Circle Equation Completing the Square

Question: Describe the graph of the equation $x^2 + y^2 + 4x - 8y = 16$
Answer: It is the circle with center (–2, 4) and radius 6
Analysis:

$x^2 + y^2 + 4x - 8y = 16$	Group x terms and group y terms
$(x^2 + 4x) + (y^2 - 8y) = 16$	Complete the square on each grouping and maintain an equivalent equation.
$(x^2 + 4x + 4) + (y^2 - 8y + 16) = 16 + 4 + 16$	Write each grouping as a square.
$(x + 2)^2 + (y - 4)^2 = 36 = 6^2$	Read the radius and the coordinates of the center.
The radius is 6 and the center is at (–2, 4)	

Question: Describe the graph of the equation $x^2 + y^2 + 6x + 10y - 2 = 0$
Answer: It is the circle with center (–3, –5) and radius 6
Analysis:

$x^2 + y^2 + 6x + 10y - 2 = 0$	Add 2 to both sides.
$x^2 + y^2 + 6x + 10y = 2$	Group x terms and group y terms
$(x^2 + 6x) + (y^2 + 10y) = 2$	Complete the square on each grouping and maintain an equivalent equation.
$(x^2 + 6x + 9) + (y^2 + 10y + 25) = 2 + 9 + 25$	Write each grouping as a square.
$(x + 3)^2 + (y + 5)^2 = 36 = 6^2$	Read the radius and the coordinates of the center.
The radius is 6 and the center is at (–3, –5)	

Question: Describe the graph of the equation $x^2 + y^2 + 2x + 12y - 12 = 0$
Answer: It is the circle with center (–1, –6) and radius 7
Analysis:

$x^2 + y^2 + 2x + 12y - 12 = 0$	Add 2 to both sides.
$x^2 + y^2 + 2x + 12y = 12$	Group x terms and group y terms
$(x^2 + 2x) + (y^2 + 12y) = 12$	Complete the square on each grouping and maintain an equivalent equation.
$(x^2 + 2x + 1) + (y^2 + 12y + 36) = 12 + 1 + 36$	Write each grouping as a square.
$(x + 1)^2 + (y + 6)^2 = 49 = 7^2$	Read the radius and the coordinates of the center.
The radius is 7 and the center is at (–1, –6)	