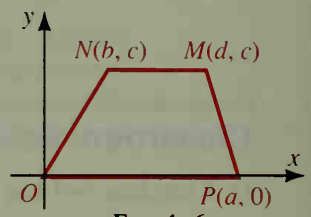
Written Exercises

Use coordinate geometry to prove each statement. First draw a figure and choose convenient axes and coordinates.

A

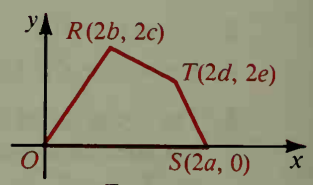
1. The diagonals of a rectangle are congruent. (Theorem 5-12)
2. The diagonals of a parallelogram bisect each other. (Theorem 5-3)
3. The diagonals of a rhombus are perpendicular. (Theorem 5-13) (*Hint*: Let the vertices be $(0, 0)$, $(a, 0)$, $(a + b, c)$, and (b, c). Show that $c^2 = a^2 - b^2$.)

Exercises 4–6 refer to trapezoid *MNOP* at the right.



Exs. 4–6

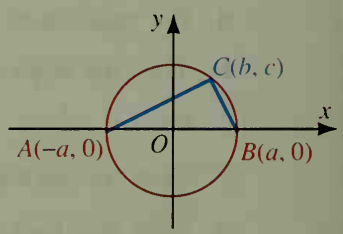
4. Prove that the median of a trapezoid:
   a. is parallel to the bases.
   b. has a length equal to the average of the base lengths. (Theorem 5-19)
5. Prove that the segment joining the midpoints of the diagonals of a trapezoid is parallel to the bases and has a length equal to half the difference of the lengths of the bases.
6. Assume that $a = b + d$.
   a. Show that the trapezoid is isosceles.
   b. Prove that its diagonals are congruent.



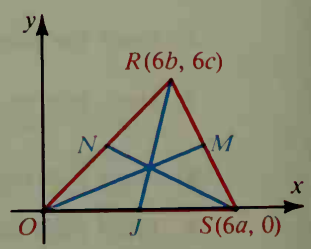
Ex. 7

B

7. Prove that the figure formed by joining, in order, the midpoints of the sides of quadrilateral *ROST* is a parallelogram.
8. Prove that the quadrilateral formed by joining, in order, the midpoints of the sides of an isosceles trapezoid is a rhombus.
9. Prove that an angle inscribed in a semicircle is a right angle. (*Hint*: The coordinates of *C* must satisfy the equation of the circle.)
10. Prove that the sum of the squares of the lengths of the sides of a parallelogram is equal to the sum of the squares of the lengths of the diagonals.



Ex. 9

C

11. Use axes and coordinates as shown to prove: The medians of a triangle intersect in a point (called the *centroid*) that is two thirds of the distance from each vertex to the midpoint of the opposite side. (*Hint*: Find the coordinates of the midpoints, then the slopes of the medians, then the equations of the lines containing the medians.)