Find the distance between each pair of points and the midpoint of the line segment joining the points. Express all radicals in simplest form.

1) $(13, 6),\ (0, 6)$

2) $(0, 8),\ (-6, 0)$

3) $\left(\frac{1}{2}, -1\right),\ (-1, 1)$

4) $\left(5, \sqrt{5}\right),\ \left(3, -\sqrt{5}\right)$

5) $\left(\sqrt{6}+1, \sqrt{3}-\sqrt{2}\right),\ \left(\sqrt{6}-1, \sqrt{3}+\sqrt{2}\right)$

6) $(a, 7),\ (a, -9)$

7) $(6+r,\ s),\ (r-2,\ s)$

8) $(-a,\ b),\ (2a,\ 4b)$

9) $(w-2,\ w),\ (w,\ 4w)$

10) $\left(a,\ \sqrt{ab}\right),\ \left(b,\ -\sqrt{ab}\right)$

11) Find all the values of a so that the distance between points at $(a,\ -9)$ and $(-2a,\ 7)$ is 20 units.

Find the coordinates of Q given that M is the midpoint of $\overline{PQ}$.

12) $P(-4, 0),\ M(3, 3)$

13) $P(4, -1),\ M\left(-3, \frac{5}{2}\right)$

14) $P(h, k),\ M(0, 0)$

15) $P(0, 0),\ M(a, b)$

16) Determine whether the quadrilateral having vertices with the given coordinates is a parallelogram:

$$(-2, 3), (-3, -2), (2, -3), (3, 2)$$

Use the distance formula to determine whether the given points are collinear.

17) $(1, 2), (7, 4), (-2, 1)$

18) $(-5, -2), (-2, 1), (1, 3)$

19) Find the value of k for which the points $(15, 1), (-3, -8),$ and $(3, k)$ are collinear.

20) Determine whether the points $A(-3, 0)$, $B\left(-1, 2\sqrt{3}\right)$, and $C(1, 0)$ are the vertices of an equilateral triangle. Justify your answer.

21) The vertices of a rectangle are at $(-3, 1)$, $(-1, 3)$, $(3, -1)$, and $(1, -3)$. Find the area of the rectangle.

22) Find an equation of the perpendicular bisector of $\overline{AB}$ given $A(2, 1)$, $B(-2, 3)$.

23) Find the points on the coordinate axes that are equidistant from the points $A(-3, 0)$, $B(0, 5)$.

Prove using analytic methods. Be sure to include a coordinate diagram.

24) The diagonals of an isosceles trapezoid are congruent.

25) The diagonals of a parallelogram bisect each other.