PART 1

PAST EXAMINATION QUESTIONS: PARAMETRIC + CARTESIAN EQNS.

1. If the co-ordinates of a point Q are $\left(t^2-1,\ 2t+1\right)$, where t is variable, find the equation of the locus of Q. (N61/P1/8iii)
2. Sketch the curve of $y^2 = 4x-4$. If P is a general point of this curve and M and N are the feet of the perpendiculars from P on to the x-axis and the line $x = 1$ respectively, express PN in terms of PM. (J62/P1/8ii)
3. T is a variable point $(t, 0)$ on the x-axis and R is the point (3, 1). The perpendicular to TR at T meets the y-axis at Q. Find the co-ordinates of P, the midpoint of TQ in terms of t. Hence find the equation of the locus of P as t varies. (J66/P1/7)
4. Write down and simplify the equation of the locus of a point which moves so that its distance from the point (2, 1) is equal to its distance from the x-axis. (N66/P2/7ii)
5. AB is a line of fixed length, 6 units, joining the points $A(t, 0)$ and B which lies on the positive y-axis. P is a point on AB distance 2 units from A. Express the co-ordinates of B and of P in terms of t. Find the locus of P as t varies. (N67/P1/8)
6. Find the equation of the line with gradient m through the point (3, 1). This line meets the x-axis at P and the y-axis at Q. Express the co-ordinates of P and Q in terms of m. Hence, or otherwise, find the equation of the locus of the mid-point of PQ as m varies. (J68/P2/7)
7. Prove that the mid-point of the line joining the fixed point $P(7, 8)$ to the variable point $Q(2t+3,\ t-9)$ lies on the line $x - 2y = 6$. Find (a) the value of t for which PQ is perpendicular to the line $x - 2y = 6$, (b) the length of PQ when t has this value. (J70/P2/2)
8. The points P, Q, B have co-ordinates $(t, 0)$, $(0, 2t)$ and (4, 6) respectively. Find, in terms of t, the co-ordinates of (a) the midpoint of PB, (b) the point R such that $PRBQ$ is a parallelogram. Obtain the equation of the locus of R as t varies. (N71/P1/8)
9. Find the equation of the locus of the point equidistant from the points (4, 7) and (6, 3). Find the equation of the locus of the point distance $2\frac{1}{2}$ units from the point $(3, 1\frac{1}{2})$. Find the co-ordinates of P and Q, the points of intersection of the two loci. (J72/P1/7)
10. P is a variable point $(2t, 0)$ on the x-axis and Q is the point (6, 2). The perpendicular to PQ at P meets the y-axis at R. Show that the gradient of PR is $(t - 3)$ and find the co-ordinates of M, the midpoint of PR. Hence find the equation of the locus of M as t varies. (sp1/14)
11. The operation * maps $P(x, y)$ onto $Q\left(x^2,\ 2y\right)$. Mark on a diagram the points $A(-1, -1)$, $B(1, 2)$, $C(1, 1)$, $D(1, -2)$. Show that operation * maps A onto D and C onto B. Sketch the locus of Q as P moves in a straight line form A to C. (sp2/10)

1. $4x = y^2 - 2y - 3$
2. $PN = \frac{PM^2}{4}$
3. $P = (\frac{t}{2}, \frac{t(3-t)}{2})$. Locus $y + 2x^2 = 3x$
4. $x^2 - 4x - 2y + 5 = 0$
5. $B\left(0, \sqrt{36 - t^2}\right), P\left(\frac{2}{3}t, \frac{1}{3}\sqrt{36 - t^2}\right)$; $\frac{x^2}{16} + \frac{y^2}{4} = 1$
6. $y - 1 = m(x - 3), P(3 - \frac{1}{m}, 0)$
   $Q(0, 1 - 3m)$; $2xy = x + 3y$
7. (a) 5 (b) $6\sqrt{5}$
8. (a) $\left(\frac{1}{2}(t + 4), 3\right)$
   (b) $(t + 4, 6 - 2t)$; $y = 14 - 2x$
9. $2y = x + 5x$; $x^2 + y^2 - 6x - 3y + 5 = 0$; $(1, 3)(3, 4)$
10. $(t, 3t - t^2)$, $y = 3x - x^2$