



CAPITAL COLLEGE AND RESEARCH CENTER

Koteshwor, Kathmandu

FIRST TERMINAL EXAMINATION 2080

Subject : MATHEMATICS

GRADE XII (SCIENCE)

F.M.: 75

Time : 3:00 hrs.

SET A

P.M. : 30

Group 'A'

11×1=11

- How many three digit numbers can be formed by using the integers 4,5,6,8 with repetition.
a) 64 b) 27 c) 24 d) 6
- How many words can be formed with the letters of the words MATHEMATICS by rearranging the letters?
a) $\frac{11!}{2!}$ b) $\frac{11!}{2!2!2!}$ c) $11!$ d) $\frac{11!}{2!2!}$
- The sum of infinite terms of the following series $1 + \frac{4}{5} + \frac{7}{5^2} + \frac{10}{5^3} + \dots$ is
a) $\frac{3}{16}$ b) $\frac{35}{8}$ c) $\frac{35}{4}$ d) $\frac{35}{16}$
- If $\sin^2 A + \sin^2 B = \sin^2 C$, then triangle is
a) equilateral b) equiangular c) right angle d) isosceles
- In a $\triangle ABC$, $a = 5$, $b = 7$ and $\sin A = \frac{3}{4}$, how many such triangles are possible?
a) 1 b) 0 c) 2 d) infinite
- If $\vec{a}$ and $\vec{b}$ are unit vectors and θ is the angle between them then $\sin\left(\frac{\theta}{2}\right)$ is:
a) $|\vec{a} - \vec{b}|$ b) $\frac{1}{2}|\vec{a} - \vec{b}|$ c) $|\vec{a} + \vec{b}|$ d) none
- Which of the following is the integral value of $\int \frac{dx}{x^2-1}$?
a) $2 \log \frac{x+1}{x-1} + C$ b) $\frac{1}{2} \log \frac{x-1}{x+1} + C$
c) $\log \frac{x-1}{x+1} + C$ d) $\frac{1}{2} \log \frac{x+1}{x-1} + C$

16. a) Using Cramer's rule, solve the following equation $x + y = 3$, $x - y = 1$. [2]
 b) Solve the following equation using inverse matrix method:
 $x + y + z = 6$, $x - y + z = 2$, $5x - 9y = -3$ [3]
17. a) State principle of mathematical Induction. [2]
 b) Prove by method of induction that $3 + 3^2 + 3^3 + \dots + 3^n = \frac{3}{2}(3^n - 1)$
18. a) Write the integral of $\int \frac{1}{a^2 + x^2} dx$ [1]
 b) Define proper rational fraction with example. [1]
 c) Integrate: $\int \frac{1}{(x + 3)(x + 2)} dx$ by using concept of partial fraction. [3]
19. a) Show that $\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1} \frac{x}{a} + C$. [2]
 b) Evaluate: $\int \frac{6x + 1}{x^2 + 9} dx$ [3]

Group 'C'

8×3 = 24

20. a) Define projection of $\vec{b}$ on $\vec{a}$. [1]
 b) Prove by vector method:
 $\cos(A - B) = \cos A \cos B + \sin A \sin B$. [3]
 c) For what value of x is the pair of vectors:
 $x\vec{i} - 2\vec{j} + 4\vec{k}$ and $2\vec{i} + 7\vec{j} + \vec{k}$ orthogonal? [2]
 d) State sine law. [2]

21. a) For any positive integer n , $[r (\cos \theta + i \sin \theta)]^n = r^n [\cos n\theta + i \sin n\theta]$. [1]
 i) Name the theorem for positive integer n . [1]
 ii) Reduce the given statement when we replace n by $(-n)$? [1]
 iii) What does ' r ' represent in the above statement? [1]
 iv) What does ' θ ' represent in the above statement? [1]
 v) Write any one application of the above statement. [1]
 b) Apply De-Moivre's theorem to compute $(1 + i)^{24}$. [2]
 c) Find the value of $|\omega| + |\omega^2|$. Where ω is cube root of unity. [1]
22. a) Evaluate the integral $\int \sqrt{x^2 - a^2} dx$. Replace ' a ' with a numerical value and then find the integral. [3]
 b) Evaluate: $\int \frac{dx}{2 + 3 \cos x}$ [3]
 c) Evaluate: $\int \frac{dx}{e^x + e^{-x}}$. [2]

Good Luck



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Subject : MATHEMATICS

GRADE XII (SCIENCE)

F.M.: 75

Time : 3:00 hrs.

SET B

P.M. : 30

Group 'A'

11×1=11

1. How many numbers of five digit can be formed from the number 2,0,4,3,8 when repetition of digits is not allowed?
a) 96 b) 120 c) 144 d) 14
2. The value of $P(n, n-1)$ is
a) $n!$ b) $(n-1)!$ c) $(n+1)!$ d) 1
3. If $\sum n = 55$, then $\sum n^3$ is equal to
a) 110 b) 385 c) 3025 d) 116375
4. If any $\triangle ABC$, $\frac{\cos A}{a} = \frac{\cos B}{b}$, then the triangle is
a) Isosceles b) Equilateral
c) Right angle d) Scalene
5. If $A = 30^\circ$, $B = 45^\circ$, $C = 6$, then b is
a) $6(\sqrt{3} + 1)$ b) $6(\sqrt{3} - 1)$ c) 12 d) 6
6. If $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$, then $\vec{a} \cdot \vec{b} = \dots\dots ?$
a) 1 b) $\frac{1}{2}$ c) 0 d) 2
7. $\int \frac{dx}{\sqrt{9-4x^2}} = \dots\dots ?$
a) $\frac{1}{2} \sin^{-1}\left(\frac{2x}{3}\right) + C$ b) $\sin^{-1}\left(\frac{2x}{3}\right) + C$
c) $\tan^{-1}\left(\frac{2x}{3}\right) + C$ d) $\frac{1}{2} \tan^{-1}\left(\frac{2x}{3}\right) + C$

8. $\int \frac{\sin(2 \tan^{-1} x)}{1+x^2} dx = \dots\dots ?$

- a) $\cos(2 \tan^{-1} x) + C$ b) $-\cos(2 \tan^{-1} x) + C$
 c) $\frac{1}{2} \cos(2 \tan^{-1} x) + C$ d) $-\frac{1}{2} \cos(2 \tan^{-1} x) + C$

9. $\int \left(\frac{\cos 2x - 1}{\cos 2x + 1} \right) dx =$

- a) $\tan x - x + c$ b) $x + \tan x + c$ c) $x - \tan x + c$ d) $-x - \cot x + c$

10. What is the amplitude of a complex number i ?

- a) -1 b) 90° c) 270° d) 1

11. The augmented matrix of the system of equations $x+y=3$ & $2x-3y+1=0$ is

- a) $\begin{bmatrix} 1 & 1 & : & 3 \\ 2 & -3 & : & 1 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 1 & : & 3 \\ 2 & -3 & : & -1 \end{bmatrix}$
 c) $\begin{bmatrix} 1 & 1 & : & -3 \\ 2 & 3 & : & 1 \end{bmatrix}$ d) $\begin{bmatrix} 1 & 2 & : & 3 \\ 1 & -2 & : & -1 \end{bmatrix}$

Group 'B'

8×5= 40

12. a) How many permutations are there of the letters of the word 'SAARC'? [2]

b) The Nepali National Cricket Team consisting 16 players includes 2 wicketkeepers and 6 bowlers. In how many ways can a cricket team of eleven players containing 1 wicketkeeper and at least 5 bowlers be selected? [3]

13. a) Sum to infinity: $1+3x+5x^2+7x^3+\dots\dots (-1 < x < 1)$. [2]

b) Write the formula for the sum of first $(n+1)$ even natural number. [1]

c) Write the formula for the sum of cubes of first 'n' natural number. [1]

d) Find the sum of squares of first 20 natural number. [1]

14. a) Prove: $1 - \tan \frac{A}{2} \tan \frac{B}{2} = \frac{2c}{a+b+c}$ [2]

b) Prove that in any triangle: $\sin \frac{A}{2} = \sqrt{\frac{(S-b)(S-c)}{bc}}$. [3]

15. a) In any triangle ABC, if $a = 3$, $b = 3\sqrt{3}$, $A = 30^\circ$, find B. [2]

b) In any $\triangle ABC$, if $A = 30^\circ$ and $B = 90^\circ$, find $a:b:c$. [3]

16. a) Using cramer's rule, solve:

$$3x+2y+9=0 \text{ \& } 2x-3y+6=0. \quad [2]$$

b) Solve the following equations using inverse matrix method: [3]

$$x-3y-7z=6, 2x+3y+z=9, \text{ and } 4x+y=7$$

17. a) State principle of mathematical induction.

b) Prove by method of induction that $1+2+3+\dots+n = \frac{n(n+1)}{2}$ [3]

18. a) Write the integral of $\int \frac{1}{\sqrt{a^2-x^2}} dx$ [1]

b) Define proper rational fraction with suitable example. [1]

c) Integrate: $\int \frac{1}{(x+a)(x+b)} dx$ by using concept of partial fraction. [3]

19. a) Show that $\int \frac{1}{\sqrt{x^2+a^2}} dx = \log(x + \sqrt{x^2+a^2}) + C$ [2]

b) Evaluate: $\int \frac{dx}{\sqrt{3-2x-x^2}}$ [3]

Group 'C'

8×3 = 24

20. a) Define projection of $\vec{a}$ on $\vec{b}$. [1]

b) Prove by vector method:

$$\cos(A+B) = \cos A \cos B - \sin A \sin B \quad [3]$$

c) For what value of m are the vectors $\vec{i} - 2\vec{j} + 4\vec{k}$, $2\vec{i} + 7\vec{j} + m\vec{k}$ orthogonal? [2]

d) State cosine law. [2]

Sukuna Secondary School

Sundarharaicha-10, Morang

1st terminal Examination-2081

Class-12

Sub- Maths

Time-1.5 hour

Full mark-37.5

Group-A

Attempt all questions

Rewrite the best answer from the following options.

5 × 1 = 5

1. In how many ways can 6 gentleman and 4 ladies be seated in a round table?

a. 9!

b. $5! \times 4!$

c. $5! \times 3!$

d. $5! \times 6C4$

2. In the expansion of $(x - \frac{1}{3x^2})^9$ the term independent of x is....

a. t_3

b. t_4

c. t_5

d. t_6

3. In a ΔABC , If $4a=b+c$, then $\tan \frac{B}{2} \cdot \tan \frac{C}{2} = \dots$

a. $\frac{1}{3}$

b. $\frac{3}{5}$

c. $\frac{2}{3}$

d. $\frac{1}{4}$

4. The eccentricity of hyperbola $x^2 - y^2 = 9$ is...

a. less than 1

b. 1

c. $\sqrt{2}$

d. none of these

or

The value of $(\frac{1+\omega}{\omega^2})^2$ is ...

a. 1

b. -1

c. ω

d. ω^2

5. If $y = \ln(\ln x)$ the derivative of y is

a. $\frac{dy}{dx} = \frac{1}{\ln x}$

b. $\frac{dy}{dx} = (\ln x)^2$

c. $\frac{dy}{dx} = \frac{1}{x \ln x}$

d. $x \ln x$

Group B (5 × 5 = 25)

6.a. It is required to sit 5 boys and 4 girls in a row so that the girls occupy the even places. How many such arrangement are possible? 2

b. Out of 6 ladies and 8 gentleman a committee of 11 is to be formed. In how many ways can this be done if the committee contains. (i) at least 4 ladies? (ii) at most 4 ladies? 3

7.a. In the expansion of $(1+x)^{2n+1}$, the coefficient of x^r and x^{r+1} are equal. Find the value of r? 2

b. If $(1+x)^n = C_0 + C_1 x + C_2 x^2 + \dots + C_n x^n$ then prove that

$$C_0 C_2 + C_1 C_3 + C_2 C_4 + \dots + C_{n-2} C_n = \frac{(2n)!}{(n-2)!(n+2)!}$$

8.a. Find the conditions for the line $lx + my + n = 0$ to be a normal to the parabola $y^2 = 4ax$ 2

b. Find coordinates of vertices, eccentricity, coordinate of foci and equation of directrix of hyperbola $16x^2 - 9y^2 + 96x - 72y + 144 = 0$ 3

a. Show that $\frac{a+b\omega+c\omega^2}{b+c\omega+a\omega^2} = \omega$ where ω and ω^2 are cube root of unity of complex number. 2

b. Write complex number $(\cos\theta + i \sin\theta)$ in Euler's form. If $z = \cos\theta + i \sin\theta$ find the value of $z^n + \frac{1}{z^n}$ by using De-Moivre's theorem. 1+2

9.a. Solve the following system of equations by row equivalent matrix method. 3

$$4x - 5y + 2z = 1, 3x - 4z = 10, 2y = 3z - 6$$

b. Solve the equation by Cramer's rule 2

$$x - 2y - z = 7, 2x + y + z = 0, 3x - 5y + 8z = 13$$

10.a. If the sides of a triangle are proportional to $2:\sqrt{6}:\sqrt{3}+1$, find the angles? 2

b. In ΔABC , if $(\cos A + 2 \cos C):(\cos A + 2 \cos B) = \sin B : \sin C$, prove that the triangle is either isosceles or right angled? 3

or
Use simplex method and maximize $z = 15x + 12y$ subject to 5

$$2x + 3y \leq 21, 3x + 2y \leq 24, x, y \geq 0$$

Group C ($7.5 \times 1 = 7.5$)

11.a. Find the derivative with respect to x of $x^{\cosh^{-1} \frac{x}{a}}$ 2

b. prove that $1 + \frac{1}{4} - \frac{1}{4 \cdot 8} + \frac{1 \cdot 1 \cdot 3}{4 \cdot 8 \cdot 12} - \frac{1 \cdot 1 \cdot 3 \cdot 5}{48 \cdot 12 \cdot 16} + \dots \dots \dots \text{to } \infty = \sqrt{\frac{3}{2}}$ 2.5

c. Prove that the circles $x^2 + y^2 + 2kx + 2ly = 0$ and $x^2 + y^2 + 2mx + 2ny = 0$ touch each other if $\frac{k}{m} = \frac{l}{n}$ 3

or
Solve by De-Moivre's theorem $z^4 + 1 = 0$

Group 'A' [11*1=11]

- What is the amplitude of a complex number i ?
a. -1 b. 90° c. 270° d. -90°
- What is the sum of squares of first 20 natural number ?
a. 210 b. 4410 c. 2870 d. 280
- What is the slope of normal to the curve $y=2x^2+3x+5$ at $(-2,7)$?
a. -5 b. $-1/5$ c. $1/5$ d. 5
- Which one of the following conic is represented by the equation $4x^2-16x+y^2=48$?
a. Parabola b. Ellipse c. Circle d. Hyperbola
- The Gauss- forward elimination step ends a system of equation with the matrix $\begin{bmatrix} a_{11} & a_{12} : c_1 \\ 0 & a_{22} : c_2 \end{bmatrix}$ Such That $a_{22} \neq 0$. The system has.....
a. No solutions b. Infinite many solution.
c. Finite solutions d. Unique solution
- The velocity of a rectilinear motion given by the equation $S=3t^2-2t+1$ at $t=4$ is
a. 49 b. 22 c. 21 d. 5
- Tangent to the curve $y=x^3$ at $x=2$ and $x=-2$ are
a. Parallel b. Perpendicular c. Intersecting d. doesnot exist
- In Gauss-seidal method for solving $3x+y=5$ and $x+5y=11$, $(x_0, y_0)=(0,0)$, what is (x_1, y_1) ?
a. (5,11) b. (11,5) c. $(\frac{5}{3}, \frac{11}{5})$ d. $(\frac{3}{5}, \frac{5}{11})$
- Karl pearson's correlation coefficient ranges from
a. $-\infty$ to $+\infty$ b. 0 to 1
c. 0 to ∞ d. -1 to +1
- The intersection value of pivot column and pivot row is called
a. Vital element b. important element
c. pivot element d. basic element
- It is given that $Z=r(\cos\theta + i\sin\theta)$ and n be a positive integer. Which one of the following represent Z^n
a. $r[\cos\theta+i\sin.n\theta]$ b. $r^n [\cos\theta-i\sin n\theta]$
c. $r^n [\cos n\theta+i\sin n\theta]$ d. $r[\cos n \theta- i\sin n\theta]$

Group 'B' [5*8=40]

- If $Z_1=r_1 e^{i\theta_1}$ and $Z_2=r_2 e^{i\theta_2}$ be two Euler's form, then
a. what is the amplitude of Z_1, Z_2 ? [1]
b. what is the Euler's form of Z_1, Z_2 ? [1]
c. What is the amplitude of $\frac{Z_1}{Z_2}$? [1]
d. What is the Euler's form of $\frac{Z_1}{Z_2}$? [1]
e. What is modulus of Z_1, Z_2 ? [1]
- (a) Find the eccentricity and foci of the hyperbola $4x^2-9y^2=36$? [2]
b. Find the equation of the ellipse whose distance between two foci is 8. And the semi-latus return is 6. [3]
- Answer the following
(i) Write the equation of tangent to the curve $y=f(x)$ at (x_1, y_1) if $f'(x)$ exists. [1]
(ii) It is given that $y=f(x)$ be a function and $f'(x)$ is first order derivative in terms of x . Write dy in terms of $f'(x)$ and dx . [1]
(iii) What does $\frac{dy}{dx}$ represent geometrically at particular point of a curve? [1]
(iv) Write the meaning of dy and Δy in percentage error in the estimate $=\frac{\Delta y - dy}{y} \times 100\%$ [1]

- (v) What is the value of $\lim_{\theta \rightarrow 0} \frac{\tan \theta}{\theta}$? [1]
15. a. if $Z = \cos \theta + i \sin \theta$, find the value of $Z^n + \frac{1}{Z^n}$ by using De-moivre's theorem. [2]
 b. Use mathematical induction method and prove that: $2^{3n} - 1$ is divisible by 7. [3]
16. The equations of two regression lines are $3x + 4y = 65$ and $3x + y = 32$. Find :
 (i) The means of X and Y. [1]
 (ii) The regression coefficients. [2]
 (iii) The correlation coefficients between X and Y [1]
 (iv) The ratio of standard deviations of X and Y [1]
17. (a) Applying L' Hospital rule to evaluate :
 $\lim_{x \rightarrow 0} \frac{e^x + e^{-x} - 2 \cos x}{\sin^2 x}$ [2]
 (b) Dipendra sir, sells 7 shares of A and buys 9 shares of B, thus increasing his cash by Rs. 70. And kamal sir, sells 9 shares of A and buys 14 shares of B, thus decreasing his cash by Rs.80
 (i) Formulate the simultaneous linear equation. [1]
 (ii) Using Cramer's rule, find the price of shares A&B [2]
18. (a) Using Gauss- elimination method, solve the following system of equations
 $x - 2y + 3z = 2$, $2x - 3y + z = 1$, $3x - y + 2z = 9$ [4]
 (b) what is the difference between Δy and dy ? [1]
19. Use simplex method and maximize
 $(Z) = 20x + 50y$ [5]

Subject to

$$x + y \leq 30$$

$$x + 2y \leq 40$$

$$x, y \geq 0$$

Group 'C' [8*3=24]

20. (a) prove that: $1 + 4 + 7 + 10 + \dots + (3n - 2)$
 $= \frac{n(3n - 1)}{2}$ by using principle of mathematical induction. [2]
 (b) The side of a square sheet is increasing at the rate of 5cm/min. At what rate is the area increasing when the side is 12cm? [3]
 (c) Calculate the coefficient of rank correlation between age (in years) and weight (in kg) [3]
 Of the following observations.

Age(X)	12	14	16	18	20
Weight(Y)	25	32	40	50	56

21. (a) show that $\frac{a + b\omega + c\omega^2}{b + c\omega + a\omega^2} = \omega$ where, ω and ω^2
 cube roots of unity [2]
 (b) solve the following system of equations using inverse matrix method. [3]
 $x + 2y + 3z = 20$, $5x - 2y = 4$, $-4x + 3z = 4$
 (c) Find the general term and also the sum of n terms of the series: $1 \cdot n + 2 \cdot (n - 1) + 3 \cdot (n - 2) + \dots$ [3]
22. (a) Find $\frac{dy}{dx}$ of $x^{\sin y} = y^{\cos x}$ [3]
 (b) Using De-moivre's theorem, evaluate $(1 + \sqrt{3}i)^4$ [2]
 (c) For the hyperbola given by $9x^2 - 16y^2 = 144$, find the latus rectum and equation of directrices. [3]

Sub.Code : 0081 (new course) Set 'E'

NEB-GRADE XII

2081 (2024)

Mathematics

(For Regular Students only)

(For the students whose first two digits of registration number starts from 80)

Attempt all the questions.

Group 'A'

[11×1=11]

Rewrite the correct options of each questions in your same answer sheet.

1. The number of combination of n things taken ' r ' at a time is...

- A) $\frac{n!}{r!}$ B) $\frac{n!}{(n-r)!}$ C) $\frac{n!}{r!(n-r)!}$ D) $\frac{n!}{r(n-r)!}$

2. The polar form of complex number $\frac{1-i}{1+i}$ is...

- A) $\cos 0^\circ + i \sin 0^\circ$ B) $\cos 90^\circ + i \sin 90^\circ$
C) $\cos 120^\circ + i \sin 120^\circ$ D) $\cos 270^\circ + i \sin 270^\circ$

3. In a triangle ABC, $a=1$, $b=\sqrt{3}$ and $\angle C = 30^\circ$. Which one of the following is the type of triangle ?

- A) isosceles and obtuse angled B) equilateral
C) right angled D) isosceles triangle

4. If a conic section has eccentricity $(e) = \frac{\sqrt{a^2+b^2}}{a}$, what is the equation of that conic section ?

- A) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ B) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
C) $x^2 + y^2 = a^2$ D) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$

5. Which one of the following is the angle between two vectors $\vec{i} + \vec{j}$ and $\vec{j} + \vec{k}$?

- A) 0° B) 60° C) 90° D) 180°

Contd...

6. Let A and B be two dependent events. If $P(A) = 0.5$, $P(B) = 0.75$ and $P(A \cap B) = 0.4$. What is the value of $P(A/B)$?
A) equal to $P(B)$
B) less than $P(A \cap B)$
C) less than $P(B/A)$
D) equal to $P(B/A)$
7. Which one of the following is the derivative of $\tanh^{-1}x$?
A) $\frac{1}{1-x^2}, |x| < 1$
B) $\frac{1}{\sqrt{1-x^2}}, |x| < 1$
C) $\frac{-1}{1+x^2}, |x| < 1$
D) $\frac{-1}{1-x^2}, |x| < 1$
8. Which one of the following is equal to $\lim_{x \rightarrow \frac{1}{2}} \frac{\tan \pi x}{\sec^2 \pi x}$?
A) $-\frac{1}{2}$
B) $\frac{1}{2}$
C) 0
D) 1
9. Which one of the following is the angle made by the tangent to the curve $2y = 2 - x^2$ at $x=1$?
A) 0°
B) $\frac{\pi}{4}$
C) $\frac{\pi}{2}$
D) $\frac{3\pi}{4}$
10. Which one of the following differential equation gives integrating factor ?
A) $xdy - y^2dx = 0$
B) $x^2dy - xy^2dx = 0$
C) $\sin^2 x \frac{dy}{dx} + y = 2$
D) $3xy dy - y^2 dx = 0$
11. After using forward elimination of the variable in solving system of equations by Gauss method, the equation changed into matrix form will be in.
A) Lower triangular matrix
B) Upper triangular matrix
C) Identity matrix
D) Symmetric matrix

Or

The highest point reached by a projectile is 40m above the horizontal. If the initial velocity is $40\sqrt{2} \text{ ms}^{-1}$, then the angle of projectile is ($g=10\text{ms}^{-2}$)

- A) 0° B) 30° C) 45° D) 60°

(3) Sub.Code : 0081(new course) set 'E'

NEB-GRADE XII

2081 (2024)

Mathematics

(For Regular Students only)

(For the students whose first two digits of registration number starts from 80)

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Time: 3 hrs.

Full Marks: 75

Attempt all the questions.

Group 'A'

Question No. 1 to 11 (Multiple Choice Questions) will be provided after 30 minutes of starting examination. Rewrite its (MCQ) correct options (answer) in the same answer sheet.

Group 'B'

8×5=40

12. a) Write the total number of permutations of set of n objects arranged in a circle. [1]
b) Write the general term in the expansion $(a+x)^n$. [1]
c) Write the series of $\log_e(1-x)$ [$x < 1$]. [1]
d) Write the complex number $(\cos\theta + i\sin\theta)$ in Euler's form. [1]
e) Write the sum of cube of first n natural numbers. [1]

13. a) Show that $\frac{a + b\omega + c\omega^2}{b + c\omega + a\omega^2} = \omega$, where, ω and ω^2 are cube root of unity. [2]

- b) Solve the following system of equations by row equivalent matrix method.
 $4x - 5y + 2z = 1$, $3x = 4z - 10$, $2y = 3z - 6$. [3]

- ✓ 14. a) If $\sin C \cdot \sin(A - B) = \sin A \sin(B - C)$, prove that a^2 , b^2 , c^2 are in A.P. [3]

- b) Find the equation of ellipse whose major axis is twice the minor axis and passes through the point $(1, 0)$. [2]

- ✓ 15. a) Does a conic, $y^2 = 12x$ have two tangents from the point $(6, 9)$? Justify it with calculation. [3]

Contd...

- b) The dot product of two non-zero vectors gives a positive real number. Justify it with example. [2]
16. a) Write the slope of tangent to the curve $y = f(x)$ at (x_p, y_p) . [1]
 b) Write the derivative of $\operatorname{cosech} x$ with respect to x . [1]
- c) A differential equation is in the form $\frac{dy}{dx} + Py = Q$, where P and Q are functions of x only. Name the differential equation. [1]
- d) Write the integral of $\int \frac{1}{a^2 - x^2} dx$ [1]
- e) Write a characteristic of L-Hospital's rule. [1]
17. The following table gives the age and weight of school children in a locality

age in year	4	5	7	9	10	11
weight in kg.	20	25	28	30	32	33

- a) Find the co-efficient of correlation between age and the weight. [2]
 b) Estimate the weight when the age is 12 years. [3]
18. a) Integrate : $\int \frac{dx}{x^2 + 9}$. [2]
- b) Solve: $\frac{dy}{dx} = \frac{1-y}{2x+1}$. [3]
19. Use the Simplex method and maximize $z = 15x + 12y$ subject to $2x + 3y \leq 24$, $3x + 2y \leq 24$, $x, y \geq 0$. [5]

Or

- a) Write any one example that satisfies triangle of forces. [2]
- b) The velocity of a particle when at its greatest height is $\frac{\sqrt{10}}{5}$ of its velocity when at half its greatest height. Find the angle of projection . [3]

Group 'C'

[3×8=24]

20. a) If $z = \cos \theta + i \sin \theta$, find the value of $z^n + \frac{1}{z^n}$ by using De-moivre's theorem. [2]
- b) In a group of 12 students, 8 are boys and remaining girls. In how many ways can 5 students be selected for quiz competition so as to include at most three girls. [3]

Contd...

- c) Prove by the method of principle of mathematical induction that $n^3 + 2n$ is divisible by 3. [3]
21. a) Find the equation of tangents to the circle $x^2 + y^2 = 25$ drawn through the point (13, 0). [3]
- b) If three sides of a triangle are proportional to $2 : \sqrt{6} : \sqrt{3} + 1$, find the angles. [2]
- c) Find the area of a triangle formed by the points whose position vectors are $2\vec{i} - \vec{j} + 3\vec{k}$, $\vec{i} - \vec{j} - 2\vec{k}$ and $\vec{i} + 2\vec{j} + 3\vec{k}$. [3]
22. a) Which type of differential equation $\sin x \frac{dy}{dx} + y \cos x = x \sin x$ represents? Also solve it. [3]
- b) Evaluate: $\int \frac{x}{(x-1)(x^2+1)} dx$. [3]
- c) Two cars start from certain places at the same instant. One goes east at 60km/hr and other goes south at 80km/hr. How fast is the distance between them increasing? Express in symbolic form. [2]

9. Which one of the following is equal to $\lim_{x \rightarrow 0} \frac{e^{3x} - 1}{2x}$?

- a) 0 b) $\frac{1}{2}$ c) $\frac{3}{2}$ d) None

10. $\int \tanh^{-1} x \, dx$ is equal to

- a) $\frac{1}{1-x^2}, |x| < 1$ b) $\frac{1}{\sqrt{1-x^2}}, |x| < 1$
c) $\frac{-1}{1+x^2}, |x| < 1$ d) $\frac{-1}{1-x^2}, |x| < 1$

11. In $\int \frac{dx}{a+b \cos x}$, a and b are

- a) Positive constants b) Negative constants
c) Real numbers d) None

Group 'B'

[8×5=40]

12. a) Find the points on the curve $\frac{x^2}{9} + \frac{y^2}{16} = 1$ where the tangent are parallel to x-axis. [2]

b) State L Hospital's Rule on limits and hence evaluate $\lim_{x \rightarrow 0} \frac{\tan x - x}{x - \sin x}$ [1+2=3]

13. a) Integrate $\int \frac{2x-3}{x^2+3x-18} \, dx$ [2]

b) Prove that

$$\int e^{ax} \sin bx \, dx = \frac{e^{ax}}{a^2 + b^2} (a \sin bx - b \cos bx) + c \quad [2]$$

c) Integrate $\sqrt{x^2 + 36} \, dx$ [1]

14. For any positive integer n

$$[r(\cos \theta + i \sin \theta)]^n = r^n (\cos n\theta + i \sin n\theta)$$

- i) Name the theorem for positive integer n. [1]
ii) Reduce the given statement when we replace n by (-n) [1]
iii) What does 'r' represent in the above theorem? [1]
iv) What does 'θ' represent in the above theorem? [1]
v) Write any one application of the above statement. [1]

15. a) Use mathematical induction and prove that:

$$1+2+3+\dots+n = \frac{n(n+1)}{2} \quad [3]$$

b) Find the sum of square of first 20 natural number. [2]

16. a) Solve by row equivalent matrix method $x + z = 1, z + 2y = 2,$

$$5x - 9y = -3 \quad [3]$$

- b) In any triangle if $\cos B = \frac{\sin A}{2 \sin C}$ Prove that the triangle is isosceles. [2]

Group 'C'

[3×8=24]

17. a) Evaluate $\int \frac{dx}{(4x+3)\sqrt{x+3}}$ [2]

b) Integrate $\int \frac{dx}{3+4 \cos hx}$ [3]

c) Prove that $\int \frac{dx}{\sin x + \cos x} = \frac{1}{\sqrt{2}} \log \left| \tan \left(\frac{x}{2} + \frac{\pi}{8} \right) \right| + c$ [3]

18. a) If $a^4 + b^4 + c^4 = 2c^2(a^2 + b^2)$ prove that $c = 45^\circ$ or 135° . [3]

b) If $n = 15$, $\sigma_x = 3.2$, $\sigma_y = 3.4$ and $\sum (x - \bar{x})(y - \bar{y}) = 122$ find the correlation coefficient between the two variables. [2]

c) Calculate the Karl Pearson's coefficient of correlation from the following data. [3]

x	12	9	8	10	13	7
y	14	8	6	9	12	3

19. a) The height (x) in cms and weight (y) in kg are given for 5 persons in a community.

x	12	9	8	10	13	7
y	14	8	6	9	12	3

Find the correlation coefficient between x and y and regression coefficient y on x. [3+2]

- b) The regression equation related to age(x) and blood pressure (y) are given as below

$$0.22x - y + 81.1175 = 0 \text{ and } x - 1.623y + 105.695 = 0$$

- a) Find the regression coefficient. [2]

- b) Find the correlation coefficient. [1]

Best of Luck



SUKUNA SECONDARY SCHOOL

Sundarharaincha-10, Morang

FIRST TERMINAL EXAMINATION-2080

Class: XII

Full Mark: 40

Subject: Mathematics

Time: 1.5 Hours

Candidates are required to give their answers in their own words as far as practicable. The figures in the margins indicate full marks.

Group 'A'

[5×1=5]

Rewrite the correct options of each question in your answer sheet.

1. In how many ways 'r' letters be posted in 'n' letters box ($n \geq r$)

- a. $n \times r$ b. n^r c. $\frac{n!}{r!}$ d. $\frac{n!}{(n-r)!}$

2. Using L Hospital rule what is the value of

$$\lim_{x \rightarrow 0} \frac{2(e^{2x}-1)}{\log(1+x)}$$

- a. 1 b. 2 c. 3 d. 4

3. The length of latus rectum of parabola $x^2 = 12y - 16$ is

- a. 16 b. 12 c. 6 d. 3

4. The nth term of series $2 + (2+4) + (2+4+6) + \dots$ is

- a. n b. 2n c. $n(n+1)$ d. $\frac{n(n+1)}{2}$

5. If the sides of a triangle are in the ratio 2:2:5 then the triangle is

- a. isosceles triangle b. equilateral triangle
c. obtuse angle triangle d. no such triangle can be formed

Group "B"

[5×3+4=19]

6. a. What is the coefficient of x^6 in the expansion of $(3x^2 - \frac{1}{3x})^9$ [2]

b. Express an exponential e^{-x} infinite series. [1]

c. If $(1+x)^n = c_0 + c_1 x + c_2 x^2 + \dots + c_n x^n$. Then, prove that

$$c_0 c_2 + c_1 c_3 + c_2 c_4 + \dots + c_{n-2} c_n = \frac{2n!}{(n-2)!(n+2)!} \quad [2]$$

7. a. In how many ways can the letters of the word 'LOGIC'

be arranged so that (i) The vowel may occupy odd position?

(ii) No two vowel are together? [2]

- b. From 6 gentleman and 4 ladies a committee of 5 is to be formed.
 ✓ In how many ways can this be done so as to include at least 3 ladies? [3]
- 8.a. By using principle of mathematical induction, prove that
 $(n + 3)^2 \geq 2n + 7$ [2]
- b. If $\frac{1}{a+c} + \frac{1}{b+c} = \frac{3}{a+b+c}$ show that $C=60^\circ$ [2]
- c. State the tangent law. [1]
9. Using row equivalent method solve the following linear equations
 $2x+y-z=9, 3x-y+2z=-1, 4x+y-3z=17$ [4]

Group "C"

[2×8=16]

- 10.a. Water flows into an inverted conical tank at the rate of $42 \text{ cm}^3/\text{sec}$. When the depth of water is 8 cm, how fast is the level rising? Assume the height of the tank is 12cm and the radius of the top is 6cm. [4]
- b. Find the derivative of $y = \tan^{-1}(\tanh \frac{x}{2})$. [2]
- c. Find the point on the circle $x^2 + y^2 = 16$ at which tangents parallel to y-axis. [2]
- 11.a. Show that the line $\frac{x}{a} + \frac{y}{b} = 1$ will tangent to the circle $(x - a)^2 + (y - b)^2 = r^2$ if $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{r^2}$ [2]
- b. Find the equations of common tangents to parabolas $y^2 = 4x$ and $x^2 = 4y$. [3]
- c. Find the coordinates of Centre, vertices, foci, eccentricity, equation of directrix, length of latus rectum of conic section.
 $9x^2 - 16y^2 + 36x + 32y - 124 = 0$ [3]

!!! Best of luck !!!