

## Exercises

- A quadrilateral has vertices  $M(3,5)$ ,  $N(-1,-9)$ ,  $P(14,9)$ , and  $Q(8,11)$ .
  - Prove that figure  $MNPQ$  is a trapezoid.
  - Prove that  $NP$  is three times as long as  $MQ$ .
- Prove that the quadrilateral with vertices  $A(0,0)$ ,  $B(16,-6)$ ,  $C(19,2)$ , and  $D(3,8)$  is a rectangle.
- Prove that a circle which has centre  $C(6,1)$  and which passes through  $V(15,5)$ , also passes through  $W(2,10)$ .
- Prove that the quadrilateral with vertices  $A(8,-1)$ ,  $B(17,12)$ ,  $C(4,3)$ , and  $D(-5,-10)$  is a rhombus.
- A quadrilateral has vertices  $D(-11,-5)$ ,  $E(-3,-19)$ ,  $F(7,5)$ , and  $G(1,27)$ . The midpoints of  $DG$ ,  $DE$ ,  $EF$ , and  $FG$  are  $A$ ,  $B$ ,  $C$ , and  $D$  respectively. Prove that figure  $ABCD$  is a parallelogram.
- A triangle has vertices  $R(17,16)$ ,  $S(1,4)$ , and  $T(7,-4)$ .
  - Prove that  $\triangle RST$  is right-angled.
  - $M$  is the midpoint of  $RT$ . Prove that a circle with centre  $M$  and passing through  $R$ , also passes through  $T$  and  $S$ .
- A triangle has vertices  $A(4,17)$ ,  $B(-8,5)$ , and  $C(12,-7)$ . The midpoints of the sides are  $M$ ,  $N$ , and  $P$ . Prove that the perimeter of  $\triangle MNP$  is one-half the perimeter of  $\triangle ABC$ .
- A quadrilateral has vertices  $P(-3,12)$ ,  $Q(-7,-4)$ ,  $R(2,8)$ , and  $S(0,16)$ .
  - Prove that figure  $PQRS$  is a trapezoid.
  - $M$  is the midpoint of  $PQ$  and  $N$  is the midpoint of  $RS$ . Prove that  $MN$  is parallel to both  $PS$  and  $QR$ .
  - Prove that the length of  $MN$  is the average of the lengths of  $PS$  and  $QR$ .
- Prove that the quadrilateral with vertices  $M(5,3)$ ,  $N(15,9)$ ,  $O(9,19)$ , and  $P(-1,13)$  is a square.
  - Prove that the quadrilateral formed by joining the midpoints of the sides is also a square.
- A triangle has vertices  $T(-3,-7)$ ,  $U(9,-1)$ , and  $V(5,11)$ .  $M$  is the midpoint of  $VT$ .  $N$  is the midpoint of  $VU$ .  $TN$  is extended its own length to  $A$ .  $UM$  is extended its own length to  $B$ . Prove that  $A$ ,  $V$ , and  $B$  lie in a straight line.
- A quadrilateral has vertices  $Q(-8,14)$ ,  $R(6,-6)$ ,  $S(14,4)$ , and  $T(0,24)$ .
  - Show that figure  $QRST$  is a parallelogram.
  - The midpoints of the sides are  $M$ ,  $N$ ,  $O$ , and  $P$ . Show that the quadrilateral formed from these points is also a parallelogram.
  - Show that the perimeter of figure  $MNOP$  is equal to the sum of the diagonals of figure  $QRST$ .