Equations of circles

Problem

1. Take a fixed circle with centre (a, b) and radius r. What is its equation? What are the equations of the following circles?
   - Centre $(a + 1, b)$, radius r.
   - Centre $(a - 1, b)$, radius r.
   - Centre $(a, b + 1)$, radius r.
   - Centre $(a, b - 1)$, radius r.
   - Centre $(-a, b)$, radius r.
   - Centre (b, a), radius r.
   - Centre $(a - b, 0)$, radius r.
   - Centre $(2a, b)$, radius r.
   - Centre (a, b), radius $2r$.
   - Centre (a, b), radius $\frac{1}{3}r$.
   - Centre (a, b), radius $r + 1$.
2. Which of the following are equations of circles? For each that is, specify the centre and radius of the circle. For each that isn't, can you say what shape the equation describes?
   - $(x - \pi)^2 + (y + 2)^2 = 3$
   - $(x + 1)^2 + (y - 4)^2 = -1$
   - $x^2 + 2x + y = 2$
   - $x^2 + y^2 = 4$
   - $(x - 1)^2 + y^2 = 4$
   - $(x - 1)^2 - y^2 = 4$
   - $x^2 + y^2 - 3x - y = -1.5$
   - $x^2 + y^2 + 3x + y = -1.5$
3. Find the equation of the circle of which the line segment from $(-5, 2)$ to $(3, -1)$ is a diameter. How many other circles pass through both of these two points? Can you find the equations of any of them?

Relevance

E2 How is the solution of equations related to problems in geometry?

G2 What is the connection between algebra and geometry, and how can we exploit it?

