

Sample Extension 1 Maths Paper suitable for HSC students

Question 6 (contd..)

(b) A particle P moves along a straight line. At time t seconds after the motion begins, the displacement of P from a fixed point O on the line is x metres, where $x = 3 \sin(t) - 2 \cos(t) - 1$. Find (i) the velocity and the acceleration of P when $t = 0$, (ii) the time at which P first passes through O, (iii) the greatest distance of P from O during the motion.

(c) A particle is moving along the x axis. Its velocity v at position x is given by $v^{\frac{1}{2}} = 20x - x^2$. Find the acceleration of the particle when $x = 4$.

(d) A particle moves so that its displacement x (in metres) from a point O after t seconds is given by $x = 2 \sin 4t$. (i) Show that it will perform SHM; (ii) Find its distance from O, $(\pi/16)$ seconds after it leaves the point O. (iii) Find the magnitude of the acceleration when the velocity is $4\sqrt{3}$ m/s. (iv) Find the time taken to reach a point 1.5 m from O.

Question 7

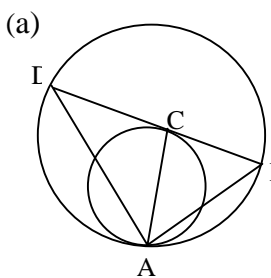
(a) Show that the equation of the normal to the parabola $y^2 = 4ax$ at the point $P(at^2, 2at)$ is $y + tx = at(2 + t^2)$. The normal meets the x -axis at Q; the perpendicular from P to the y -axis meets the x -axis at R. Show that the length of QR is independent of t .

(b) A curve is defined by the parametric equations $x = t^2$, $y = \frac{2}{t}$ $t \neq 0$. Show that the equation of the tangent to the curve at the point $P(p^2, \frac{2}{p})$ is $x + p^3y = 3p^2$. Given that the tangent passes through the point (1,2) determine the possible values of p .

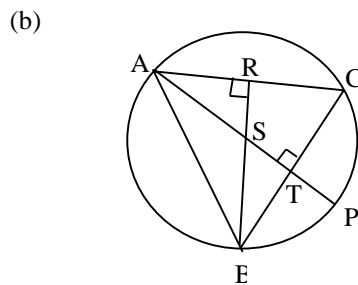
(c) Show that the area enclosed by the parabolae $y^2 = kx$ and $x^2 = ky$ is $\frac{k^2}{3}$. Show that the volume generated by the revolution of this area about the either axis is $\frac{3\pi k^3}{10}$.

(d) How many different arrangements can be made from the letters of the word TRINITY taken four at a time?

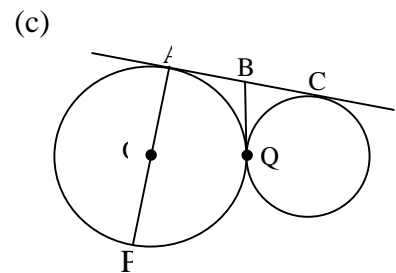
Question 8



Two circles touch internally at A. BCD is a tangent to the smaller circle at C. Prove that the chord AC bisects the angle BAD.



BR is perpendicular to AC; AT is perpendicular to BC. BR and AT meet at S. AT is produced to meet the circle at P. (i) Show that A, R, T and B all lie on a circle with diameter AB; (ii) Show that $ST = TP$.



Two circles touch externally at Q. CBA is a common tangent. (i) Show that angle AQC is a right angle (ii) Show that P, Q, and C are collinear. (iii) Show that OB is parallel to PQ.