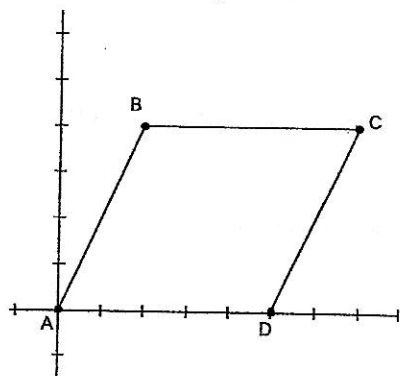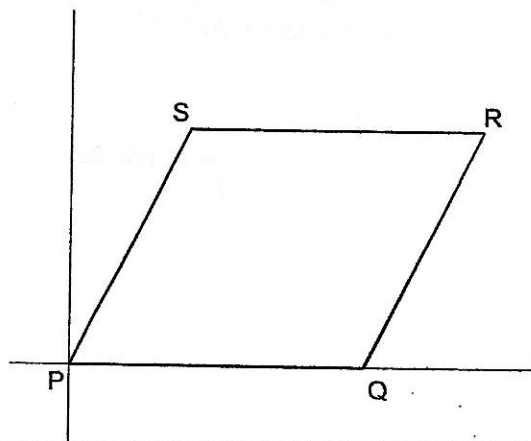# Coordinate Geometry and Proof

Objective:
Students will prove theorems using coordinate representations of geometric figures.

1. Given: Quadrilateral $ABCD$, with vertices A $(0, 0)$, B $(2, 4)$, C $(7, 4)$, D $(5, 0)$, prove: $ABCD$ is a parallelogram.
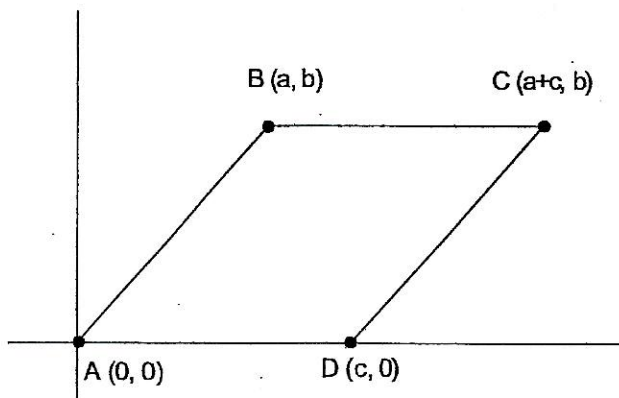

2. The given parallelogram $PQRS$ has vertices P $(0, 0)$, Q $(a, 0)$, R $(?, ?)$ and S (b, c).

    a) Determine the coordinates of R.

    b) Find the midpoint of $\overline{QS}$.

    c) Find the midpoint of $\overline{PR}$.

    d) What do you notice?

    e) Show that if the diagonals are equal in length then the parallelogram is a rectangle.

3. Prove the diagonals of a rhombus are perpendicular.

Coordinate Geometry and Proof

1. Prove the diagonals of a rectangle are equal.

2. Prove the diagonals of an isosceles trapezoid are equal.

3. Show that the triangle with vertices $(0, 0)$, $(6, 4)$, and $(4, 7)$ is a right triangle.

4. Prove that the diagonals of a parallelogram bisect each other.

5. Show that the segments connecting consecutive midpoints of the sides of a quadrilateral form a parallelogram.

6. In the diagram below, suppose that M and N are midpoints of PQ and RQ, respectively, and $PN = RM$.

   a) Find the coordinates of M and N.

   b) Using the distance formula, write and simplify an equation expressing the fact that $PN = RM$.

   c) Use the equation you found in part (b) to express b in terms of a alone. What does this tell you about $\triangle PQR$?