

Radiant Secondary School  
Bheemdattnagar, Kanchanpur  
First Terminal Examination (2081)

Time: 3 Hrs      Subject: Mathematics, Grade XII, Subject Code: 00  
Candidates are required to give answer in their own words as far as practicable. The figure given in the margin indicates full marks.  
**Attempt All the Questions.**

**Group A [11 × 1 = 11]**

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

1. The series  $-x - \frac{x^2}{2!} - \frac{x^3}{3!} - \frac{x^4}{4!} - \dots$  is expansion of  
(a)  $e^{-x}$       (b)  $1 - e^{-x}$       (c)  $1 - e^x$       (d) none
2. The expression  $C(n, r) - C(n-1, r-1)$  equals to  
(a)  $C(n-1, r)$       (b)  $C(n, r+1)$       (c)  $C(n+1, r)$       (d) none
3. The number of ways to form a 4 digit number using the figures 0, 5, 4, 7, where repetition of digits is allowed, is  
(a) 64      (b) 128      (c) 192      (d) 256
4. A boy has 4 coins of different denominations: Re. 1, Rs. 2, Rs. 5 and Rs. 10. How many different sums can he form using at least one of the coins at a time?  
(a) 4      (b) 10      (c) 14      (d) 15
5. In  $\triangle ABC$ , if  $\sin A : \sin B : \sin C = 12 : 5 : 13$ , the triangle is  
(a) acute angled      (b) obtuse angled  
(c) right angled      (d) not possible
6. If  $a = 3$ ,  $b = 5$ ,  $c = 7$ , then measure of  $\angle C$  =  
(a)  $180^\circ$       (b)  $150^\circ$       (c)  $120^\circ$       (d)  $60^\circ$
7. The derivative of the function  $y = \tan^{-1} \sinh 3x$  with respect to  $x$  is  
(a)  $3 \operatorname{sech} 3x$       (b)  $\frac{3 \cosh 3x}{\cosh 6x}$       (c)  $\frac{3}{1 - \sinh^2 3x}$       (d) none
8. Formula for the integral of the form  $\int \frac{1}{\sqrt{x^2 - a^2}} dx$  is  
(a)  $\sin^{-1} \left( \frac{x}{a} \right) + C$       (b)  $\log_e \sqrt{x^2 - a^2} + C$   
(c)  $\log_e (x + \sqrt{x^2 - a^2}) + C$       (d)  $\sin^{-1} \left( \frac{a}{x} \right) + C$
9. Let  $AX = B$  be the matrix form of a system of  $n$  linear equations in  $n$  variables. If the matrix  $A$  is a singular matrix, then the system has  
(a) unique solution      (b) no solution  
(c) infinitely many solutions      (d) not a unique solution

10. The integral  $\int \frac{4}{(x+2)(x-2)} dx$  is equal to

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

11. The linear system  $2x_2 - 6x_1 = 10$ ,  $3x_1 - x_2 = 6$  is

- (a) consistent and independent.      (b) consistent and dependent.  
(c) inconsistent and independent.      (d) inconsistent and dependent.

**Group B [8 × 5 = 40]**

12. (a) How many 4 digit vehicle numbers formed from 0, 3, 5, 7, 8, using different digits, are more than 800? [2]

(b) There are 10 skilled and 15 learner cricket players in a club. In how many ways can a team of 15 players be selected for a tournament consisting of at least 7 skilled players? [3]

13. (a) State binomial theorem. Write any one of its applications. For what values of  $x$  is  $(1-x)^{-1} = 1 + x + x^2 + \dots$  valid? [2.5]

(b) Show that  $x = y + \frac{y^2}{2!} + \frac{y^3}{3!} + \dots$  if the condition  
 $y = x - \frac{x^2}{2} + \frac{x^3}{3} - \dots$  is given. [2.5]

14. (a) Find the middle term (s) in the expansion of  $\left(2x - \frac{1}{x}\right)^{25}$  [2]

(b) What is the sum of the coefficients in the expansion:  
 $(1+x)^n = C_0 + C_1x + C_2x^2 + \dots + C_nx^n$ ? Prove that

$$C_0 + 2C_1 + 3C_2 + \dots + (n+1)C_n = (n+2)2^{n-1} \quad [3]$$

15. (a) Prove that  $(a+b+c) \left( \tan \frac{A}{2} + \tan \frac{B}{2} \right) = 2c \cot \frac{C}{2}$  [3]

Or

Find the equation of the tangent to the circle  $x^2 + y^2 = a^2$  at the point  $(x_1, y_1)$  which lies on the circle. [3]

(b) In triangle ABC, if  $A = 30^\circ$ ,  $B = 45^\circ$  and  $a = 6\sqrt{2}$ , calculate the measure of side length  $c$ . [2]

16. (a) Evaluate:  $\int \frac{dx}{1-4 \cos 2x}$  [3]

(b) Evaluate:  $\int \frac{dx}{(8+x)(5-4x)}$  [2]

17. (a) Find derivative of  $(\cosh^{-1} x)^x$  with respect to  $x$ . [2]

(b) What is practical significance and geometrical meaning of derivative? Using L Hospital's rule evaluate:

$$\lim_{x \rightarrow 0} \frac{e^x + e^{-x} - 2 \cos x}{\sin^2 x} \quad [1+2]$$



18. Using Row Equivalent method or inverse matrix method, solve:

$$9y - 5x = 3, x + z = 1, z + 2y = 2$$

[5]

19. (a) State projection laws for a triangle. Prove one of them.

[2.5]

(b) State tangent laws for a triangle. Prove one of them.

[2.5]

Group C [ $3 \times 8 = 24$ ]

20. (a) With appropriate examples write the difference between permutation and combination of a set of objects.

[2]

(b) Find the values of  $n$  and  $r$  where  $P(n, r) = 240$  and  $C(n, r) = 120$ .

[3]

(c) How many of the arrangements of the letters in the word RADIANT do not begin with R? How many of them begin with R but do not end with T?

[3]

21. A mixture of three foods is to be formed. Per kg of the foods X, Y, Z contain the nutrients L, M, N as given in the table below:

Foods	Units of nutrients in per kg food		
	L	M	N
X	2	2	3
Y	2	3	2
Z	1	2	2

The quantities of nutrients L, M, N are 80 units, 140 units and 130 units, respectively.

(a) Express the information in terms of a system of linear equations.

[2]

(b) Solve the system using a matrix method.

[4.5]

(c) If per kg cost of the foods X, Y, Z are Rs. 200, Rs. 300, Rs. 200, respectively, find the total cost of the mixture of the three foods.

[1.5]

22. (a) Write an application of integration of a function.

Evaluate:  $\int \frac{3x^2 dx}{(x+5)(x+4)^2}$

[1+3]

(b) Write the formula for the integral:  $\int e^{ax} \sin bx \, dx$ .

Also, evaluate:  $\int x\sqrt{2x-x^2+5} \, dx$

[1+3]

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**Radiant Secondary School**  
**Second Terminal Examination 2081**

**Grade XII Mathematics FM: 75 Time: 3 Hrs SET B**  
Attempt All the Questions.

**Group A [11 × 1 = 11]**

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

- The coefficient of middle term in the expansion of  $(x^2 + \frac{c}{x})^6$  is 1280, the value of  $c$  is  
(a) 4 (b) 5 (c) 6 (d) 8
- Let  $a, b, c$  be positive. The circles  $x^2 + y^2 = a^2$  and  $(x - c)^2 + y^2 = b^2$  touch externally if  
(a)  $a - b = c$  (b)  $b - a = c$  (c)  $a + b = c$  (d)  $a = b + c$
- The equation of directrix of parabola  $y^2 = 6x$  is  
(a)  $2x - 3 = 0$  (b)  $2x + 3 = 0$   
(c)  $2y - 3 = 0$  (d)  $2y + 3 = 0$
- The point on curve  $2x^2 - 4x - y - 3 = 0$  at which the tangent drawn is parallel to the line  $y = 4x + 2$  is  
(a) (2, -3) (b) (2, 10) (c) (0, -3) (d) (0, 2)
- Let  $\omega$  be a complex cube root of unity. The value of  $(2 + 5\omega + 2\omega^2)^6$  is .....  
(a) 279 (b) 729 (c) 927 (d) 972
- If  $c = 3, a = 5, b = 7$ , then measure of  $\angle B$  is  
(a)  $180^\circ$  (b)  $150^\circ$  (c)  $120^\circ$  (d)  $60^\circ$
- The number of ways in which the word "PASUPATI" can be arranged so that all the vowels come together is  
(a) 1440 (b) 1520 (c) 1850 (d) 2000
- For a linear system  $AX = B$  if  $A^{-1}$  does not exist, then  
(a) the system has no solution (b)  $X = A^{-1}B$   
(c) the system has infinitely many solutions (d) (a) or (c)
- The sum of first  $n$  natural numbers is 36, the value of  $n + 1$  is...  
(a) 7 (b) 8 (c) 9 (d) 10
- The integral  $\int \frac{7}{(x+2)(x-5)} dx$  is equal to  
(a)  $\ln \frac{x+2}{x-5} + C$  (b)  $7 \ln \frac{x-5}{x+2} + C$   
(c)  $\ln(x+2)(x-5) + C$  (d)  $\ln \frac{x-5}{x+2} + C$

- If the final form of Gauss elimination process for a system of linear equations is  
 $3x_1 + x_2 - x_3 = 6$   
 $2x_2 + x_3 = 10$ , the system is  
(a) consistent and independent. (b) consistent and dependent.  
(c) inconsistent and independent. (d) inconsistent and dependent.

**Group B [8 × 5 = 40]**

- (a) Out of 15 equally qualified cricket players, in how many ways can 1 captain, 1 vice-captain and 1 manager be elected so that no one can hold more than one post? [2]  
(b) In an examination question paper, there are 10 questions divided into two groups: 4 in Group A and 6 in Group B. An examinee is required to attempt 8 questions choosing at most 4 from each group. How many ways of selections are possible there? [3]
- (a) Consider the expansion  $(1+x)^n = C_0 + C_1x + \dots + C_nx^n$ . Prove that  $C_0 + C_1 + \dots + C_n = 2^n$ . Also, prove that  $C_0 + 3C_1 + 5C_2 + \dots + (2n+1)C_n = (n+1)2^n$ . [1+2]  
(b) Define Euler's number  $e$ . Using its series expansion, prove that  $\frac{1}{2!} + \frac{2}{3!} + \frac{3}{4!} + \dots = 1$  [1+1]
- (a) In  $\triangle ABC$ , given that  $\frac{1}{a+b} + \frac{1}{a+c} = \frac{3}{a+b+c}$ . Prove that  $\angle A = 60^\circ$  [3]  
(b) In triangle ABC, if  $B = 120^\circ, b = 6$  and  $a = 2\sqrt{6}$ , calculate the measure of side length  $c$ . [2]
- (a) Evaluate:  $\int \frac{dx}{5 + \cosh x}$  [3]  
(b) Evaluate:  $\int \frac{dx}{(x+2)^2(5x-1)}$  [2]
- (a) Using L'Hospital's rule, evaluate:  $\lim_{x \rightarrow 0} \frac{x e^x - \ln(x+1)}{2x^2}$ . [2]  
(b) Water flows into an inverted tank at the rate of  $24 \text{ cm}^3/\text{min}$ . When the depth of water is 9cm, how fast is the level rising? Assume that the height of the tank is 15cm and the radius at the top is 5cm. [3]

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17. Why do we need computational methods for system of linear equations?

Using Gauss elimination method or Gauss Seidel method, solve the system of equations:

$$4x_1 + x_2 + x_3 = 7$$

$$2x_1 - 5x_2 + 2x_3 = 1$$

$$x_1 - x_2 - 3x_3 = 6$$

[1+4]

18. State De Moivre's theorem for complex numbers.

Also, find the fourth roots of  $1 - \sqrt{3}i$ .

[1+4]

19. (a) Evaluate  $\int \sqrt{4x^2 - 9} dx$

[2]

(b) State L Hospital's rule. Also, evaluate:

$$\lim_{x \rightarrow 0} \frac{\ln x}{\ln \tan x}$$

[1+2]

**Group C [3 × 8 = 24]**

20. (a) Using Crammer's rule, solve the system

$$\frac{2}{x} + \frac{5}{y} = 2, \quad \frac{2}{x} - \frac{10}{y} = -1.$$

[2]

(b) The cost of 4kg wheat, 7kg rice and 5kg sugar is Rs. 182.

The cost of 8kg wheat, 6kg rice and 3kg sugar is Rs. 210.

The cost of 5kg wheat, 3kg rice and 7kg sugar is Rs. 150.

Express the information in the form of linear equations.

Also, find the rate per kg of each item using

**matrix inverse or row equivalent method.**

[6]

21. (a) Find the equation of tangents to circle  $x^2 + y^2 = 65$  from the point (11, 3). Also find the angle between them.

[5]

(b) Find the equation of parabola whose vertex is (3, 2) and Focus at (3, 6).

[3]

22. (a) State Binomial Theorem and write its general term. Which term in the expansion of  $\left(2x - \frac{1}{3x}\right)^{10}$  is independent of  $x$ ?

[2+1]

(b) What is the sum of the squares of first  $n$  natural numbers?

Find the  $n$ th term and sum to first  $n$  terms of the series:

$$1 \cdot 2 + 3 \cdot 3 + 5 \cdot 4 + \dots$$

[1+4]

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**Second Terminal Examination 2081**

**Grade XII Mathematics FM: 75 Time: 3 Hrs SET A**  
Attempt All the Questions.

**Group A [11 × 1 = 11]**

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

1. The coefficient of middle term in the expansion of  $(\frac{p}{x} + x^2)^6$  is 2500, the value of  $p$  is  
(a) 4 (b) 5 (c) 6 (d) 8
2. Let  $a, b, c$  be positive with  $a < b$  and the circles  $x^2 + y^2 = b^2$  and  $(x - c)^2 + y^2 = a^2$  touch internally then  
(a)  $a - c = b$  (b)  $a + b = c$  (c)  $a = b$  (d)  $a = b - c$
3. The equation of directrix of parabola  $x^2 = 6y$  is  
(a)  $2x + 3 = 0$  (b)  $2x - 3 = 0$   
(c)  $2y + 3 = 0$  (d)  $2y - 3 = 0$
4. The point on curve  $2x^2 - 4x - y - 3 = 0$  at which the tangent drawn is parallel to the line  $y = 5$  is  
(a)  $(-1, -5)$  (b)  $(-1, 3)$  (c)  $(0, -3)$  (d)  $(0, 2)$
5. Let  $\omega$  be a complex cube root of unity. The value of  $(2 + 5\omega + 2\omega^2)^6$  is .....  
(a) 279 (b) 729 (c) 927 (d) 972
6. If  $a = 3, b = 5, c = 7$ , then measure of  $\angle C =$   
(a)  $180^\circ$  (b)  $150^\circ$  (c)  $120^\circ$  (d)  $60^\circ$
7. The number of ways in which the word "MONALISA" can be arranged so that all the vowels come together is  
(a) 1440 (b) 1520 (c) 1850 (d) 2000
8. For a linear system  $AX = B$  if  $A^{-1}$  does not exist, then  
(a) the system has no solution (b)  $X = A^{-1}B$   
(c) the system has infinitely many solutions (d) (a) or (c)
9. The sum of first  $n$  natural numbers is 78, the value of  $n + 1$  is.....  
(a) 11 (b) 12 (c) 13 (d) 14
10. The integral  $\int \frac{7}{(x+3)(x-4)} dx$  is equal to  
(a)  $\ln \frac{x+3}{x-4} + C$  (b)  $7 \ln \frac{x-4}{x+3} + C$   
(c)  $\ln(x+3)(x-4) + C$  (d)  $\ln \frac{x-4}{x+3} + C$

$$78 = \frac{n(n+1)}{2}$$

11. If the final form of Gauss elimination process for a system of linear equations is

$$\begin{aligned} 9x + 5y - z &= 21 \\ 2y + 4z &= 3 \end{aligned} \text{ , the system is}$$

- (a) consistent and independent. (b) consistent and dependent.  
(c) inconsistent and independent. (d) inconsistent and dependent.

**Group B [8 × 5 = 40]**

12. (a) Out of 9 equally qualified volleyball players, in how many ways can 1 captain, 1 vice-captain and 1 manager be selected so that no one can hold more than one post? [2]  
(b) In an examination question paper, there are 12 questions divided into two groups A and B, 6 in each. An examinee is required to attempt 9 questions choosing at least 3 from each group. How many ways of selections are possible there? [3]
13. (a) Consider the expansion  $(1+x)^n = C_0 + C_1x + \dots + C_nx^n$ . Prove that  $C_0 + C_1 + \dots + C_n = 2^n$ . Also, prove that  $C_0 + 2C_1 + 3C_2 + \dots + (n+1)C_n = (n+2)2^{n-1}$ . [1+2]  
(b) Define Euler's number  $e$ . Using its series expansion, prove that  $\frac{2}{3!} + \frac{4}{5!} + \frac{6}{7!} + \dots = \frac{1}{e}$  [1+1]
14. (a) In  $\Delta ABC$ , given that  $a^4 + b^4 + c^4 - 2a^2c^2 - 2b^2c^2 = 0$ . Prove that  $\angle C = 45^\circ$  or  $135^\circ$ . [3]  
(b) In triangle ABC, if  $A = 120^\circ$ ,  $a = 6$  and  $c = 2\sqrt{6}$ , calculate the measure of side length  $b$ . [2]
15. (a) Evaluate :  $\int \frac{dx}{3+4 \cosh x}$  [3]  
(b) Evaluate :  $\int \frac{dx}{(x+4)^2(7x-3)}$  [2]
16. (a) Using L' Hospital's rule, evaluate:  $\lim_{x \rightarrow 0} \frac{5x^2}{x e^x - \ln(x+1)}$ . [2]  
(b) Water flows into an inverted tank at the rate of  $42 \text{ cm}^3/\text{sec}$ . When the depth of water is 8cm, how fast is the level rising? Assume that the height of the tank is 12cm and the radius at the top is 6cm. [3]
17. Why do we need computational methods for system of linear equations?



Using Gauss elimination method or Gauss Seidel method, solve the system of equations:

$$3x_1 + x_2 - x_3 = 2$$

$$2x_1 - 5x_2 + x_3 = 20$$

$$x_1 - 3x_2 - 8x_3 = 3$$

[1+4]

18. State De Moivre's theorem for complex numbers.

Also, find the fourth roots of  $\sqrt{3} + i$ .

[1+4]

19. (a) Evaluate  $\int \sqrt{5x^2 - 4} dx$

[2]

(b) State L Hospital's rule. Also, evaluate:

$$\lim_{x \rightarrow 0} \frac{\ln \tan x}{\ln x}$$

[1+2]

### Group C [ $3 \times 8 = 24$ ]

20. (a) Using Crammer's rule, solve the system

$$\frac{2}{x} + \frac{5}{y} = 17, \frac{5}{x} - \frac{2}{y} = -1.$$

[2]

(b) The cost of 3 chairs, 2 tables and 1 desk is Rs. 970. The cost of 2 chairs, 1 table and 3 desks is Rs. 860. The cost of 1 chair, 2 tables and 1 desk is Rs. 990. Express the information in the form of linear equations. Also, find the cost of each chair, table and desk **using inverse matrix method or row equivalent method.**

[6]

21. (a) Find the equation of tangents to circle  $x^2 + y^2 = 64$  from the point (7, 8). Also find the angle between them.

[5]

(b) Find the equation of parabola whose vertex is (2, 6) and Focus at (7, 6).

[3]

22. (a) State Binomial Theorem and write its general term. Which term in the expansion of  $\left(7x - \frac{1}{6x}\right)^{24}$  is independent of  $x$ ?

[2+1]

(b) What is the sum of the squares of first  $n$  natural numbers?

Find the  $n$ th term and sum to first  $n$  terms of the series:

$$1 \cdot 3 + 2 \cdot 5 + 3 \cdot 7 + \dots$$

[1+4]

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