12. Prove that the poles of tangents to the parabola $y^2 = 4ax$ with respect to the parabola $y^2 = 4bx$ lie on a parabola.

13. One focus of a hyperbola is located at the point $(1, -3)$ and the corresponding directrix is the line $y = 2$. Find the equation of the hyperbola if its eccentricity is $3/2$.

14. If PSQ is a chord passing through the focus S of a conic and l is semi latus rectum, show that $\frac{1}{SP} + \frac{1}{SQ} = \frac{2}{l}$.

15. Evaluate $\int \frac{1}{(1-x)(4+x^2)}\, dx$.

16. Solve $(x^2 - y^2)\, dx - xy\, dy = 0$.

17. Solve $(1 + y^2)\, dx = (Tan^{-1} y - x)\, dy$.

SECTION - C

5 × 7 = 35

LONG ANSWER TYPE QUESTIONS

Attempt **any** 5 questions. Each question carries 7 marks.

18. Find the equation of the circle whose centre lies on X-axis and passing through $(-2, 3)$ and $(4, 5)$.

19. Find the coordinates of the limiting points of the coaxial system determined by $x^2 + y^2 + 2x - 6y = 0$ and $2x^2 + 2y^2 - 10y + 5 = 0$.

20. Find the eccentricity, coordinates of foci, length of latus rectum and equations of directrices of the ellipse $9x^2 + 16y^2 - 36x + 32y - 92 = 0$.

21. If $y = \frac{Sinh^{-1} x}{\sqrt{1 + x^2}}$ then show that $(1 + x^2)\, y_2 + 3xy_1 + y = 0$ and hence deduce that $(1 + x^2)\, y_{n+2} + (2n + 3)\, xy_{n+1} + (n + 1)^2\, y_n = 0$.

22. Obtain reduction formula for $I_n = \int \sin^n x\, dx$ for an integer $n \geq 2$ and deduce the value of $\int \sin^4 x\, dx$.

23. Show that $\int_0^{\pi/2} \frac{x}{\sin x + \cos x}\, dx = \frac{\pi}{2\sqrt{2}} \log(\sqrt{2} + 1)$.

24. Dividing $[0, 6]$ into 6 equal parts, evaluate $\int_0^6 x^3\, dx$ approximately by using :

i) Trapezoidal rule
ii) Simpson's rule