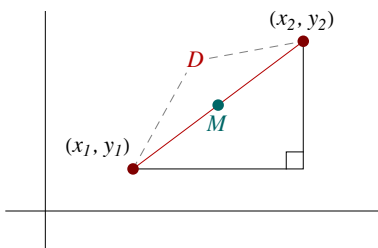
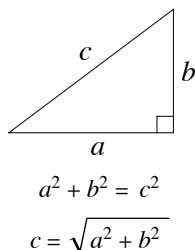


1.8 Coordinate Geometry

Objectives: To find the distance and midpoint given two points in the plane; find equations of circles; symmetry of graphs.

The Distance Formula

The distance between two points $P_1 : (x_1, y_1)$ and $P_2 : (x_2, y_2)$ follows directly from the *Pythagorean Theorem* for a right triangle:



Distance Formula:

$$\sqrt{\quad}$$

Midpoint Formula:

Example 1 Show that the triangle with vertices $(2, 1)$, $(5, 2)$ and $(4, -5)$ is a right triangle, and find the area of the triangle.

Example 2 Is the line $y = 2x - 1$ a *bisector* of the line segment with endpoints $(1, 8)$ and $(5, 2)$?

Equations of Circles

A circle is defined as the set of all points (x, y) that are an equal distance, r , from a fixed point (h, k) . Using the distance formula we can derive the **standard form** of the equation of a circle:



Standard form for the Equation of a Circle:

Example 3 Identify the center and radius for the circle given by $(x + 7)^2 + (y - 2)^2 = 16$.

Example 4 Find the equation of the circle whose diameter has endpoints $(-1, 6)$ and $(7, 2)$.

When the equation of a circle is expanded and like terms collected we get the **general form** of the equation of a circle:

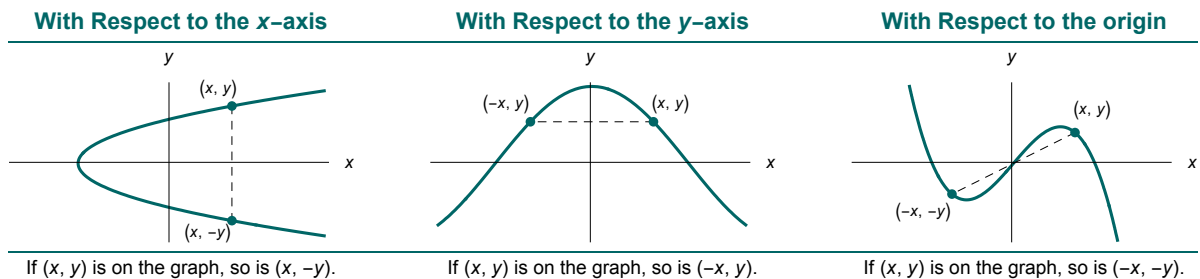
$$x^2 + y^2 + Ax + By + C = 0$$

Example 5 Complete the square on both x and y to find the center and radius of the circle. Write the circle in standard form and make a sketch of the circle: $x^2 + y^2 - 8x + 6y - 11 = 0$.

Example 6 Find the x and y intercepts of the circle in *Example 5*.

Symmetry

The graph of an equation can sometimes exhibit symmetry, i.e., one side of the graph is a mirror image of the other side.



Example 7 Determine the symmetry of the graphs of: (a) $x = y^2 - 2$ (b) $y = \frac{x^3 - 9x}{x^2 + 1}$ (c) $y = |x|$