arride learning

BASIC-I

Contents

Syllabus

Number system, Modulus & Polynomial

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Number System :

(I) Natural Number

Numbers 1,2,3,4,... etc. are known as natuaral numbers. It is denoted by the symbol N. It can also be denoted by I^+ or Z^+. $N = \{1, 2, 3, 4, ...\}$

(II) Whole Numbers

All natural numbers along with zero are known as whole numbers. It is denoted by the symbol W. They are also known as non-negative numbers. $W = \{0, 1, 2, ...\}$

(III) Integers

The numbers -----3, -2, -1, 0, 1, 2, 3..... are known as integers. They are denoted by I or Z.
I or Z = {...-3,-2,-1,0,1,2,3.....}

(a) Positive integers are denoted by I^+ = {1,2,3.....}

(b) Negative integers are denoted by I^- = {.......,-3,-2,-1}

(c) The set of non-negative integers is {0,1,2,....}

(d) The set of non-positive integers is {......,-3,-2,-1,0}

(IV) Even Integers

Integers divisible by 2 are known as even integers. For example, $0, \pm 2, \pm 4, ...$

(V) Odd Integers

Integers which are not divisible by 2 are known as even integers. For example, $\pm 1, \pm 3, \pm 5, \pm 7.........$

(VI) Prime Number

The natural numbers which are divisible by 1 or itself are known as prime numbers. For example, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31

(VII) Composite Number

The natural numbers which are not prime are known as composite numbers.

Note : (i) '1' is neither prime nor composite.
(ii) '2' is the only even number which is prime.
(iii) '4' is the least composite number.

(VIII) Co-prime Number

Two numbers are coprime if their HCF is 1. For example, (3,4), (3,10), (3,8), (5,6), (7,8) etc.

Note : (i) Two consecutive numbers are always coprime.
(ii) Two distinct prime numbers are always coprime but vice-versa is not true.

(IX) Twin Prime

If the difference between two prime numbers is 2 then they are known as twin prime numbers. For example, {3,5}, {5,7}, {11,13}, {17,19}, {29,31}

(X) Rational Numbers

The numbers that can be written in the form p/q where p and q are integers and $q \neq 0$, are known as rational numbers. The set of rational numbers is denoted by Q.

$$Q = \{\frac{p}{q} : p, q \in I \text{ and } q \neq 0\}$$

Note : (i) Every integer is rational as they can be expressed as p/1.
(ii) The rational number are either terminating decimal or non-terminating repeating decimal.

(XI) Irrational Numbers

The numbers which cannot be expressed in the form p/q are known as irrational numbers. The set is denoted by Q^C. For example, $\sqrt{2}, 1+\sqrt{3}, e, \pi$ etc

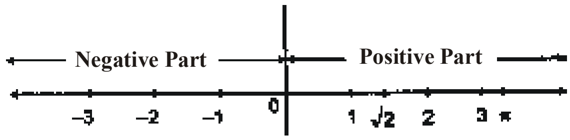
Note : Irrational numbers non-terminating, non-repeating decimals.

(XII) Real Numbers

All rational and irrational numbers are known as real numbers. The set of real numbers is denoted by R.

$$R = Q \cup Q^C.$$

Every real number lies on a line known as real line. In other words, every point on the real line is real.



Real Line or Number Line

Every such numbers can be compared, i.e., if a and b are two distinct numbers then either a < b or a < b.

Note : (a) All integers are rational but vice-versa is not true.

(b) Negative of any irrational number is irrational.

(c) The sum and difference of a rational and irrational is irrational.

(d) The product and quotient of a non-zero rational and irrational number is irrational.

(e) The product and quotient of two irrational numbers may be rational or irrational.

(XIII) Complex Number

The numbers that can be written in the form a+ib are known as complex numbers. Here, a and b are real and $i = \sqrt{-1}$ is called 'iota'. The set of complex numbers is denoted by C.

Note : $N \subset W \subset I \subset Q \subset R \subset C$

Divisibility Test :

(i) Any number is divisible by 2 if the digit at unit place is divisible by 2.
(ii) Any number is divisible by 3 if the sum of its digits is divisible by 3.
(iii) Any number is divisible by 4 if the number formed its last two digits is divisible by 4.
(iv) Any number is divisible by 5 if the digit at unit place is 0 or 5.
(v) Any number is divisible by 6 if it is divisible by both 2 and 3.
(vi) Any number is divisible by 8 if the number formed its last three digits is divisible by 8.
(vii) Any number is divisible by 9 if the sum of its digits is divisible by 9.
(viii) Any number is divisible by 10 if the digit at unit place is 0.
(ix) Any number is divisible by 11 if the difference of the sum of its digits at even and odd places is divisible by 11. For example, 1298,1221, 12344321, 1234554321, 1234566654231

Remainder Theorem :

Let p(x) be a polynomial of degree 1 or more. Let a be any real number. If p(x) is divided by (x-a) then the remainder is p(a).

Factor Theorem :

Let p(x) be a polynomial of degree 1 or more. Let a be any real number such that p(a) = 0 then (x-a) is a factor of p(x). Also if (x-a) is a factor of p(x) then p(a) = 0.

Some Important Formulae :

(1) $(a+b)^2 = a^2 + 2ab + b^2 = (a-b)^2 + 4ab$

(2) $(a-b)^2 = a^2 - 2ab + b^2 = (a+b)^2 - 4ab$

(3) $a^2 - b^2 = (a+b)(a-b)$

(4) $(a+b)^2 = a^3 + b^3 + 3ab(a+b)$

(5) $(a-b)^2 = a^3 + b^3 + 3ab(a-b)$

(6) $a^3 + b^3 = (a+b)^3 - 3ab(a+b) = (a+b)(a^2 + b^2 - ab)$

(7) $a^3 - b^3 = (a-b)^3 + 3ab(a-b) = (a-b)(a^2 + b^2 + ab)$

(8) $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca = a^2 + b^2 + c^2 + 2abc\left(\frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right)$

(9) $a^2 + b^2 + c^2 - ab - bc - ca = \frac{1}{2}[(a-b)^2 + (b-c)^2 + (c-a)^2]$

(10) $a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ca) = \frac{1}{2}(a+b+c)[(a-b)^2 + (b-c)^2 + (c-a)^2]$

(11) $a^4 - b^4 = (a+b)(a-b)(a^2 + b^2)$

(12) $a^4 + a^2 + 1 = (a^2+1)^2 - a^2 = (1 + a + a^2)()1 - a + a^2)$

Indices :

If a be any non-zero real or imaginary number and m be positive integer then $a^m = a.a.a......a(m\ \text{times})$ where m is known as index and a is known as base.

Law of indices

(1) $a^0 = 1, \quad (a \neq 0)$

(2) $a^{-m} = \frac{1}{a^m}, \qquad (a \neq 0)$

(3) $a^{m+n} = a^m .\ a^n$ where m and n are real.

(4) $a^{m-n} = \frac{a^m}{a^n}, a \neq 0$ where m & n are real.

(5) $(a^m)^n = a^{mn}$

(6) $a^{p/q} = \sqrt[q]{a^p}$

Ratio :

1. If A and B are two numbers of same type then their ratio is represented by A : B and is equal to $\frac{A}{B}$

2. Any ratio can be represented as $\frac{a}{b} = \frac{ma}{mb} = \frac{na}{nb} = ...$ where m and n are real numbers.

3. To compare two ratios their denominators should be same.

4. The ratio of two integers can be expressed as ratio, i.e., $\frac{a}{b} : \frac{c}{d} : \frac{a/b}{c/d} = \frac{ad}{bc}$ or $ad : bc$, etc.

5. The ratios can be multiplied to combine, i.e., $\frac{a}{b}.\frac{c}{d}.\frac{e}{f}..... = \frac{ace}{bdf}....$

Proportion :

If two ratios a:b and c:d are equal then the numbers a,b,c,d are said to be proportional. If $\frac{a}{b}=\frac{c}{d}$ then a:b=c:d or a : b : : c : d.

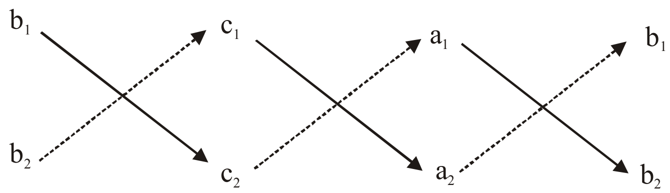
1. a and d are known as exterior and b and c are interio quantities.
2. Product of exteriors = Product of interiors
3. If a:b = c:d then b:a = d:c
4. If a:c = b:d then a:c = b:d
5. If a:b = c:d then $\frac{a+b}{b}=\frac{c+d}{d}$
6. If a:b = c:d then $\frac{a-b}{b}=\frac{c-d}{d}$
7. If a:b = c:d then $\frac{a+b}{a-b}=\frac{c+d}{c-d}$

Cross multiplication :

Two equations in three variables are as follows:

$$a_1x+b_1y+c_1z=0 \quad ....(i)$$
$$a_2x+b_2y+c_2z=0 \quad ....(ii)$$

then by cross multiplication, $$\frac{x}{b_1c_2-b_2c_1}=\frac{y}{c_1a_2-c_2a_1}=\frac{z}{a_1b_2-a_2b_1} ....(iii)$$



Intevals :

Intervals are the subsets of R and are used to express the solutions of inequation or the domain of functions. If a and b are two real numbers such that a<b then following four intervals can be defined-

Intervals	**Symbols**
(i) Open Interval : $(a,b)=\{x : a<x<b\}$	( ) or][
(ii) Closed Interval : $[a,b]=\{x : a\le x\le b\}$	[ ]
(iii) Open-Closed Interval : $(a,b]=\{x : a<x\le b\}$	( ] or]]
(iv) Closed-Open Interval : $[a,b)=\{x : a\le x<b\}$	[ ) or [[

Infinite intervals may be as follows :

(i) $(a,\infty)=\{x : x>a\}$

(ii) $[a,\infty)=\{x : x\ge a\}$

(iii) $(-\infty,b)=\{x : x<b\}$

(iv) $(-\infty,b]=\{x : x\le b\}$

(v) $(-\infty,\infty]=\{x : x\in R\}$

Note : (i) For some values of x we can use the brackets {}. For example, If x = 1,2 then $x\in\{1,2\}$

(ii) If there is no value of x then we write $x\in\phi$ (null set)

Various Types of functions :

(I) Polynomial fucutions :

If a function f is defined as $f(x)=a_0x^n+a_1x^{n-1}+a_2x^{n-2}+...+a_{n-1}x+a_n$ where n is a non-negative integers and $a_0, a_1, ..., a_n$ are real and $a_0 \neq 0$ then f is known as a polynomial function of degree n.

Note : If two polynomial functions are such that $f(x), f(1/x)=f(x)+f(1/x)$, then $f(x)=1\pm x^n$

(II) Constant function :

Function $f:A\to B$ is a constant function if the image of every element of A is a constant in set B. Therefore, $f:A\to B; f(x)=c, \forall x\in A, c\in B$ is constant function.

(III) Identity function :

The function $f:A\to A, f(x)=x\forall x\in A$ is an identity function in A and is denoted by I_A .

(IV) Algebraic Fuctions :

y is an algebraic function of x if it satisfies the equation

$P_0(x)y^n+P_1(x)y^{n-1}+.......+P_{n-1}(x)y+P_n(x)=0$ where n is a positive polynomial and $P_0(x), P_1(x).....$ are the polynomials in x. For example, $y=|x|$ is an algebraic function as it satisfies the relation $y^2-x^2=0$.

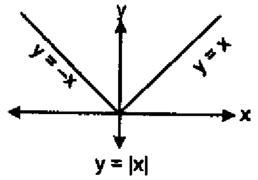
Note : (i) All polynomial functions are algebraic but vice-versa is not true.
(ii) The functions which are not algebraic are nown as non-algebraic.

(V) Rational Fuction :

A function of the form $y=f(x)=\frac{g(x)}{h(x)}$, is known as rational function where g(x) and h(x) are polynomial functions and $h(x)\neq 0$.

(VI) Absolute Value Function/ Modulus Fuction :

$f(x)=|x|$ is known as modulus function and is defined as $y=|x|=\begin{cases} x & \text{if} \quad x\geq 0 \\ -x & \text{if} \quad x<0 \end{cases}$



Properties of Modulus Function :

If $a, b\in R$ then

(i) $|a|\geq 0$ (ii) $|a|=|-a|$ (iii) $|a|\geq a, |a|\geq -a$ (iv) $|ab|=|a||b|$

(v) $\left|\frac{a}{b}\right|=\frac{|a|}{|b|}$ (vi) $|a+b|\leq |a|+|b|$ (vii) $|a-b|\geq ||a|-|b||$

Determinant :

The symbol $\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}$ is called the determinant of order two.

Its value is given by: $D = a_1 b_2 - a_2 b_1$

Expansion of Determinant :

The symbol $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ is called the determinant of order three.

Its value can be found as: $D = a_1 \begin{vmatrix} b_2 & c_2 \\ b_3 & c_3 \end{vmatrix} - a_2 \begin{vmatrix} b_1 & c_1 \\ b_3 & c_3 \end{vmatrix} + a_3 \begin{vmatrix} b_1 & c_1 \\ b_2 & c_2 \end{vmatrix}$ **OR**

$D = a_1 \begin{vmatrix} b_2 & c_2 \\ b_3 & c_3 \end{vmatrix} - b_1 \begin{vmatrix} a_2 & c_2 \\ a_3 & c_3 \end{vmatrix} + c_1 \begin{vmatrix} a_2 & b_2 \\ a_3 & b_3 \end{vmatrix}$ ... & so on.

In this manner we can expand a determinant in 6 ways using elements of;
R_1, R_2, R_3 or C_1, C_2, C_3.

Minors :

The minor of a given element of a determinant is the determinant of the elements which remain after deleting the row & the column in which the given element stands. For example, the minor of a_1 in

$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ is $\begin{vmatrix} b_2 & c_2 \\ b_3 & c_3 \end{vmatrix}$ & the minor of b_2 is $\begin{vmatrix} a_1 & c_1 \\ a_3 & c_3 \end{vmatrix}$.

Hence a determinant of order two will have "4 minors" & a determinant of order three will have "9 minors".

Cofactor :

Cofactor of the element a_{ij} is $C_{ij} = (-1)^{i+j} \cdot M_{ij}$; Where i & j denotes the row & column in which the particular element lies.

Note that the value of a determinant of order three in terms of 'Minor' & 'Cofactor' can be written as: $D = a_{11}M_{11} - a_{12}M_{12} + a_{13}M_{13}$ **OR**

$D = a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13}$ & so on.

Transpose of a Determinants :

The transpose of a determinant is a determinant obtained after interchanging the rows & columns of it.

$$D = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} \Rightarrow D^T = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$$

EXERCISE # 1

PART - I : OBJECTIVE QUESTIONS

*** Marked Questions are having more than one correct option.**

1. Which of the following statement is incorrect :
(A) rational number + rational number = rational number
(B) irrational number + rational number = irrational number
(C) integer + rational number = rational number
(D) irrational number + irrational number = irrational number

2 If x, y are rational numbers such that $(x + y) + (x - 2y)\sqrt{2} = 2x - y + (x - y - 1)\sqrt{6}$ then :
(A) x = 1, y = 1 (B) x = 2, y = 1
(C) x = 5, y = 1 (D) x & y can take infinitely many values

3*. The difference of squares of two distinct odd natural numbers is always a multiple of :
(A) 4 (B) 3 (C) 6 (D) 8

4. The number of real roots of the equation $(x - 1)^2 + (x - 2)^2 + (x - 3)^2 = 0$ is :
(A) 0 (B) 1 (C) 2 (D) 3

5. Let $x \in Q$, $y \in Q^c$, then which of the following statement is always WRONG?
(A) $xy \in Q^c$ (B) $y/x \in Q$, whenever defined
(C) $\sqrt{2}x + y \in Q$ (D) $x/y \in Q^c$, whenever defined

6. If $x + \frac{1}{x} = 2$, then $x^2 + \frac{1}{x^2}$ is equal to
(A) 0 (B) 1 (C) 2 (D) 3

7. If a, b, c are real, then $a(a - b) + b(b - c) + c(c - a) = 0$, only if :
(A) a + b + c = 0 (B) a = b = c
(C) a = b or b = c or c = a (D) a – b – c = 0

8. If a, b, c are real and distinct numbers, then the value of $\frac{(a-b)^3+(b-c)^3+(c-a)^3}{(a-b).(b-c).(c-a)}$ is :
(A) 1 (B) a b c (C) 2 (D) 3

9. If (x – a) is a factor of $x^3 - a^2x + x + 2$, then 'a' is equal to
(A) 0 (B) 2 (C) –2 (D) 1

10. The polynomials $P(x) = kx^3 + 3x^2 - 3$ and $Q(x) = 2x^3 - 5x + k$, when divided by $(x - 4)$ leave the same remainder. The value of k is

(A) 2 (B) 1 (C) 0 (D) –1

11. If $2x^3 - 5x^2 + x + 2 = (x - 2)(ax^2 - bx - 1)$, then a & b are respectively :

(A) 2, 1 (B) 2, – 1 (C) 1, 2 (D) – 1, 1/2

12. If x, y are integral solutions of $2x^2 - 3xy - 2y^2 = 7$, then value of $|x + y|$ is :

(A) 2 (B) 4 (C) 6 (D) 2 or 4 or 6

13. The complete set of values of x which satisfy in the equations :

$5x + 2 < 3x + 8$ and $\frac{x+2}{x-1} < 4$ is :

(A) $(-\infty, 1)$ (B) $(2, 3)$ (C) $(-\infty, 3)$ (D) $(-\infty, 1) \cup (2, 3)$

14. The complete solution set of the inequality $\frac{x^4 - 3x^3 + 2x^2}{x^2 - x - 30} \geq 0$ is :

(A) $(-\infty, -5) \cup (1, 2) \cup (6, \infty) \cup \{0\}$ (B) $(-\infty, -5) \cup [1, 2] \cup (6, \infty) \cup \{0\}$

(C) $(-\infty, -5] \cup [1, 2] \cup [6, \infty) \cup \{0\}$ (D) None of these

15. If $\frac{6x^2 - 5x - 3}{x^2 - 2x + 6} \leq 4$, then the least and the highest values of $4x^2$ are :

(A) 0 & 81 (B) 9 & 81 (C) 36 & 81 (D) none of these

16. Solution of $|4x + 3| + |3x - 4| = 12$ is

(A) $x = -\frac{7}{3}, \frac{3}{7}$ (B) $x = -\frac{5}{2}, \frac{2}{5}$ (C) $x = -\frac{11}{7}, \frac{13}{7}$ (D) $x = -\frac{3}{7}, \frac{7}{5}$

17. The number of real roots of the equation $|x|^2 - 3|x| + 2 = 0$ is :

(A) 1 (B) 2 (C) 3 (D) 4

18. The minimum value of $f(x) = |x - 1| + |x - 2| + |x - 3|$ is equal to :

(A) 1 (B) 2 (C) 3 (D) 0

19. If $|x^2 - 2x - 8| + |x^2 + X - 2| = 3|x + 2|$, then the set of all real values of x is :

(A) $[1, 4] \cup \{-2\}$ (B) $[1, 4]$ (C) $[-2, 1] \cup [4, \infty)$ (D) $(-\infty, -2] \cup [1, 4]$

20. The equation $||x - 1| + a| = 4$ can have real solutions for x if 'a' belongs to the interval :

(A) $(-\infty, 4]$ (B) $(0, 4)$ (C) $(4, +\infty)$ (D) $[4, 14]$

21. The set of real value(s) of p for which the equation $|2x + 3| + |2x - 3| = px + 6$ has more than two solutions is :

(A) $[0, 4)$ (B) $(-4, 4)$ (C) $R - \{4, -4, 0\}$ (D) $\{0\}$

22. The complete set of real 'x' satisfying $||x - 1| - 1| \leq 1$ is :

(A) $[0, 2]$ (B) $[-1, 3]$ (C) $[-1, 1]$ (D) $[1, 3]$

23. The solution set of the inequality $\frac{|x+2| - |x|}{\sqrt{4 - x^3}} \geq 0$ is :

(A) $[-1, \sqrt[3]{4})$ (B) $[1, \sqrt[3]{4})$ (C) $[-1, \sqrt[3]{2})$ (D) $[0, \sqrt[3]{4})$

24. Number of real solution(s) of the equation $|x-3|^{3x^2-10x+3}=1$ is :

(A) exactly four (B) exactly three (C) exactly two (D) exactly one

25. The set of all real numbers x for which $x^2 - |x + 2| + x > 0$ is :

(A) $(-\infty,-\sqrt{2})\cup(2,\infty)$ (B) $(-\infty,-\sqrt{2})\cup(\sqrt{2},\infty)$

(C) $(-\infty,-1)\cup(1,\infty)$ (D) $(\sqrt{2},\infty)$

26. The absolute value of the determinant $\begin{vmatrix} -1 & 2 & 1 \\ 3+2\sqrt{2} & 2+2\sqrt{2} & 1 \\ 3-2\sqrt{2} & 2-2\sqrt{2} & 1 \end{vmatrix}$ is:

(A) $16\sqrt{2}$ (B) $8\sqrt{2}$ (C) 8 (D) none of these

27.* $\left(\dfrac{2+\sqrt{3}}{\sqrt{2}+\sqrt{2+\sqrt{3}}}+\dfrac{2-\sqrt{3}}{\sqrt{2}-\sqrt{2-\sqrt{3}}}\right)^2$ when simplified reduces to :

(A) an irrational number (B) a rational number

(C) an integer (D) a prime number

28. The value of $\begin{vmatrix} a+1 & a-2 \\ a+2 & a-1 \end{vmatrix}$ is -

(A) $2a^2$ (B) 0 (C) -3 (D) 3

29. The value of $\begin{vmatrix} 1+\cos\theta & \sin\theta \\ \sin\theta & 1-\cos\theta \end{vmatrix}$ is -

(A) 2 (B) -1 (C) 0 (D) $\cos 2\theta$

30. The value of $\begin{vmatrix} 1 & 2 & 3 \\ -4 & 3 & 6 \\ 2 & -7 & 9 \end{vmatrix}$ is –

(A) 213 (B) -231 (C) 231 (D) 39

31. The cofactor of element 0 in Determinant $\begin{vmatrix} -1 & 2 & 1 \\ -2 & 3 & -3 \\ 4 & 0 & -4 \end{vmatrix}$ is -

(A) 2 (B) 5 (C) -5 (D) 9

PART - II : MISCELLANEOUS QUESTIONS

Comprehensions

Let P(x) be quadratic polynomial with real coefficients such that for all real x the relation $2(1+P(x))$ = P(x – 1) + P(x + 1) holds. If P(0) = 8 and P(2) = 32 then

32. Sum of all the coefficients of P(x) is
(A) 20 (B) 19 (C) 17 (D) 15

33. If the range of P(x) is $[m, \infty)$ then the value of 'm' is
(A) – 12 (B) – 15 (C) – 17 (D) – 5

34. The value of P(40) is
(A) 2007 (B) 2008 (C) 2009 (D) 2010

EXERCISE # 2

* ***Marked Questions are having more than one correct option.***

1. Remove the irrationality from the denominator :

(i) $\sqrt{\dfrac{\sqrt{2}-1}{\sqrt{2}+1}}$ (ii) $\dfrac{1}{1+\sqrt{2}+\sqrt{3}}$

2. Resolve the following into factors.
(i) $(x - y)^3 - y^3$ (ii) $x^3 - 6x^2 + 11x - 6$ (iii) $a^2 (b - c) + b^2 (c - a) + c^2 (a - b)$

(iv) $a^3 - \dfrac{1}{a^3} + 4$ (v) $x^3 - 9x - 10$

3. Solve the following inequalities :

(i) $x^2 - 7x + 10 > 0$ (ii) $x^2 - 4x + 3 < 0$ (iii) $\dfrac{2x}{2x^2+5x+2} > \dfrac{1}{x+1}$ (iv) $\dfrac{x-2}{x+2} > \dfrac{2x-3}{4x-1}$

4. Find all real value of x which satisfy $x^2 - 3x + 2 > 0$ and $x^2 - 3x - 4 \le 0$.

5. Solve the following inequalities :

(i) $(x - 1)^2 (x + 1)^3 (x - 4) \ge 0$ (ii) $\dfrac{x^4(x+1)^2(x-2)}{(x-3)^3(x+4)} > 0$

(iii) $(x^2 - x - 1)(x^2 - x - 7) < -5$ (iv) $\dfrac{(x+2)(x^2-2x+1)}{-4+3x-x^2} \ge 0$

6. Solve the following linear equations
(i) $|x|^2 - |x| + 4 = 2x^2 - 3|x| + 1$ (ii) $||x - 1| - 2| = |x - 3|$

7. Solve the simultaneous equations $|x + 2| + y = 5$, $x - |y| = 1$

8. Solve the following inequalities :

(i) $\left|\dfrac{3x}{x^2-4}\right| \le 1$ (ii) $\dfrac{|x+3|+x}{x+2} > 1$ (iii) $|x^2 + 3x| + x^2 - 2 \ge 0$ (iv) $|x + 3| > |2x - 1|$

9. The sum of all the real roots of the equation $|x - 2|^2 + |x - 2| - 2 = 0$ is _______.

10. Find the set of all solutions of the equation $2^{|y|} - |2^{y-1} - 1| = 2^{y-1} + 1$

11. The equation $\sqrt{x+1} - \sqrt{x-1} = \sqrt{4x-1}$ has
(A) no solution (B) one solution (C) two solutions (D) more than two solutions