Chapter Summary

1. The distance between points (x_1, y_1) and (x_2, y_2) is
$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$
The midpoint of the segment joining these points is the point
$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right).$$

2. The circle with center (a, b) and radius r has the equation
$$(x - a)^2 + (y - b)^2 = r^2.$$

3. The slope m of a line through two points (x_1, y_1) and (x_2, y_2), $x_1 \neq x_2$, is defined as follows: $m = \frac{y_2 - y_1}{x_2 - x_1}$. The slope of a horizontal line is zero. Slope is not defined for vertical lines.

4. Two nonvertical lines with slopes m_1 and m_2 are:
   a. parallel if and only if $m_1 = m_2$.
   b. perpendicular if and only if $m_1 \cdot m_2 = -1$.

5. Any quantity that has both magnitude and direction is called a vector. A vector can be represented by an arrow or by an ordered pair. The magnitude of $\overrightarrow{AB}$ equals the length of $\overline{AB}$. Two vectors are perpendicular if the arrows representing them are perpendicular. Two vectors are parallel if the arrows representing them have the same or opposite directions. Two vectors are equal if they have the same magnitude and direction.

6. Two operations with vectors were discussed: multiplication of a vector by a real number, and addition of vectors.

7. The graph of any equation that can be written in the form $Ax + By = C$, with A and B not both zero, is a line. An equation of the line through point (x_1, y_1) with slope m is $y - y_1 = m(x - x_1)$. An equation of the line with slope m and y-intercept b is $y = mx + b$. The coordinates of the point of intersection of two lines can be found by solving their equations simultaneously.

8. To prove theorems using coordinate geometry, proceed as follows:
   a. Place x- and y-axes in a convenient position with respect to a figure.
   b. Use known properties to assign coordinates to points of the figure.
   c. Use the distance formula, the midpoint formula, and the slope properties of parallel and perpendicular lines to prove theorems.