SECTION A (40 MARKS)

Answer **all** questions in this section.

1. Calculate the coordinates of the point of intersection of the curve $\frac{x}{y} + \frac{6y}{x} = 5$ and line $x - 2y - 2 = 0$ (05 marks)

2. By using suitable substitution evaluate $\int_0^1 \frac{x}{\sqrt{(1+x)}}dx$ (05 marks)

3. Given that $\sin x + \sin y = \beta_1$ and $Cos\ x + Cos\ y = \beta_2$
   Show that
   (i) $\tan\frac{x+y}{2} = \frac{\beta_1}{\beta_2}$ (02 marks)

   $(n+1) + \frac{n(n-1)x^2}{2!}$

   (ii) $\cos(x+y) = \frac{\beta_2^2 - \beta_2^2}{\beta_2^2 + \beta_1^2}$ (03 marks)

4. Use small changes to estimate cube root of 27.15 (05 marks)

5. Variable point $P(x, y)$ moves such that its distance from point A (3,0) is equal to its distance from the line $x + 3 = 0$.
   Describe the locus of point P (05 marks)

6. Prove that points A($^-2$,0 ,6) and B(3, $^-4$, 5) lie on opposite sides of the plane $2x - y + 3Z = 21$. (05 marks)

7. The second and third terms of a geometrical progression are 24 and 12(b + 1) respectively. Find b if the sum of the first three terms of the progression is 76. (05 marks)

8. Determine the area of the largest rectangular piece of land that can be enclosed by 200 meters of wire when fencing it, if one side has existing wall. (05 marks)

SECTION B (60 marks)

Answer any **five** questions from his section.

9. (a) In a triangle ABC, prove that

$$\frac{\cos(\beta + C)}{\operatorname{cosec}\beta \ \operatorname{cosec} C} = \frac{bc}{ab + ac}$$ (06 marks)

(b) Find the solution of $3\cot\theta + \operatorname{Cosec}\theta = 2$ for $0° \leq \theta \leq 360°$ (06 marks)

10. (a) Use Demoivre's theorem to simplify

$$\frac{[\sqrt{3}\,(\cos\theta + i\sin\theta]^8}{[3\cos 2\theta + 3i\sin 2\theta]^3}$$ (04 marks)

8

(b) If $(1 + 3i)Z_1 = 5(1 + i)$, show that locus of $|Z - Z_1| = |Z_1|$, where Z is a complex number, is a circle and find its center and radius (08marks)

11. (a) The first term of an A.P is equal to the first term of a G.P whose common ratio is $\frac{1}{3}$ and sum to infinity is 9. If the common difference of the A.P is 2. Find the sum of the sum first ten terms of the A.P (06 marks)

(b) If the letters or a word **DEFEATED** are arranged, find number of ways for which the 3Es will be separated. (06 marks)

8

12. (a) Find the equation of a plane containing points A(1,1,1) B(1,0,1) and C(3,2,-1) (05 marks)

(b) Find the perpendicular distance of point A (2,-1, 4) from the line $\underset{\sim}{r} = \begin{pmatrix} 1 \\ 0 \\ 2 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix}$ (07 marks)

13. (a) The normal at the point $P(5\cos\theta, 4\sin\theta)$ on an ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ meets the x and y- axes at A and B respectively. Find the mid-point of line AB. (06 marks)

(b) Show that the circles $x^2 + y^2 - 2ax + c^2 = 0$ and $x^2 + y^2 - 2b$

14. (a) Evaluate $\int_1^3 \frac{x^2+1}{x^3+4x^2+3x}\,dx$ (07 marks)

(b) Find $\int \frac{1}{3x^2+5x+4}\,dx$ x^2+x-8x (05 marks)

15. The population of a certain village was noted that every year, 5 people die due to a deadly genetic disease and rate of population increase is proportional to the people present at that time. Given that initially population of that village was 120 and after a year increased to 210.

(a) Find the number of people after five years. (10 marks)

(b) What time will it take for the number of people in that village to be 37,275? (02 marks)

16. Given that $y = x - \frac{-8}{x^2}$

(a) Determine the;

(i) Intercept (02 marks)

(ii) Turning point (03 marks)

(iii) Equation of the a asymptotes (02 marks)

(b) Sketch the curve. (05 marks)

END