**Basic Mathematics XI**

**SET - I**

Group A [5×3×2=30]

1. a. Construct the truth table for ~(p ∨ q) ∧ q and hence draw a conclusion from the truth table.

b. If A = {1, 2, 3}, find a relation on A determined by the condition   
x + y > 4.

c. Test periodicity and symmetricity of the function y = tan 2x.

2. a. Solve: sinx – cosx = 1 for 0 ≤ x ≤ 2π

b. Using principle of mathematical induction, prove that : 1 + 3 + 5 + …. + (2n–1) = n2.

c. If and are inverse matrices of each other, find x and y.

3. a. Using Cramer's rule, solve

2x + y = 8, x – 2y = –1

b. If α = and β = , prove that α4 + α2β2 + β4 = 0.

c. For what value of a will the equation x2 + (3a – 1)x – 2(a2 – 1) = 0 has equal roots.

4. a. Find the distance between two parallel lines 3x + 4y = 17 and 6x + 8y + 1 = 0

b. Find the equation of a circle concentric with x2 + y2 – 4x + 6y + 7 = 0 and passing through a point (–2, 0).

c. Evaluate: θ→π θθθπ

5. a. Find if x = t + and y = t –

b. Evaluate: ∫ *l*n x2 dx

c. The side of a square is increasing at the rate of 2 cm/min. At what rate is the area increasing when the side is 5 cm long?

**Group B [5×2×4 = 40]**

6. a. Define the complement of a set. State and prove De-Morgan's Laws.

**OR**

Define absolute value of a real number. For any two real numbers x and y prove that:

|x + y| ≤ |x| + |y|

b. Draw the graph of the function y = x2 – 4x + 3 giving its different characteristics.

7. a. In any triangle ABC

If show that < C = 60°.

**OR**

If cos–1x + cos–1y + cos–1z = π, show that xy + yx + zx = 1

b. If a, b, c are non-zero and = 0

then show that, abc = 1.

8. a. Using row equivalent method **or** inverse matrix method, solve the system of linear equations:

x + 2y – z = 8

2x + 3y + z = 5

3x + y + 2z = –1

b. Under what condition will quadratic equation ax2 + bx + c = 0 has,

i. reciprocal roots

ii. roots equal in magnitude but opposite in sign

9. a. Obtain the condition that lx + my + n = 0 may be a tangent to the circle x2 + y2 + 2gx + 2fy + c = 0.

b. Evaluate: →θ θθθ

**OR**

Show that the function f(x) = ≤

is discontinuous at x = . Also, write how it could be made continuous?

10. a. Find from the definition, the derivative of sin2 3x.

b. Using the method of integration, find the area bounded by the curve = 1

**Group C [5×6 = 30]**

11. Define one to one function and onto function with suitable example. Determine whether the function f : R → R given by f(x) = x2 – 1 is one to one or onto or both or neither.

12. If one A.M. 'A' and two G.M.'s G1 and G2 are inserted between two positive numbers, prove that = 2A. Also prove that   
A.M., G.M. and H.M. between two unequal positive quantities satisfy   
A.M. > G.M. > H.M.

13. The origin is a corner of the square and two of it's sides are y + 2x = 0 and y + 2x = 3. Find the equations of other two sides. Also prove that the distance between two parallel lines y = mx + c1 and y = mx + c2 is .

**OR**

Prove that the product of the perpendicular from (α, β) to the lines given by ax2 + 2hxy + by2 = 0 is ααββ. Also find the acute angle of bisector between the lines 4x + 3y – 7 = 0 and 24x + 7y – 31 = 0.

14. Define absolute value of complex number and solve by using De-Moivre's theorem : Z6 = 1.

15. For a function, write the conditions so that its graph has concave upward and concave downward. Find the interval where given function   
f(x) = x4 – 8x3 + 18x – 24 is concave upward and concave downward. Also find the point of inflection.

**OR**

Two concentric circles are expanding in such a way that the radius of the inner circle is increasing at the rate 8 cm/sec. and that of the outer circle at the rate of 5 cm/sec. At a certain instant the radii of the inner and outer circles are respectively 24 cm and 30 cm. At what rate does the area between the two circles changes.

**SET - II**

Group A [5×3×2=30]

1. a. Write inverse and converse of the statement "If two triangles are similar then their corresponding sides are proportional."

b. If A = {1, 2} and B = {2, 3, 4}, find a relation from A on B defined by the condition y = 2x.

c. Examine whether the function f(x) = 3x2 + cos x is even or odd. Also test for symmetricity.

2. a. Solve: tanθ + cotθ = 2 (0 ≤ θ ≤ π)

b. Using principle of mathematical induction, prove that "xn – yn is divisible by x – y."

c. If A = and B = , find (AB)T.

3. a. Using inverse matrix method, solve

x + 2y = 5 ; 3x – y = 1

b. If w is complex cube root of unity, find the value of (1 – w + w2)4   
(1 + w – w2)4.

c. Find the value of k so that the equation (3k + 1) x2 + 2(k + 1)x + k = 0 has reciprocal roots.

4. a. Find the equation of a straight line passing through origin and perpendicular to the line 3x – 5y = 7.

b. Find equation of a circle whose two of the diameters are 2x + y = 10 and x – y + 1 = 0 and passing through origin.

c. Evaluate: →∞ ( – )

5. a. Find if x3 + y3 – 3xy = 0

b. Evaluate: ∫ cotx (*l*n sinx)3 dx

c. Find the intervals in which f(x) = x2 – 2x + 10 is increasing or decreasing

**Group B [5×2×4 = 40]**

6. a. If A, B and C be three non-empty sets, prove that,

A – (B ∪ C) = (A – B) ∩ (A – C).

**OR**

Define absolute value of real number. Rewrite the given relation without using absolute value sign |2x – 1| ≤ 5. Also, draw the graph of the inequality.

b. Sketch the graph of f(x) = (x – 4)2 – 8 indicating its characteristics.

7. a. If tan–1x + tan–1y + tan–1z = π, show that x + y + z = xyz.

**OR**

Solve the triangle if a = , b = 2 and c = – 1.

b. Prove that:

= (b2 – ac) (ax2 + 2bxy + cy2)

8. a. Applying row equivalent matrix method **or** inverse matrix method, solve the following system of linear equations:

x + y + z = 1

x + 2y + 3z = 4

x + 3y + 7z = 13

b. Find the condition for two given quadratic equations p1x2 + q1x + r1 = 0 and p2x2 + q2x + r2 = 0 may have one root common.

9. a. Find the equation of the line through (1, –1) which cuts off a chord of length 4 from the circle x2 + y2 – 6x + 4y – 3 = 0.

b. Evaluate: →

**OR**

A function f(x) is defined as follows:

f(x) =

Is the function continuous at x = 1 ? If not how can you make it continuous?

10. a. Find the derivative of by the definition.

b. Using method of integration, find the area of the circle

x2 + y2 = r2

**Group C [5×6 = 30]**

11. Let a function f: A → B be defined by f(x) = with A = {–1, 0, 1, 2, 3, 4} and B = {–1, 0, , , 1, 2, 3}. Find the range of f. Is the function *f* one-one and onto both? If not, how can the function be made one-one and onto both?

12. Define sequence and series. Find the nth term and then sum of first n term of the given series

6 + 13 + 24 + 29 + ……

13. Derive the formula for the length of the perpendicular from a point (x1, y1) to the line x cosα + y sinα = p. Also find, the distance between the parallel lines 3x + 5y = 11 and 3x + 5y = –23

**OR**

Find the condition that the general equation of second degree may represent a pair of lines. For what value of k will the given equation represent a pair of straight lines.

x2 – kxy + 4y2 + x + 2y – 2 = 0

14. State De-Moivre's theorem for any complex number solve by using De-Moivre's theorem : z6 = –1.

15. Write the conditions for a function to have local maximum and local minimum value of a function. Find the maxima or minima for the given function 4x3 – 15x2 + 12x + 7. Also, find the point of inflection.

**OR**

Water is running into a conical reservoir, 10 cm deep and 5 cm in radius at the rate of 1.5 cm3 /min.

i. At what rate is the water level rising when the water is 4 cm deep.

ii. At what rate is the area of water surface of the reservoir increasing when the water is 6 cm deep.

**SET - III**

Group A [5×3×2=30]

1. a. Write inverse and converse of the statement “if 3 is an odd number then 6 is not an odd number”

b. Check whether the function f:[-2,3]R given by f(x)=x2 is one to one, onto or both.

c. What are the odd and even functions? Determine whether the function

f(x) =2x +2-x is even, odd or neither.

1. a. Solve: tanx +tan2x= tan3x.

b. If H is the harmonic mean between a and b, prove that (H-2a)(H-2b)=H2

c. For the given, matrices A= and B=. Show that (A+B)T= AT+BT.

1. a. Can you solve the system 3x+4y=10, 6x+8y=24 by the inverse matrix method, if not why?

b. Prove that =w where w,w2are complex cube roots of unity.

c. If one root of the equation ax2+bx + c=0 be twice the other show that 2b2 = 9ac.

1. a. Find the angle between the pairs of line represented by

b. Find the equation of the circle which has the points (0,-1)and (2,3) as ends of a diameter.

c. Evaluate 

5. a. Find the derivative of 

b. Show that the function has neither maximum nor minimum value.

c. Evaluate 

**Group B [5×2×4 = 40]**

1. a. What is contradiction? Prepare the truth table for the compound statement.

Or

Define absolute value of any real number. Solve the inequality;

b. Sketch the graph of the function  indicating its different characteristics.

1. a. In any  if  prove that  =1350.

Or

Ifprove that 

b. Write the any two properties of determinant? Hence prove that 

1. a. Solve; 3x+ 4y +5z =18; 2x - y +8z=13; 5x - 2y+7z=20 by using Row –equivalent matrix method or inverse matrix method.

b. Prove that the quadratic equation ax2+bx + c=0 cannot have more than two roots.

1. a. Find the equations of tangents drawn from the point (4,-2) to the circle. Also show that they are at right angle.

b. Evaluate:.

1. a. Find from the first principle the derivative of 

b. Evaluate:or

Find the area of ellipse by using integration.

**Group C [5×6 = 30]**

1. Define domain and range of a function. Find the domain and range of the function 
2. Using the principle of mathematical induction prove that 12+22+32+…+ n2 =.
3. State Demoivre’s theorem. Use it find the fourth roots of ‘i’.
4. Derive the formula for the length of the perpendicular form a point (x1,y1) to a line .Also find the distance between the parallel lines 5x+12y+8=0 and 10x+24y-3=0

Or

Prove that the bisectors of the angle between the pair of straight lines ax2 + 2hxy+ by2 = 0 is given by 

1. A closed cylindrical can is to be made so that its volume is 52 cm3. Find its dimensions if the surface is to be a minimum.

Or

The volume of a spherical balloon is increasing at the rate of 25 cubic cm/sec. Find the rate of change of its surface at the instant when its radius is 5 cm.

**SET - IV**

Group A [5×3×2=30]

1. a. Write the truth table of the statement  .Draw a conclusion from a table.

b. Examine the function y = cosx for symmetry and even or odd in nature.

c. Prove by the principle of mathematical induction: 2+4+6+… …+2n = n(n+1)

1. a. If x=,and y=,test the validity of tan-1x+tan-1y=tan-1

b. If A= and B= find (AB)T.

c. Using Cramer’s rule, solve: x-2y = 0; 3x + 7y = 5 .

1. a. For what value of p will the equation 5x2 – p x + 45 = 0 has equal roots.

b. If w be a complex cube root of unity, find the value of :(1-w+w2)4( 1+ w –w2)4 .

c. Define one to one and onto functions with an example.

1. a. What are the points on x-axis whose perpendicular distance from the straight line is ‘a’?

b. Find the equation of the circle concentric with the circle x2+y2 - 8x +12y + 15= 0 and passing through at the point (5, 4).

c. Prove that 

1. a. Find  if x3+y3 – 3axy = 0.

b. The side of a square sheet is increasing at the rate of 5 cm/min. At what rate is the area increasing when the side is 12 cm. long?

c. Evaluate: 

**Group B [5×2×4 = 40]**

1. a. Define symmetric difference of two sets. Prove that 

Or

Define the absolute value of real number. For any positive real number a, prove that 

b. Sketch the graph of the function (–π ≤ x ≤ π) indicating its different characteristics.

1. a. Solve : 2 sin2x -3sinx cosx+3 cos2x=1

Or

State and prove that sine law of trigonometry.

b. Prove that 

1. a. When does a matrix have its inverse? Using inverse matrix method or row equivalent matrix method solve:

x + y + z = 6; x – y + z = 2; x + y – z = 0.

b. Find the conditions that the two quadratic equationshave one root common and both roots common.

1. a. Find the equation of the line through the point (1,-1) which cuts off a chord of length  from the circle x2 +y2 – 6x + 4y – 3 =0 .

b. Discuss the limit of the function f(x)=  at x=2 . Is f continuous at x=2?

1. a. Find from the first principle the derivative of 

b. Evaluate; .

Or

Find the area of the region between the curves.y2 = 16 x and the line   
y = 2x.

**Group C [5×6 = 30]**

1. What is function? Find the domain and range of the function 
2. Find the nth term and the sum of the n-term of the series:   
   12.2 +22.3+ 32.4 +…..
3. Define the conjugate of a complex number. Find the square roots of.
4. Find the equation of the bisectors of the angle between the straight lines 3x+4y+2=0 and 5x-12y-6=0.Verify that bisectors are perpendicular to each other. Also identify the acute angle bisector.

Or

What is the homogenous equation of degree two? Prove that the two lines represented by include an angle 2

1. A door is in the form of a rectangle surmounted by a semi-circle. If total perimeter is 9m, find the radius of semi-circle for the greatest door area.

Or

Water is running into a conical reservoir, 10cm deep and 5cm in radius at the rate of 1.5 cm3/min. At what rate is the level rising when the water is 4 cm deep?

**SET - V**

**Group A (5×3×2 =30)**

1. a. If M={1,3,5,7}, N={2,4,6,8}, and U={1,2,3,4,5,6,7,8,9}, find  and 

b. If A={1,2,3}, find the relation A satisfy the condition x + y < 4. Is this relation a function? Give a reason.

c. Evaluate 

1. a. Rewrite  using absolute value sign.

b. Does the limit of the function  exist at x=0? Justify your answer.

c. Find if and 

1. a. Show that the function is increasing on R.

b. If , find the value of A3.

1. a. Using Cramer's rule, solve the system of equations.





b. Without expanding the determinant prove that 

c. If the equation  represent a pair of line, find the value of K.

1. a. If are the cube roots of unity, prove that 

b. Find  if 

c. Express  into polar form.

**Group B (5×4×2=40)**

1. a. If A,B and C be any three non-empty sets, prove that 

b. Evaluate 

1. a. Define bi-conditional of two statements . Prepare the truth table of 

b. A function f(x) is defined as follows.



Is f(x) continuous at x=2. If not, how can f(x) be made continuous at x=2?

1. a. If ,and . Prove that xyz+1 =2yz.

b. Find from the definition, the derivative of 

1. a. Prove that =(y-z)(z-x)(x-y)(yz + zx +xy)

b. Solve the following system of linear equations by row equivalent matrix method *or* inverse matrix method.

2x+6y=2 3x-z=-8 2x-y+z=-3

1. a. If x+y=2 is the equation of the chord of the circle , find the equation of the circle so that this chord is a diameter.

b. Find  when 

**Group C (5×6=30)**

1. Define bijective function with an example. Let  be the set of real numbers. Show that the function define by is bijective and find the formula for .
2. The AM, GM and HM between two unequal positive numbers satisfy the relations

i. AM × HM = (GM)2 ii. AM > GM > HM

1. Prove that the straight lines joining the origin to the point of intersection of the line and the curve are right angle if .

**OR**

What are the three standard equations of straight lines? The origin is a corner of a square and two of its sides are y + 2x = 0 and y + 2x = 3 , find the equations of the other two sides.

1. State De-Moivre's theorem. Using De-Moivre's theorem, find the square roots of 4 + 4i .
2. List the criteria for the function y=f(x) to have local maxima and local minima at a point. Find the local maxima and minima of on the interval (-1, 2), also find the point of inflection.

**OR**

A ladder 5 meters long rests against a vertical wall. If its top slides down wards at the rate of 10 cm/s, find the rate at which the foot of the ladder is sliding when the foot of the ladder is 4 meters away from the wall.