}{b}=\frac{ka}{kb}, k\neq 0$ **(LHR 2013)**
(4) Simplify (7, 9) + (3, –5). **(LHR 2013)**
(5) Define the terms: rational number and irrational number. **(GRW 2013)**
(6) Does the set $\{0,-1\}$ possess closure property w.r.t addition and multiplication? **(GRW 2013)**
(7) Does $\{1\}$ possess closure property w.r.t. addition and multiplication? Justify. **(LHR 2014)**
(8) Prove that $z\bar{z}=|z|^2, \forall z\in C$ **(LHR 2014)**
(9) Simplify $(i)^{-3}$ **(LHR 2014)**
(10) Find multiplicative inverse. $\left(\sqrt{2},-\sqrt{5}\right)$ **(GRW 2014)**
(11) Find product of (8,9) and (5,–6). **(GRW 2014)**
(12) Find the multiplicative inverse of (–3,–5) **(GRW 2014)**
(23) Write any two properties of inequalities. **(LHR 2015)**
(24) Show that $\forall z\in C, z^2+\bar{z}^2$ is a real number. **(LHR 2015)**
(25) Find the multiplicative inverse of $(1,2)$. **(LHR 2015)**
(26) Simplify $(5,-4)\div(-3,-8)$. **(LHR 2015)**
(27) Simplify $(-i)^{19}$. **(GRW 2015)**
(28) Find multiplicative inverse of (2, 4). **(GRW 2015)**
(29) Name the property used in the inequality $-3<-2\Rightarrow 0<1$ **(GRW 2016)**

(30) Find the multiplicative inverse of $-3-5i$. (GRW 2016)

(31) Factorize : a^2+4b^2 (GRW 2016)

(32) Show that $\forall z \in C, z^2+\bar{z}^2$ is a real number. (LHR 2016)

(33) Show that $\frac{1}{a}.\frac{1}{b}=\frac{1}{ab}$ (LHR 2016)

(34) Find the sum and product of the complex numbers $(8,9)$ and $(5,-6)$. (LHR 2016)

(35) Find modulus of the complex number $1-i\sqrt{3}$. (LHR 2016)

(36) Prove that $\frac{1}{a}.\frac{1}{b}=\frac{1}{ab}$; justify each step. (LHR 2017)

(37) Factorize: $3x^2+3y^2$ (LHR 2017)

(38) Simplify: $\left(3-\sqrt{-4}\right)^{-3}$ (LHR 2017)

(39) Does the set $\{0,-1\}$ possess closure property with respect to: (LHR 2017)
(a) Addition (b) Multiplication

(40) Find multiplicative inverse of $a+bi$. (LHR 2017)

(41) Prove that $|z_1z_2|=|z_1||z_2| \ \forall z_1,z_2 \in C$. (LHR 2017)

(42) Simplify $\frac{4+16x}{4}$ by justifying each step. (GRW 2017)

(43) Find the multiplicative inverse of complex number $\left(\sqrt{2},-\sqrt{5}\right)$ (GRW 2017)

(44) Simplify $(-1)^{\frac{-21}{2}}$. (GRW 2017)

SHORT QUESTIONS

(From Past Papers 2013-2017)

(Faisalabad + Sargodha + Rawalpindi Board)

(1) What is multiplicative inverse of $2+3i$? (SGD 2013)

(2) Factorize: $3x^2+3y^2$ (SGD 2013)

(3) Simplify: $(-ai)^4, a \in R$ (SGD 2014)

(4) Define terms rational number and irrational number. (SGD 2014)

(5) Simplify: $(-1)^{\frac{-21}{2}}$ (SGD 2014)

(6) Separate real and imaginary parts of $\frac{2-7i}{4+5i}$ (SGD 2015)

(7) Find multiplicative inverse of $-3-5i$. (SGD 2015)

(8) If z be the complex number then prove that $\overline{z_1+z_2}=\bar{z}_1+\bar{z}_2$. (SGD 2015)

(9) Simplify $\frac{2}{\sqrt{5}-\sqrt{-8}}$ in the form $a+bi$. (SGD 2015)

(10) Define irrational numbers. (SGD 2016)

(11) Simplify $(-1)^{-\frac{21}{2}}$. (SGD 2016)

(12) Find multiplicative inverse of $(1,0)$ (SGD 2016)

(13) Find the multiplicative inverse of $(-4, 7)$ (RWP 2013)

(14) If $z \in C$, show that $z\bar{z}=|z|^2$ (RWP 2013)

(15) Show that $\forall z \in C, z.\bar{z}=|z|^2$ (RWP 2014)

(16) Does the set $\{1,-1\}$ possess closure property w.r.t addition and multiplication? **(RWP 2014)**

(17) Prove that rule of addition $\frac{a}{c}+\frac{b}{c}=\frac{a+b}{c}$. **(RWP 2015)**

(18) Simplify i^9 **(RWP 2015)**

(19) Find multiplicative inverse of $(1,0)$. **(RWP 2016)**

(20) Find real and imaginary parts of $\left(\sqrt{3}+i\right)^3$. **(RWP 2016)**

(21) Express $\frac{i}{1+i}$ in the form $a+ib$ **(FSD 2013)**

(22) Find multiplicative inverse of $1-2i$. **(FSD 2013)**

(23) Prove that $\frac{a}{c}+\frac{b}{c}=\frac{a+b}{c}$ **(FSD 2014)**

(24) Separate $\frac{i}{1+i}$ into real and imaginary parts. **(FSD 2014)**

(25) Separate real and imaginary parts of $\frac{2-7i}{4+5i}$ **(FSD 2015)**

(26) Find multiplicative inverse of $-3-5i$ **(FSD 2015)**

(27) Define rational numbers. **(FSD 2016)**

(28) Simplify: $(8,-5)-(-7,4)$ **(FSD 2016)**

(29) $\forall z\in C$, show that $z\bar{z}=|z|^2$ **(FSD 2016)**

(30) Prove that $-\frac{7}{12}-\frac{5}{18}=\frac{-21-10}{36}$ by principle equality of fractions. **(FSD 2017)**

(31) Simplify $(-1)^{-\frac{21}{2}}$. **(FSD 2017)**

(32) Express comlex number $1+i\sqrt{3}$ in polar form. **(FSD 2017)**

(33) Does the set $\{1,-1\}$ possess cloure property with respect to
(i) Addition (ii) Multiplication. **(SGD 2017)**

(34) Factorize: a^2+4b^2 **(SGD 2017)**

(35) Simplify: $(5,-4)\div(-3,-8)$ **(SGD 2017)**

(36) Simplify: $(5,-4)\div(-3,-8)$ **(RWP 2017)**

(37) Show that $\forall z\in C$, $z^2+\bar{z}^2$ is a real number. **(RWP 2017)**

(38) Simplify by justifying each step $\dfrac{\frac{1}{a}-\frac{1}{b}}{1-\frac{1}{a}\cdot\frac{1}{b}}$. **(RWP 2017)**

(39) Simplify $(a+ib)^3$. **(RWP 2017)**

(40) If $z=a+bi$, show that $(z-\bar{z})^2$ is real number. **(RWP 2017)**

(41) Does the set $\{0,-1\}$ have closure property with respect to addition and multiplication?

SHORT QUESTIONS

(From Past Papers 2013-2017)

(D.G Khan + Bahawalpur/R.Y Khan Board + Multan + Sahiwal)

(1) Prove that $\frac{a}{b}=\frac{c}{d}$ if $ad=bc$. (MTN 2013)

(2) Simplify: (2, 6) (3, 7). (MTN 2013)

(3) Find the multiplicative inverse of complex number (1, 2). (MTN 2013)

(4) Does the set $\{1, -1\}$ possess closure property with respect to addition and multiplication? (MTN 2013)

(5) Simplify and justify each step $\frac{\frac{1}{4}+\frac{1}{5}}{\frac{1}{4}-\frac{1}{5}}$ (MTN 2014)

(6) Factorize: $3x^2+3y^2$ (MTN 2014)

(7) Name the properties used in : $(a)4+9=9+4$, $(b)a-a=0$ (MTN 2014)

(8) Express $\left(2+\sqrt{-3}\right)\left(3+\sqrt{-3}\right)$ in the form of $a+bi$ (MTN 2014)

(9) Find modulus of $1-i\sqrt{3}$. (MTN 2015)

(10) Simplify by justifying each step $\frac{\frac{a}{b}+\frac{c}{d}}{\frac{a}{b}-\frac{c}{d}}$. (MTN 2015)

(11) Find multiplicative inverse of (–4,7) (MTN 2015)

(12) Separate $\frac{2-7i}{4+5i}$ into real and imaginary parts. (MTN 2015)

(13) Define rational numbers. (SWL 2016)

(14) Simplify: i^{-10}. (SWL 2016)

(15) Simplify: $(5,-4)\div(-3,-8)$ (SWL 2016)

(16) Simplify $\frac{2}{\sqrt{5}+\sqrt{-8}}$ by expressing in the form of $a+ib$ (MTN 2016)

(17) Factorize: a^2+4b^2. (MTN 2016)

(18) Write reflexive property of equality of real number. (MTN 2016)

(19) Name the property used in $a(b-c)=ab-bc$ (MTN 2016)

(20) Separate $\left(\frac{i}{1+i}\right)$ into real and imaginary part. (MTN 2016)

(21) Find the modulus of $-5i$. (DGK 2013)

(22) Find the multiplicative inverse of $-3-5i$ (DGK 2013)

(23) Express the complex number $1+i\sqrt{3}$ in polar form (DGK 2013)

(24) State De-Moivre theorem (DGK 2013)

(25) Find product of $(8,9),(5,-6)$. (DGK 2014)

(26) Find the multiplicative inverse of (–3,–5) (DGK 2014)

(27) Find multiplicative inverse of $\left(\sqrt{2},-\sqrt{5}\right)$. (DGK 2015)

(28) Find modulus of $1-i\sqrt{3}$ (DGK 2015)

(29) State Trichotomy property of real number. (DGK 2016)

(30) Simplify i^{101} . (DGK 2016)

(31) Simplify $(2,6)\div(3,7)$ (DGK 2016)

(32) State symmetric property of equality.

(33) Prove that : $z.\bar{z}=|z|^2$, $\forall z \in C$

(34) If $z_1=2+i$, $z_2=3-2i$, $z_3=1+3i$ then express $\frac{\bar{z}_1.\bar{z}_3}{z_2}$ in the form $a+ib$

(35) Find the Modulus of $3+4i$.

(36) Find multiplicative inverse. $(\sqrt{2},-\sqrt{5})$

(37) Does the set $\{0,-1\}$ possess closure property with respect to addition and

(38) Simplify i^{101}.

(39) Express the complex number $1+i\sqrt{3}$ in polar form.

(40) Show that $\forall z \in C, z^2+\bar{z}^2$ is a real number.

(41) Name the property used in $a(b-c)=ab-bc$

(42) Separate $\left(\frac{i}{1+i}\right)$ into real and imaginary part.

(43) Simplify by justifying each step $\frac{\frac{1}{a}-\frac{1}{b}}{1-\frac{1}{a}\cdot\frac{1}{b}}$

(44) Simplify $\frac{2}{\sqrt{5}+\sqrt{-8}}$ by expressing in the form $a+bi$.

(45) Simplify $(5,-4)\div(-3,-8)$.

(46) Does the set $\{0,-1\}$ have closure property with respect to
(i) Addition (ii) Multiplication.

(47) Show that $\forall Z \in C$, where $z+(\bar{z})^2$ is real number.

(48) Factorize: $9a^2+16b^2$

(49) Factorize: a^2+4b^2

(50) Simplify $(5,-4)\div(-3,-2)$.

(51) Prove that $-\frac{7}{12}-\frac{5}{18}=\frac{-21-10}{36}$

(52) Simplify by justifying each step $\frac{\frac{1}{4}+\frac{1}{5}}{\frac{1}{4}-\frac{1}{5}}$.

(53) Separate into real and imaginary parts $\frac{2-7i}{4+5i}$.

(54) Prove that $\bar{Z}=Z$ iff Z is real.

(55) Separate into real and imaginary parts $\frac{i}{1+i}$:

(56) State Trichotomy property and Transitive property of inequality.

(57) If $z_1=2+i$, $z_2=3-2i$, $z_3=1+3i$ then express $\frac{\bar{z}_1\bar{z}_3}{z_2}$ in the form $a+bi$.

(58) Does the set $\{1,-1\}$ possess closure property with respect to addition.

(59) Show that $\forall Z \in C$, where $(z-\bar{z})^2$ is real number.

(60) Factorize: $9a^2+16b^2$

(From Past Papers 2013-2017)
(D.G Khan + Bahawalpur/R.Y Khan Board + Multan + Sahiwal)

(1) Prove that $\frac{a}{b}=\frac{c}{d}$ if $ad=bc$. (MTN 2013)
(2) Simplify: (2, 6) (3, 7). (MTN 2013)
(3) Find the multiplicative inverse of complex number $(1, 2)$. (MTN 2013)
(4) Does the set $\{1,-1\}$ possess closure property with respect to addition and multiplication? (MTN 2013)
(5) Simplify and justify each step $\frac{\frac{1}{4}+\frac{1}{5}}{\frac{1}{4}-\frac{1}{5}}$ (MTN 2014)
(6) Factorize: $3x^2+3y^2$ (MTN 2014)
(7) Name the properties used in : $(a)\,4+9=9+4$, $(b)\,a-a=0$ (MTN 2014)
(8) Express $\left(2+\sqrt{-3}\right)\left(3+\sqrt{-3}\right)$ in the form of $a+bi$ (MTN 2014)
(9) Find modulus of $1-i\sqrt{3}$. (MTN 2015)
(10) Simplify by justifying each step $\frac{\frac{a}{b}+\frac{c}{d}}{\frac{a}{b}-\frac{c}{d}}$. (MTN 2015)
(11) Find multiplicative inverse of $(-4,7)$ (MTN 2015)
(12) Separate $\frac{2-7i}{4+5i}$ into real and imaginary parts. (MTN 2015)
(13) Define rational numbers. (SWL 2016)
(14) Simplify: i^{-10}. (SWL 2016)
(15) Simplify: $(5,-4)\div(-3,-8)$ (SWL 2016)
(16) Simplify $\frac{2}{\sqrt{5}+\sqrt{-8}}$ by expressing in the form of $a+ib$ (MTN 2016)
(17) Factorize: a^2+4b^2. (MTN 2016)
(18) Write reflexive property of equality of real number. (MTN 2016)
(19) Name the property used in $a(b-c)=ab-bc$ (MTN 2016)
(20) Separate $\left(\frac{i}{1+i}\right)$ into real and imaginary part. (MTN 2016)
(21) Find the modulus of $-5i$. (DGK 2013)
(22) Find the multiplicative inverse of $-3-5i$ (DGK 2013)
(23) Express the complex number $1+i\sqrt{3}$ in polar form (DGK 2013)
(24) State De-Moivre theorem (DGK 2013)
(25) Find product of $(8,9),(5,-6)$. (DGK 2014)
(26) Find the multiplicative inverse of $(-3,-5)$ (DGK 2014)
(27) Find multiplicative inverse of $\left(\sqrt{2},-\sqrt{5}\right)$. (DGK 2015)
(28) Find modulus of $1-i\sqrt{3}$ (DGK 2015)
(29) State Trichotomy property of real number. (DGK 2016)
(30) Simplify i^{101} . (DGK 2016)
(31) Simplify $(2,6)\div(3,7)$ (DGK 2016)

(32) State symmetric property of equality. (DGK 2016)

(33) Prove that : $z.\overline{z}=|z|^2$, $\forall z \in C$ (DGK 2016)

(34) If $z_1=2+i$, $z_2=3-2i$, $z_3=1+3i$ then express $\frac{\overline{z_1}.\overline{z_3}}{z_2}$ in the form $a+ib$ (BWP 2013

(35) Find the Modulus of $3+4i$. (BWP 2013

(36) Find multiplicative inverse. $(\sqrt{2},-\sqrt{5})$ (BWP 2013

(37) Does the set $\{0,-1\}$ possess closure property with respect to addition and multiplicatio (BWP 2014

(38) Simplify i^{101}. (BWP 2014)

(39) Express the complex number $1+i\sqrt{3}$ in polar form. (BWP 2015)

(40) Show that $\forall z \in C, z^2+\overline{z}^2$ is a real number. (BWP 2016)

(41) Name the property used in $a(b-c)=ab-bc$ (BWP 2016

(42) Separate $\left(\frac{i}{1+i}\right)$ into real and imaginary part. (BWP 2016

(43) Simplify by justifying each step $\frac{\frac{1}{a}-\frac{1}{b}}{1-\frac{1}{a}\cdot\frac{1}{b}}$ (MLT 201

(44) Simplify $\frac{2}{\sqrt{5}+\sqrt{-8}}$ by expressing in the form $a+bi$. (MLT 2017

(45) Simplify $(5,-4)\div(-3,-8)$. (MLT 2017

(46) Does the set $\{0,-1\}$ have closure property with respect to
(i) Addition (ii) Multiplication. (MLT 2017

(47) Show that $\forall Z \in C$, where $z+(\overline{z})^2$ is real number. (MLT 2017

(48) Factorize: $9a^2+16b^2$ (MLT 2017

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(50) Simplify $(5,-4)\div(-3,-2)$. (D.G.K 201

(51) Prove that $-\frac{7}{12}-\frac{5}{18}=\frac{-21-10}{36}$ (D.G.K 201

(52) Simplify by justifying each step $\frac{\frac{1}{4}+\frac{1}{5}}{\frac{1}{4}-\frac{1}{5}}$. (D.G.K 201

(53) Separate into real and imaginary parts $\frac{2-7i}{4+5i}$. (D.G.K 201

(54) Prove that $\overline{Z}=Z$ iff Z is real. (D.G.K 201

(55) Separate into real and imaginary parts $\frac{i}{1+i}$: (BWP 2017

(56) State Trichotomy property and Transitive property of inequality. (BWP 2017

(57) If $z_1=2+i$, $z_2=3-2i$, $z_3=1+3i$ then express $\frac{\overline{z_1}\,\overline{z_3}}{z_2}$ in the form $a+bi$. (BWP 2017

(58) Does the set $\{1,-1\}$ possess closure property with respect to addition. (SWL 2017

(59) Show that $\forall Z \in C$, where $(z-\overline{z})^2$ is real number. (SWL 2017

(60) Factorize: $9a^2+16b^2$ (SWL 2017