Title Balbharati

List of Practicals

Subject: Mathematics and Statistics (Arts and Science)

Standard : XI

Following are the guidelines for conducting practicals in Mathematics and Statistics.

(1) Total 18 practical sessions should be conducted in the academic year, 9 from paper I and 9 from paper II.

(2) All the practical sessions are compulsory.

(3) Every practical session must contain at least 4 problems.

(4) These are specimen problems. Teachers may use these or can give similar problems in practical session.

(5) Practical sessions conducted during the year should be maintained in the form of journal (file).

(6) Teacher in charge must sign the journal at the end of every practical session.

(7) Journal should be certified before the practical examination.

(8) The practical examination will be of 20 marks with duration of1 hour. Two problems from paper I and two problems from paper II will be given. Student will have to solve 3 problems out of given 4 problems.

(9) In the journal, on the first page of each of the new practical session; definition, formulae, rules, laws related to the topic are to be written as introduction to the session.

Practical Session No. 1

Angle and its measurement

(1) Find the radian measure of the angle between hour-hand and minute-hand of a clock at : (i) twenty minutes past two (ii) ten minutes past eleven
(iii) thirty minutes past six (iv) five minutes past one

(2) Find the exact time when the angle between hour-hand and the minute-hand of a clock will be :
(i) 44^0 for the first time after 12 O'clock. (ii) 59^0 for the first time after 6 O'clock.

(3) A wire of length 10 cm is bent to form an arc of a circle of radius 4 cm. Find the radian and degree measure of the angle subtended by the arc at the center of the circle. Also find the area of the corresponding sector.

(4) Arrange following angles in ascending order : π^c, π^0, 3^c, 100^0, $\frac{\pi^c}{2}$

(5) ABCDEFGH is a regular octagon inscribed in a circle of radius 1 unit. O is the center of the circle. Find
(i) radian measure of ∠AOB (ii) $l(chord\ AB)$ (iii) $l(arc\ AB)$
(iv) area of the region enclosed between chord AB and arc AB.

Practical Session No. 2
Trigonometry 1

(1) Construct an angle in standard position whose terminal arm passes through $A(-6, 8)$. Hence find all trigonometric ratios of this angle.

(2) Construct angle of measure 22.5^0 by bisecting angle of measure 45^0. Hence find the value of $tan22.5^0$.

(3) Draw and measure the angle in standard position whose tangent ratio is $\frac{7}{13}$.

(4) Draw and estimate the angle in standard position whose sine ratio is 0.57.

(5) Construct a triangle, the measures of whose angles are 32^0, 58^0 and 90^0. Measure the lengths of sides of this triangle. Find $sin32^0$ and $cos32^0$. Hence find the value of $\sin^2 32^0 + \cos^2 32^0$.

(6) (a) Which is greater, $\sin(1856^0)$or $\sin(2019^0)$? Give reason.
(b) Which of the following is positive ? $\sin(-310^0)$ and $\sin 310^0$. Give reason.

Practical Session No. 3
Trigonometry 2

(1) Show that $(\cos\theta + i\sin\theta)^3 = \cos 3\theta + i\sin 3\theta$

(2) Show that $\cos 3\theta - \sin 3\theta = (\cos\theta + \sin\theta)(1 - 2\sin 2\theta)$

(3) Prove that $\cos^2\theta + \cos^2(\theta + 120^0) + \cos^2(\theta - 120^0) = \frac{3}{2}$

(4) If $A + B + C = \pi$ then prove that

$\cos^2 A + \cos^2 B + \cos^2 C = 1 - 2\cos A\cos B\cos C$.

Hence prove that $\cos 60^0 = \frac{1}{2}$.

(5) Find the values of $\sin 18^0$ and $\cos 18^0$.

(6) If $\tan A = \frac{5}{6}$ and $\tan B = \frac{1}{11}$ then show that $A + B = \frac{\pi}{4}\ or\ \frac{5\pi}{4}$.

Practical Session No. 4
Determinants and Matrices

(1) If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$ then show that

(i) $A^2 = \begin{bmatrix} \cos 2\alpha & \sin 2\alpha \\ -\sin 2\alpha & \cos 2\alpha \end{bmatrix}$ (ii) $A^3 = \begin{bmatrix} \cos 3\alpha & \sin 3\alpha \\ -\sin 3\alpha & \cos 3\alpha \end{bmatrix}$

(2) If $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ then prove that $A^n = \begin{bmatrix} 1+2n & -4n \\ n & 1-2n \end{bmatrix}$, for all $n \in N$.

(3) Construct a 3×3 matrix $A = [a_{ij}]$ whose elements are given by :

(i) $a_{ij} = i \times j$ (ii) $a_{ij} = (i + j)^2$

(iii) $a_{ij} = \begin{cases} 0\ , if\ i \neq j \\ 1\ , if\ i = j \end{cases}$ (iv) $a_{ij} = \begin{cases} 0\ , & \text{if } i = j \\ 1\ , & \text{if } i > j \\ -1\ , & \text{if } i < j \end{cases}$

(4) Show that $\begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix} = (a-b)(b-c)(c-a)$

(5) Show that $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc + ab + bc + ca$

(6) If $x \neq y \neq z$ and $\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0$ then show that $1 + xyz = 0$.

(7) Show that $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$

Practical Session No. 5

Straight Lines

(1) Show that the equation of the line passing through $A(x_1, y_1)$ and parallel to the line $ax + by + c = 0$ is $a(x - x_1) + b(y - y_1) = 0$. Hence find the equation of the line passing through $(1, 1)$ and parallel to the line $15x + 8y + 1947 = 0$.

(2) Show that the equation of the line having slope m and making X - intercept d is given by $y = m(x - d)$. Find the Y - intercept of this line.

(3) A line makes intercepts h and k on the co-ordinate axes. If p is the length of the perpendicular drawn from the origin to the line then show that $\frac{1}{h^2} + \frac{1}{k^2} = \frac{1}{p^2}$.

(4) Show that there are two lines which pass through the point $A(3, 7)$ and the sum of whose intercepts on the co-ordinate axes is zero. Draw the rough sketch of these two lines.

(5) Find the number of lines which pass through the point $B(5, 5)$ and the sum of whose intercepts on the co-ordinate axes is zero.

(6) Find the co-ordinates of the orthocenter of the triangle formed by lines $2x - y - 9 = 0$, $x - 2y + 9 = 0$ and $x + y - 9 = 0$.

Practical Session No. 6

Circle and parabola

1) Find the center and radius of the circle $x^2 + y^2 - x + 2y - 3 = 0$

2) Find the equation of circle passing through the point of intersection of the lines $x + 3y = 0$ and $2x - 7y = 0$ and whose centre is the point of intersection of the lines $x + y + 1 = 0$ and $x - 2y + 4 = 0$.

3) Find the equation of circle, the end points of whose diameter are the centers of circles $x^2 + y^2 + 6x - 14y - 1 = 0$ and $x^2 + y^2 - 4x + 10y - 2 = 0$.

4) Find the equation of the circle passing through points $(5, 7), (6, 6)$ and $(2, -2)$.

5) Consider a circle with center at origin and radius r. Let P(x, y) be any point on the circle making an angle θ with positive direction of the X - axis then verify that P(x, y) = P (r cosθ , r sinθ). By taking r = 5 and θ = 135^0 verify the above result.

6) Find the equations of tangents to the circle $x^2 + y^2 = 4$ drawn from the point $(2, -1)$.

7) Find the co-ordinates of the focus, equation of the directrix, length of Latus Rectum, and the co-ordinates of the end points of the Latus Rectum of the parabola

$i)\ 5\,y^2 = 24x\,,$ $ii)\ x^2 = 12\,y\,,$ $iii)\ 3\,y^2 = -16\,x\,.$

8) Find the co-ordinates of the focus, equation of the directrix, length of Latus Rectum, and the co-ordinates of the end points of the Latus Rectum of the parabola $x^2 + 4x + 4y + 16 = 0$.

9) Find the area of triangle formed by the lines joining the vertex of the parabola $x^2 = 12y$ to the ends of its Latus rectum.

10) For which point of the parabola $y^2 = 18x$ is the ordinate equal to 3 time the abscissa?

Practical Session No. 7
(Ellipse and hyperbola)

1) Find the lengths of the major and minor axes, coordinates of vertices, eccentricity, co-ordinates of the foci, equations of directrices and the length of the Latus Rectum of the following conics

$i)\ 9x^2 + 16y^2 = 144,$ $ii)\ 4x^2 + 25y^2 = 100$

$iii)\ \frac{x^2}{25} - \frac{y^2}{9} = 1$ $iv)\ \frac{y^2}{4} - \frac{x^2}{9} = 1$

2) Find the equation of ellipse referred to its principal axes with eccentricity $\frac{3}{4}$ and passing through the point (6,4).

3) An ellipse has OB as a semi-major axis, S and S' are its foci and $\angle SBS'$ is a right-angle, then find the eccentricity of the ellipse.

4) Find focal distances of the point P$\left(5, 4\sqrt{3}\right)$ on the ellipse $16x^2 + 25y^2 = 1600$.

5) If e_1 and e_2 are eccentricities of hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{y^2}{b^2} - \frac{x^2}{a^2} = 1$ then show that $\frac{1}{{e_1}^2} + \frac{1}{{e_2}^2} = 1$

6) Find the equation of hyperbola whose

i) directrix is $2x + y = 1$, focus at (1,2) and eccentricity $\sqrt{3}$.

ii) foci are at $(\pm 4, 0)$ and the length of its latus rectum is 12 unit.

iii) vertices are $(0, \pm 2)$ and the foci are at $(0, \pm 3)$.

7) An interesting property of rectangular hyperbola

Equation of rectangular hyperbola is $xy = k$ (k is non zero constant) …(I)

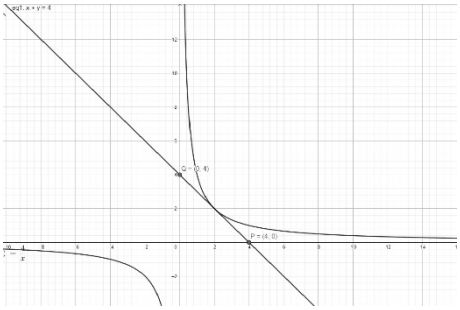
Tangent is drawn to the curve at point on it whose abscissa is 'a'.

Therefore point of contact is (a, …)

Slope of tangent $= \left[\frac{d}{dx}\left(\frac{k}{x}\right)\right]$ at point (a, …)

$= \left(\frac{-k}{x^2}\right)$ at point (a, …)

$= \frac{-k}{a^2}$ …(II)



Equation of tangent to $xy = k$ at point (a, …) is (by slope point form)

y - ….. $= \left(\frac{-k}{a^2}\right)(x - a)$

i.e. $a^2 (y - \ldots) = -k (x - a)$

i.e. ……

i.e. ……

this equation of tangent in terms of double intercept form is

$\frac{x}{2a} + \frac{y}{\frac{2k}{a}} = 1$.

tangent cuts the x – axis at point P and the Y – axis at point Q.

clearly P = (… , 0) and Q = (0, …)

Area of Δ POQ $= \frac{1}{2}$(OP)(OQ)

$= \frac{1}{2}(\ldots.)(\ldots.)$

$= 2k$ Verify this interesting result for different values of k.

i) $xy = 4$ at (2, 2) ii) $xy = 12$ at (-2, -6)

Practical Session No. 8

Measures of Dispersion

(1) For the following data : 710, 635, 423, 221, 971, 843, 307, 289. Which are the extreme values in this data ? and compute the range.

(2) A die is rolled 30 times and the following distribution is obtained. Find the variance and the standard deviation.

Score	1	2	3	4	5	6
Frequency	2	6	2	5	9	6

Repeat the experiment and construct the frequency table as shown above. Find its mean and standard deviation.

(3) Find the mean and the standard deviation of the first n natural numbers. Hence find the mean and the standard deviation of the first 200 natural numbers.

(4) The following table shows weight of students of two classes. Calculate the coefficient of variation of the two distributions.

Weight in Kg.	Class A	Class B
30-40	8	9
40-50	16	12
50-60	12	18

Also find the mean and the standard deviation for both the classes.

Practical Session No. 9

Probability

(1) The turnout of spectators at the world cup cricket match is dependent upon the weather. On a rainy day the probability of a big turnout is 0.3. If it doesn't rain, then the probability of big turnout increases by 0.6. The weather forecast gives a probability of 0.75 that it will rain on the day of the match.
Find the probability that (i) there is a big turn out and it rains (ii) there is a big turn out.

(2) A bag contains 7 red and 5 blue balls. A ball is taken at random from the bag, its color is noted and not replaced into the bag. Now a second ball is taken from the bag and its color is noted. Find the probability that one is red and the other is blue.

(3) If $P(A) = \frac{1}{4}$, $P(B) = \frac{2}{5}$ *and* $P(A \cup B) = \frac{1}{2}$ then find

1) $P(A \cap B)$ 2) $P(A \cap B')$ 3) $P(A' \cap B)$ 4) $P(A' \cup B')$ 5) $P(A' \cap B')$

(4) 2% of the population have a certain blood disease in a serious form. 10% have it in a mild form and 88% don't have it at all. A new blood test is developed, the probability of testing positive is 9/10 if the subject has the serious form, 6/10 if the subject has the mild form, and 1/10 if the subject doesn't have the disease. A subject is tested positive. What is the probability that the subject has serious form of the disease?

(5) A coin is tossed until a head appears or until it has been tossed three times. Given that head does not occur on the first toss, what is the probability that coin is tossed three times ?

(6) From a group of 8 boys and 5 girls, a committee of 5 is to be formed. Find the probability that a committee contains i) 3 boys and 2 girls ii) at least 3 boys.

Practical Session No. 10

Complex Numbers

1. If $z = 3 + 4i$ then show the following on the Argand diagram

a) z b) $-z$ c) $\overline{z}$ d) $-\overline{z}$

2. If $z_1 = 2 + 3i$ and $z_2 = 2 - 4i$ then show the following on the Argand diagram

a) z_1 b) z_2 c) $z_1 + z_2$ d) $z_1 - z_2$

3. If $z_1 = 1 + 2i$ and $z_2 = 3 + i$. Show the following on the Argand diagram

a) z_1 b) z_2 c) $z_1 \cdot z_2$ d) $\frac{z_1}{z_2}$

4. By means of Argand diagram, for $z_1 = 0 + i$ and $z_2 = -2 + 0i$,verify the following

a) $|z_1 \cdot z_2| = |z_1| \cdot |z_2|$ b) $\left|\frac{z_1}{z_2}\right| = \frac{|z_1|}{|z_2|}$ c) $\arg(z_1 \cdot z_2) = \arg z_1 + \arg z_2$ d) $\arg\left(\frac{z_1}{z_2}\right) = \arg z_1 - \arg z_2$

5. Show the roots of the equation a) $x^2 - 6x + 10 = 0$ b) $x^3 - 1 = 0$ on the Argand diagram.

Practical Session No. 11

Sequence and series

1. A sequence is generated by the formula $M_n = an^2 + bn + c$, where a ,b and c are constants. If $M_1 = 4, M_2 = 10$ and $M_3 = 18$, find the values of a ,b and c.

2. Soham starts a new job on an annual salary of Rs. 2,00,000. He is given an annual rise of Rs. 5000 at the end of every year until he reaches his annual salary of Rs. 2,50,000.Then his annual rise will be Rs 7000 per year. Find the total amount he earns
a) in the first 9 years b) over 15 years

3. Sanvi decided to save some money during the two week holiday. She saved Rs. 2 on the first day, Rs. 5 on the second, Rs. 8 on the third and so on. How much did she have at the end of the vacation? If she continuessaving in the same way, how long would it take to exceed the total saving Rs. 610?

4.Suhani is offered a job. The starting annual salary is Rs.12 Lacs. She is given 5% increment per year. What will be her annual salary after 10^{th} year? Also find her total earnings in 10 years.

(Given $1.05^9 \approx 1.55, 1.05^{10} \approx 1.63$)

5. Find a) $\sum_{n=1}^{6} \frac{2}{5}(3)^n$ b) $729 - 243 + 81 - ... \frac{-1}{3}$ c) $\sum_{n=1}^{\infty} 8(0.25)^n$

6. If the ratio of H.M. and G.M. of two quantities is $12:13$, then show that the ratio of the numbers is $9:4$

7. If a, b, c are in H.P., then show that $\frac{a}{b+c}, \frac{b}{c+a}, \frac{c}{a+b}$ are in H.P.

8. The sum of three decreasing numbers in A.P. is 27. If $-1, -1, 3$ are added to them respectively, the resulting series is a G.P. Find the numbers.

Practical Session No. 12

Permuations and Combinations

1. How many three-digit numbers can be formed using digits 0, 2,3,5,6,8 ,9 with no digit is repeated in each of the following?

   a) there are no restrictions b) number must be multiple of 5.

   c) the number is greater than 600. d) even number is less than 400.

2. A shipment of 12 cell phones contains three defective units. In how many ways can a buyer purchase four of these units and receive (a) all good units (b) two good units (c) at least two good units.

3. In how many ways can we arrange 3 red flowers, 5 yellow flowers and 7 white flowers in a row? In how many arrangement the yellow flowers are to be separated (flowers of same color are identical).

4. There are 10 persons among whom two are friends. Find the number of ways in which they can be arranged round a circle (a) if there is exactly one person between the two friends. (b) the two friends are always separated.

5. Diagonals are formed by joining vertices of a polygon count all the diagonals. Consider triangle whose sides are diagonals or sides of the polygon. How many such triangles are there in a (a) Hexagon (b) Octagon (c) Decagon

6. A committee of 4 is chosen from 8 men and 6 women. Determine the number of ways of selecting the committee if (a) there are no restrictions (b) it must contain 2 men and 2 women (c) it must contain all men (d) it must contain at least 3 men (e) it must contain at least one of each gender.

7. A class has 25 students. The class teacher has been asked to make groups of m students each and go to museum taking one group at a time. Find the size of group for which the teacher goes the maximum number of times to the museum.

8. Veer has 8 friends and wants to invite some of them on his birthday party. In how many ways this can be done if

(a) any number of friends can be invited? (b) at least two friends must be invited ?

Practical Session No. 13

Mathematical induction and Binomial theorem

1. Prove the following statements using principle of Mathematical Induction.

a) $3^n < 3^{n+1}$

b) $n^2 + 3n$ is divisible by 2

c) $\frac{1}{1\cdot 2}+\frac{1}{2\cdot 3}+\frac{1}{3\cdot 4}+\ldots+\frac{1}{n(n+1)}=\frac{n}{n+1}$

d) $\log_{10}(a_1 a_2 a_3 \ldots a_n) = \log_{10} a_1 + \log_{10} a_2 + \log_{10} a_3 + \ldots + \log_{10} a_n$

2. Using Binomial Theorem expand $(x+3)^5$.

3. Expand each expression using Binomial Theorem

a) $\left(x^2+y\right)^6$ b) $\left(2\sqrt{x}+3\right)^4$ c) $\left(x^{1/3}+y^{2/3}\right)^3$ d) $\left(\sqrt{x}+3y^{1/4}\right)^4$

4. Find the 5th term in the Binomial expansion of a) $(x+3y)^7$ b) $(2x-7)^4$ c) $(2x+3y)^9$

5. Find the coefficient A of the given term in each of the binomial expansion

	Binomial	Term
a	$(x+5)^7$	$\mathbf{A}\,x^6$
b	$\left(3y^{-2}-1\right)^8$	$\mathbf{A}\,y^{-8}$
c	$\left(x-\frac{4}{x}\right)^6$	$\mathbf{A}\,x^0$
d	$(x+2y)^4$	$\mathbf{A}\,x^2y^2$

6. Use Binomial theorem to express in the form of a+ ib

a) $(1+i)^5$ b) $\left(3+\sqrt{-4}\right)^4$ c) $\left(2-\sqrt{7}i\right)^6$

Practical Session No. 14

Sets and Relations

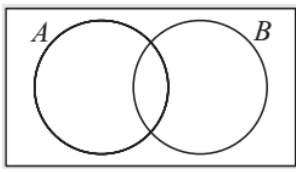
1. For the following sets, if possible i) list the elements of A ii) Find n(A)

iii) write using interval notation iv) sketch on number line

a) $A=\{x\in N:-3\le x\le 9\}$ b) $A=\{x\in Z:-3\le x\le 9\}$ c) $A=\{x\in R:-3\le x\le 9\}$

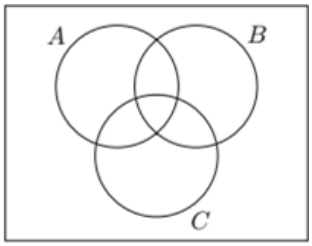
d) $A=\{x\in R:4\le x<7\}$ e) $A=\{x\in Q:-2\le x\}$ f) $A=\{x\in Z:x<7\}$

2. Use separate Venn Diagrams and shade the regions for the following:



a) A b) B' c) $A\cup B$ d) $A'\cup B$ e) $A\cup B'$ f) $A'\cup B'$
g) $(A\cup B)'$ h) $(A'\cup B)'$ i) $A\cap B$ j) $A'\cap B$ k) $A\cap B'$
l) $A'\cap B'$ m) $(A\cap B)'$ n) $(A\cap B')'$

3. Use separate Venn Diagrams and shade the regions for the following:



a) A b) B' c) $A\cup C$ d) $B'\cup C$ e) $A\cup B'\cup C$
f) $B'\cup C'\cup C$ g) $(A\cup B)\cap C'$ h) $(A'\cup B)'\cup C$ i) $B\cap A\cap C$ j) $(C'\cap B)\cup A$

4. In a group of 50 students, 20 study subject A, 25 study subject B and 20 study subject C. 10 study both A and B, 5 study both B and C, 7 study both A and C. 2 study all three subjects.

a) show this information on Venn diagram

b) find the number of students who study i) A only ii) B or C iii) A but not C iv) none of A , B or C.

5. Show all possible relations from $A=\{a,b\}$ to $B=\{5,6\}$ using Arrow diagram. Find among them the relations that are i) One-One relation ii) Onto relations iii) Null relation iv) Universal relation.

6. Plot $A\times B$ and $B\times A$ on XY plane, if

a) $A=\{x:x\in N,1\le x\le 5\};B=\{y:y\in W,y<3\}$

b) $A=\{x:x\in R,1<x\le 4\};B=\{y:y\in Z,-1\le y<3\}$

7. Let R be the relation defined by $R=\{(x,y):x+2y=6,x\in W,x\le 10,y\in Z\}$

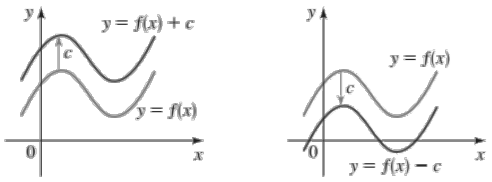
Find i) R ii) Domain of R iii) Co-domain of R iv) Range of R

8. Given the relation $R=\{(2,3),(3,4)\}$ on set of natural numbers N, add a minimum number of ordered pairs so that the relation is i) reflexive ii) symmetric iii) transitive iv) equivalence.

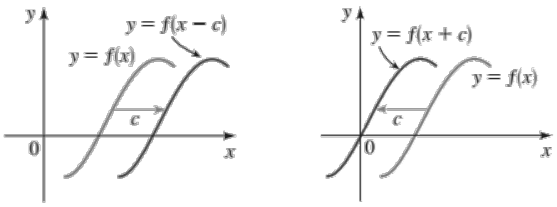
Practical Session No. 15

Functions

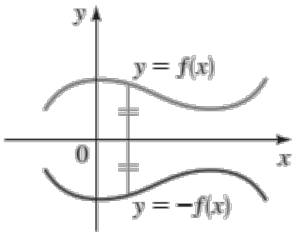
Theory: Vertical shift : **For** $c>0$ **,** $f(x)+c$ **shifts graph of** $f(x)$ **to** c **units upward , and** $f(x)-c$ **shifts graph of** $f(x)$ **to** c **units downward.**



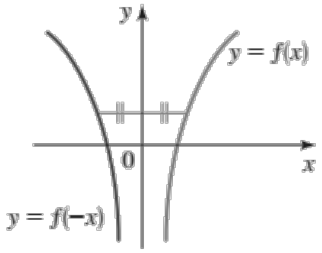
Horizontal shift : **For** $c>0$ **,** $f(x+c)$ **shifts graph of** $f(x)$ **to** c **units to left , and** $f(x-c)$ **shifts graph of** $f(x)$ **to** c **units to right.**



Reflection about X-axis : $-f(x)$ reflects the graph about X-axis



Reflection about Y-axis : $-f(x)$ reflects the graph about



Note: **If $f(-x)=f(x)$, then $f(x)$ is called Even Function, where the graph is symmetric about x-axis (i.e. Reflection about y-axis) , and if $f(-x)=-f(x)$, then $f(x)$ is called Odd function, where the graph is symmetric about Origin.**

Activity:

1) Draw the graph of $f(x)=2^x$ and $h(x)=2^{(x-4)}$ on the same graph paper

2) Draw the graph of $f(x)=\log x$ and $h(x)=\log(x+1)$ on the same graph paper

3) Draw the graph of $f(x)=\sqrt{x}$ and $h(x)=\sqrt{x-3}+2$ on the same graph paper

4) Draw the graph of $f(x)=x^3$ and $h(x)=-x^3$ on the same graph paper.

5)Draw the graph of $f(x)=\cos x, x\in[0,2\pi]$ and $h(x)=-\cos x, x\in[0,2\pi]$ on the same graph paper.

6) Draw the graph of $f(x)=\sqrt{x}$ and $h(x)=-\sqrt{x}$ on the same graph paper.

Practical Session No. 16

Limits

(1) For a given $\in > 0$, find a $\delta > 0$ such that whenever, $|x-a|<\delta$, we must have $|f(x)-l|<\in$, where $f(x)=4x-3,\ l=9,$ and $\lim\limits_{x\to 3}[f(x)]=l$.

(2) If $2x^2+3x-1\le f(x)\le x^3+x+3$ for all $x\in R$, then find $\lim\limits_{x\to 2}[f(x)]$

(3) Evaluate : $\lim\limits_{x\to 0}\left[\dfrac{6^x-3^x-2^x+1}{36^x-9^x-4^x+1}\right]$

(4) Evaluate : $\lim\limits_{x\to \frac{\pi}{3}}\left[\dfrac{2-\cos x-\sqrt{3}\sin x}{(3x-\pi)^2}\right]$

(5) Evaluate : $\lim\limits_{x\to \frac{\pi}{2}}\left[\dfrac{\left(2^{x-\frac{\pi}{2}}-1\right)^3}{\left(3^{x-\frac{\pi}{2}}-1\right)\cos x\log\left(\frac{2+2x-\pi}{2}\right)}\right]$

Practical Session No. 17

Continuity

1. By drawing the graph of $f(x)$, test whether the function $f(x) = \dfrac{x^2 - 4}{x - 2}$ is continuous at $x = 2$. Justify your answer. Identify the type of discontinuity if it is discontinuous.

2. Is $f(x) = x^2 - 3$ if $0 \leq x \leq 2$,
$= x - 4$ if $2 < x \leq 4$ continuous at $x = 2$? Justify your answer.
Identify type of the discontinuity if it is discontinuous.

3. Discuss the continuity of the function defined by $f(x) = x + 2$ for $-2 \leq x \leq 0$
$= -x + 2$ for $0 < x \leq 3$, at $x = 0$ by drawing the graph of $f(x)$. Identify type of the discontinuity if it is discontinuous.

4. Discuss the continuity of the function defined by f(x) = x for $-2 \leq x \leq 0$
$= x^2$ for $0 < x \leq 3$ at $x = 0$ by drawing the graph of $f(x)$ Identify the type of discontinuity if it is discontinuous.

5. Draw the graph of the following
$f(x) = x^2 - 1$ for $-1 \leq x < 0$
$= 2x$ for $0 < x < 1$
$= 1$ for $x = 1$
$= 4 - 2x$ for $1 < x < 2$
$= 0$ for $2 < x \leq 4$
Discuss the continuity of $f(x)$ on it's domain.

6. Let $f(x) = x^2 - 1$ if $-3 \leq x < 0$
$= px + q$ if $0 \leq x \leq 1$
= x + 2 if $1 < x \leq 3$ be continuous on it's domain. Determine the values of p and q. Hence draw the graph of f(x).

Practical Session No. 18

Differentiation

(1) Test whether the function $f(x) = (2x+3)^{\frac{3}{2}}$ is differentiable at $x = -\frac{3}{2}$

(2) Test whether the function $f(x) = (3x+5)^{\frac{3}{5}}$ is differentiable at $x = -\frac{5}{3}$

(3) Show that the function $f(x)$ is continuous at $x = 3$ but not differentiable at $x =$

where $f(x) = x^2 + x + 3$ for $x < 3$

$= x^2 + 3x - 3$ for $x \geq 3$.

(4) Show that the function $f(x)$ is continuous and differentiable at $x = -2$

where $f(x) = 3x^2 - 4x + 3$ for $x < -2$

$= x^2 - 12x - 5$ for $x \geq -2$.

(5) Let $y = \sin^2 x$. Find $\frac{dy}{dx}$ using method of first principle. Hence find $\left(\frac{dy}{dx}\right)_{x=\frac{\pi}{4}}$.