The Times Secondary School
Dillibazar, Kathmandu
First Terminal Examination – 2080

Grade: - XII   Set A   Full Marks:-75

Stream: Science   Pass Marks:-30

Subject: - 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.

Group –A [11× 1 = 11]

Rewrite the correct option in your answer sheet.

1. How many odd numbers of three different digits can be formed from the integers 1, 2, 3, 4 and 5?
   a) 12   b) 36   c) 60   d) 120

2. The middle term in the expansion of $\left(x - \frac{1}{x}\right)^{20}$ is
   a) $C(20, 10)$ b) $- C(20, 10)$ c) $C(20, 10)x$ d) $C(20, 10)x^{10}$

3. Sum of the first n natural numbers is
   a) n^2 b) $\frac{n(n+1)(2n+1)}{6}$ c) $\frac{n(n+1)}{2}$ d) $\left(\frac{n(n+1)}{2}\right)^2$

4. The radius of the circle $x^2 + y^2 + 4x - 6y + 4 = 0$ is
   a) 2   b) 3   c) 4   d) 9

5. For what value of p , do the system of equations $2x + 3y = 1$, $4x + 6y = p$ have infinite solutions?
   a) 0   b) 1   c) 2   d) 4

6. $\lim_{x\to\frac{\pi}{2}} \frac{tan5x}{tanx}$ equals
   a) $\frac{1}{5}$ b) $-\frac{1}{5}$ c) $\frac{5}{7}$ d) $-\frac{1}{7}$

7. The derivative of Arc tan sinh x is
   a) cosh x   b) sinh x   c) tanh x   d) sech x

8. The integral value of $\int \frac{dx}{a^2 - x^2}$ is
   a) $\frac{1}{2a}\ln\left(\frac{a+x}{a-x}\right) + c$ b) $\frac{1}{a}tan^{-1}\frac{x}{a} + c$
   c) $\log\left(x + \sqrt{a^2 - x^2}\right) + c$ d) $sin^{-1}\frac{x}{a} + c$

9. If the regression coefficients are $b_{xy} = -\frac{1}{3}$ and $b_{yx} = -\frac{3}{4}$, the correlation coefficient between two vriables x and y is
   a) 0.25   b) -.0.25   c) 0.50   d) - 0.50

10. If α and β be two complex roots of unity then α^2 equals
    a) 1   b) 0   c) α d) β

11. For two dependent events A and B, P(A/B) equals
    a) $\frac{P(A\cap B)}{P(A)}$ b) $P(A)P(B)$ c) $\frac{P(A\cap B)}{P(B)}$ d) $\frac{P(A)}{P(A\cap B)}$

Group 'B' [5 × 8 = 40]

12. (a) In how many ways can the letters of the word 'INTERVAL' be arranged so that the vowels may occupy only the odd positions? [2]
    b) A candidate has to pass in each of the five subjects. In how many ways can he be fail? [3]

13. If $(1 + x)^n = C_0 + C_1x + C_2x^2 + ... +C_nx^n$,
    a) Write the value of
    i) $C_0+C_1+C_2+C_3+.......+C_n$ [1]
    ii) $C_1+2C_2+3C_3+.......+nC_n$ [1]
    b) Prove that . $C_0+4C_1+7C_2+10C_3+.......+(3n+1)C_n= (3n+2)2^{n-1}$ [3]

14. Solve the system of equatiions : $x – y + 2z = 0$, $x – 2y + 3z = –1$, $2x – 2y + z = – 3$ by Row-equivalent matrix method or Cramar's Rule.

15. Find the regression equation of x on y from the following data from the following data

X	5	9	13	17	21
Y	3	8	13	18	23

   Estimate th value of x when y = 18.

16. Solve the following LP Problem, using simplex method
   Maximize Z = 7x + 5y subject to $x + 2y \leq 6$, $4x + 3y \leq 12$, $x, y \geq 0$.

17. i) Define L'Hospital's Rule and use it to evaluate $\lim_{x\to\theta} \frac{xsin\theta - \theta sinx}{x - \theta}$ [1 +1]
    ii) Find the derivative of $tanhx^{sechx}$ [3]

18. a) Write the equation of tangent to the curve y = f(x) at piont (x_1, y_1) in differential form. [1]
    b) Define the angle of intersections between two curves. [1]
    b) Find the point on the curve y = $2x^2 + 3x + 5$, the tangent at which is perpendicular to the line x - 5y +10 = 0. [3]

19. Two concentric circles are expanding in such a way that the radius of inner circle is increasing at a rate of 4cm/sec and that of the outer circle at a rate of 1.5cm/sec. Is the area between the circles increasing or decreasing when the inner and outer circles are 5 cm and 8 cm. And how fast?

Group 'C'[8 × 3 = 24]

20. (a) Prove that $\frac{1}{2.3} + \frac{1}{4.5} + \frac{1}{6.7} + ... = 1 - \log_e 2$ [2]
    b) Using De Morgan's theorem find the value of $(1 - i\sqrt{3})^6$. [3]
    c) Using mathematical induction, prove that $1 + 3 + 5 + ...+ (2n - 1) = n^2$ [3]

21. a) Find the equation of tangent to the circle $x^2 + y^2 - 6x + 8y - 4 = 0$ at (8, 6).
    b) Find the condition that the line $lx + my + n = 0$ is tangent to the circle $x^2 + y^2 + 2gx + 2fy + c = 0$.
    c) Find the equation of parabola whose vertex is at (3,2) and the focus is at (5, 2).

22. a)Define integral of the function f(x) w. r. t. x [1]
    b) Write the integral of $\int e^{ax}sinbxdx$ [1]
    c) Integrate the following
    i) $\int \frac{dx}{1+sinx+cosx}$ ii) $\int \frac{x+1}{(x-4)(x+2)}dx$ [3+3]

THE END

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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 [11× 1 = 11]
Rewrite the correct option in your answer sheet.

1. Of the numbers formed by using all the figures 1, 2, 3, 4, 5 only once, how many are even ?
   a) 24   b) 36   c) 48   d) 96

2. The sum of the binomial coefficients in the expansion of $(1 + x)^n$ is
   a) 2n   b) 2^n c) n!   d) n^2

3. Sum of the squares of the first n natural numbers is
   a) n^2 b) $\frac{n(n+1)(2n+1)}{6}$ c) $\frac{n(n+1)}{2}$ d $\left(\frac{n(n+1)}{2}\right)^2$

4. The center of the circle $x^2 + y^2 + 4x - 6y + 4 = 0$ is
   a) (-2, -3)   b) (2, -3)   c) (-2, 3)   d) (2, 3)

5. The system of equations x - 2y = 5 and kx + 6y = 9 have no solutions when k equals
   a) -2   b) 2   c) -3   d) 3

6. $\lim_{x\to\frac{\pi}{2}} \frac{sec7x}{sec5x}$ equals
   a) $\frac{7}{5}$ b) $-\frac{7}{5}$ c) $\frac{5}{7}$ d) $-\frac{5}{7}$

7. The derivative of log(tanhx) is
   a) cosh 2x   b) sinh2 x   c) 2cosech2 x   d) $sech^2$ x

8. The integral of $\int \frac{dx}{\sqrt{x^2+a^2}}$ is
   a) $\log(x + \sqrt{x^2 - a^2}) + c$ b) $\log(x - \sqrt{x^2 - a^2}) + c$
   c) $\log(x + \sqrt{x^2 + a^2}) + c$ d) $sin^{-1}\frac{x}{a} + c$

9. The correlation coefficinet 'r' between two variables lies between
   a) $-\infty \le r \le \infty$ b) $-1 \le r \le 1$ c) $0 \le r \le 1$ d) $0 \le r \le \infty$

10. If α and β be two complex roots of unity then α^{-1} equals
    a) 1   b) 0   c) α d) β

11. For two dependent events A and B, P(B/A) equals
    a) $\frac{P(A \cap B)}{P(A)}$ b). $P(A)P(B)$ c). $\frac{P(A \cap B)}{P(B)}$ d) $\frac{P(A)}{P(A \cap B)}$

Group 'B' [5 × 8 = 40]

12. (a) In how many ways can the letters of the word "CALCULUS" be arranged so that two C's do not come together. [3]
    b) How many committees of 3 men and 2 women can be formed from 12 men and 8 women? [2]

13. a) Define Eulers number. [1]
    b) Show that $1 + \frac{1+2}{2!} + \frac{1+2+3}{3!} + \frac{1+2+3+4}{4!} + \dots\dots\dots$ to $\infty = \frac{3e}{2}$. [4]

14. Solve the system of equatiions : x - y + z = - 3, x + y + z = 1, 3x - 4y - z = 1 by Row-equivalent matrix method or Cramars Rule.

15. Find the coefficient of correlation by Karl Pearson's method.

X	6	2	10	4	8
Y	9	11	6	8	7

16. Solve the following LP Problem, using simplex method
    Maximize $Z = 5x -3y$ subject to $3x + 2y \le 6, x - 3y \le 4, x, y \ge 0$

17. a)Define L'Hospital's Rule and use it to evaluate $\lim_{x\to\theta} \frac{tanbx}{tancx}$ [1 +1]
    b) Find the derivative of $sinhx^{coshx}$ [3]

18. a) Write the equation of normal to the curve y = f(x) at piont (x_1, y_1) in differential form. [1]
    b) Define the angle of intersections between two curves. [1]
    c) Find the point on the curve $2y = 3 - x^2$, the tangent at which is parallel to the line x + y = 0. [3]

19. An inverted cone has depth of 40cm and a base of radius 5cm. Water is poured into it at a rate of 1.5 cubic centimeters per second. Find the rate at which the level of water in the cone is rising when the depth is 4 cm.

Group 'C'[8 × 3 = 24]

20. (a) If the coefficient of x in the expansion of $\left(x^2 + \frac{k}{x}\right)^5$ is 270 find k. [2]
    (b) Using De Morgan's theorem find the value of $(1+ i)^{20}$. [3]
    c) Using mathematical induction, prove that $2 + 4 + 6 + \dots+ 2n = n (n + 1)$ [3]

21. a) Find the equation of tangents to the circle $x^2 + y^2 - 2x - 4y + 3 = 0$ at (2, 3). [2]
    b) Prove that the straight line $y = x + a\sqrt{2}x$ touches the circle $x^2 + y^2 = a^2$. Also, find the point of contact. [3]
    c) Find the equation of parabola whose vertex is at (5, 3) and the focus is at (5, 6).

22. a)Define integral of the function f(x) w. r. t. x [1]
    b) Write the integral of $\int \sqrt{x^2 + a^2}dx$ [1]
    c) Integrate the following
    i) $\int \frac{dx}{sinx+cosx}$ ii) $\int \frac{x-1}{(x-2)(x+1)}dx$ [3+3]

THE END