The Times Secondary School
Dillibazar, Kathmandu
First Terminal Examination – 2076

Grade: XII	**Set A**	**Full Marks:100**
Stream: Science		**Pass Marks: 40**
Subject: Basic Mathematics.		**Time : 3hrs**

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

Attempt all the questions.

Group A

1. (a) In how many ways letters of the word 'PRECARIOUS' can be arranged so that all the vowels are always together? [2]
   (b) How many different sums of money can be made form 4 coins of different denominations? [2]
2. (a) Find the middle term in the expansion of $\left(1+\frac{x}{2}\right)^{15}$ [2]
   (b) If $(1+x)^n = c_0+c_1x+c_2x^2+\ldots\ldots\ldots c_n x^n$, prove that $c_1+2c_2+3c_3+\ldots\ldots\ldots+ {}^nc_n = n.2^{n-1}$. [2]
3. (a) show that : $\frac{2}{1!}+\frac{4}{3!}+\frac{5}{5!}+\ldots\ldots\ldots$to $\infty = e$. [2]
   (b) Prove that the line lx + my + n = 0 touches the parabola $y^2 = 4ax$ if $ln = am^2$. [2]
4. (a) Find the eccentricity and foci of the hyperbola: $\frac{x^2}{36}-\frac{y^2}{24}=1$. [2]
   (b) Find the ratio in which the line joining the points (2, 4, 5) and (3, 5, –4) is divided by xy – plane. [2]
5. (a) If a line makes angle of $\frac{\pi}{3}$ and $\frac{\pi}{4}$ with the positive x – axis and z–axis respectively. Find the acute angle made by the line with the positive y – axis. [2]
   (b) Find the derivative of $(secx)^{tanx}$. [2]
6. (a) Find the points on the curve $y = x^3 - 3x^2 + 2$ where the tangent is parallel to the x–axis. [2]
   (b) Using L'Hospital's rule, Evaluate: $\lim_{x\to 0}\left(\frac{x^2-sin^2x}{x^2}\right)$. [2]
7. (a) Solve the following equation using Gauss Elimination Method: 5x – 3y = 19 and 2x + 5y = –11. [2]
   (b) Define Well– conditioned and ill conditioned of a system of equation. [2]
   (c) Using trapezoidal rule, Evaluate: $\int_0^4 x^3.dx$, n =4. [2]

Group B

8. A committee of five persons is to be selected from 5 men and 4 ladies. In how many ways can this be done so that at least two ladies are always included? [4]
9. Show that : $\dfrac{\frac{1}{2!}+\frac{1}{4!}+\frac{1}{6!}+\ldots\ldots}{\frac{1}{1!}+\frac{1}{3!}+\frac{1}{5!}+\ldots\ldots} = \dfrac{e-1}{e+1}$ [4]
10. Prove that the lines joining the ends of latus rectum of the parabola $y^2 = 4ax$ to the point of intersection of the directrix and the axis are at right. [4]
11. Find the equation of the hyperbola with vertex at (0, 8)and passing through the point ($4,4\sqrt{2}$) [4]
12. Find the angle between the lines whose direction cosines are given by l + m + n =0 and 2lm + 2ln – mn = 0. [4]
13. Show that the line AB is perpendicular to CD if A, B, C, D are the points (2, 3, 4),(5, 4, –1),(3, 6, 2) and (1, 2, 0) respectively. [4]
14. Find from first principles the derivatives of $e^{\sqrt{x}}$. [4]
15. Find the derivatives of $(x)^{sinh^2\frac{x}{a}}$. [4]
16. Find the root of the equation $x^3 - x - 4 = 0$ between 1 and 2 to three places of decimals by Netwon Raphson's Method. [4]
17. Solve the following system of equations by Gauss Seidel Method : 3x + y –z = 2, 2x – 5y + z = 20,x – 3y – 8z = 3. [4]

Group C

18. Show that: $\sum_{n=1}^{\infty}\frac{n^2}{(n+1)!}$. [6]
19. prove that the lines whose direction cosines are given by the relations al + bm +cn = 0 and fmn + gnl +hlm = 0 are perpendicular if $\frac{f}{a}+\frac{g}{b}+\frac{h}{c}=0$ [6]
20. Define Lagrange's Mean value theorem. Also, verify the theorem for the function $f(x) = 2x^2 - 10x + 29$ in [2, 7]. [6]
21. Find the roots of the equation $f(x) = x^3 - 4x - 9$ correct to three decimal places by using bisection method. [6]
22. State and prove Trapezoidal rule of numerical approximation. [6]

THE END

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Attempt all the questions.

Group A

1. (a) In a certain election, there are three candidates for president, five for secretary and only two for treasurer. Find in how many ways the election may turn out. [2]

   (b) In how many ways can 3 letters be posted in 4 letter boxes? [2]

2. (a) Find the middle term in the expansion of $(2a + 3x)^{30}$ [2]

   (b) If $c_0, c_1, c_2 \ldots\ldots c_n$ are the binomial co–efficient in the expansion of $(1+x)^n$; show that: $c_0 + c_2 + c_4 + \ldots\ldots = 2^{n-1}$ [2]

3. (a) Prove that : $\log_e 2 = \frac{1}{1.2} + \frac{1}{3.4} + \frac{1}{5.6} + \ldots\ldots\ldots$ [2]

   (b) Find the equation of the tangent from the point (–6, 9) to the parabola $y^2 = 24x$ [2]

4. (a) Find the eccentricity and foci of the hyperbola: $\frac{x^2}{9} + \frac{y^2}{16} = 1$. [2]

   (b) Show that the points A(1, 2, 3),B(4, 0, 4) and C(–2, 4, 2) are collinear. [2]

5. (a) If a straight line makes an angle $\alpha = \frac{\pi}{3}$ with the positive x – axis, an angle $\beta = \frac{\pi}{4}$ with the positive y – axis and an acute angle γ with the positive Z – axis. Find γ [2]

   (b) Find the derivative of $(x)^{\sinh x}$. [2]

6. (a) Find the slope of tangent to the curve $y = x^3 + 2x^2 + 3x - 10$ at (3, –2) [2]

   (b) Using L'Hospital's rule, Evaluate: $\lim_{x \to 0} \left(\frac{\tan x - x}{x - \sin x}\right)$. [2]

7. (a) Solve the following equation using Gauss Elimination Method: $2x + 3y = 4$ and $3x + 2y = -4$. [2]

   (b) Interpret geometrically that a system of equation in two variables is ill conditioned? [2]

   (c) Using trapezoidal rule, Evaluate: $\int_0^1 \frac{dx}{1+x^2}.dx$, n =2. [2]

Group B

8. A person has got 12 acquaintances of whom 8 are relatives. In how many ways can he invite 7 guests so that 5 of them may be Relatives ? [4]

9. Show that: $\dfrac{1+\frac{1}{2!}+\frac{1}{4!}+\frac{1}{6!}+\ldots\ldots\ldots}{1+\frac{1}{3!}+\frac{1}{5!}+\frac{1}{7!}+\cdots\ldots\ldots} = \dfrac{e^2+1}{e^2-1}$ [4]

10. Find the equation of the tangent to the parabola $y^2 = 4ax$ in the slope form. Also, find the point of contact. [4]

11. Find the centre, eccentricity and foci of the ellipse ; $x^2 + 4y^2 - 4x + 24y + 24 = 0$ [4]

12. Find the angle between the lines whose direction cosines are given by $4l + 3m - 2n = 0$ and $lm - mn + nl = 0$. [4]

13. If the coordinates of P,Q,R and S be (1,2,2),(2,4,0),(–3,0,1) and (–1,–2,2) respectively, find the projection of RS on PQ. [4]

14. Find from first principles the derivatives of $e^{\tan x}$. [4]

15. Find the derivatives of $(x)^{\cosh^2\frac{x}{a}}$. [4]

16. Use Newton– Raphson Method to find the solution of the equation $x^3 + x - 1 = 0$ in the interval [0, 1], accurate to within 10^{-4}. [4]

17. Solve the following system of equations by Gauss Seidel Method : $3x + 4y + 8z = 7$, $x + 20y + z = -18$, $25x + y - 5z = 19$. [4]

Group C

18. prove that: $1 + \frac{1+3}{2!} + \frac{1+3+5}{3!} + \frac{1+3+5+7}{5!} + \ldots\ldots = \frac{3e}{2}$ [6]

19. Prove that the straight line which makes angle x, y, z, δ with four diagonals of a cube is $\cos^2 x + \cos^2 y + \cos^2 z + \cos^2 \delta = \frac{4}{3}$ [6]

20. State Rolle's theorem.Inteprete it geometrically.Verify Rolle's theorem for th function $f(x) = \sin x$, $x \in [0, \pi]$.Also find a point in the curve represented by given function where the tangent is parallel to x–axis. [6]

21. Find the roots of the equation $f(x) = x^3 - 4x - 9$ correct to three decimal places by using bisection method. [6]

22. State and prove Trapezoidal rule of numerical approximation. [6]

THE END