

Equation of Circle

1. Identify the graphs of the following equations as a circle, a point, or an empty set.

a) $x^2 + y^2 + 4x = 0$

b) $x^2 + y^2 + 6x - 4y + 15 = 0$

c) $2x^2 + 2y^2 - 5x + y + \frac{13}{4} = 0$

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1. Identify the graphs of the following equations as a circle, a point, or an empty set.

a) $x^2 + y^2 + 4x = 0$

$$x^2 + 4x + 4 + y^2 = 4$$

$$(x + 2)^2 + y^2 = 4$$

The right side of the equation is positive, so the graph of the equation is a circle.

b) $x^2 + y^2 + 6x - 4y + 15 = 0$

$$(x^2 + 6x + 9) + (y^2 - 4y + 4) + 15 = 13$$

$$(x + 3)^2 + (y - 2)^2 = -2$$

The right side of the equation is negative, so the graph of this equation cannot be a circle; it is an empty set.

c) $2x^2 + 2y^2 - 5x + y + \frac{13}{4} = 0$

$$\frac{1}{2} \left(2x^2 + 2y^2 - 5x + y + \frac{13}{4} \right) = 0$$

$$x^2 - \frac{5}{2}x + y^2 + \frac{1}{2}y + \frac{13}{8} = 0$$

$$x^2 - \frac{5}{2}x + \left(\frac{5}{4}\right)^2 + y^2 + \frac{1}{2}y + \left(\frac{1}{4}\right)^2 + \frac{13}{8} = \left(\frac{5}{4}\right)^2 + \left(\frac{1}{4}\right)^2$$

$$\left(x - \frac{5}{4}\right)^2 + \left(y + \frac{1}{4}\right)^2 = -\frac{13}{8} + \left(\frac{5}{4}\right)^2 + \left(\frac{1}{4}\right)^2$$

$$\left(x - \frac{5}{4}\right)^2 + \left(y + \frac{1}{4}\right)^2 = -\frac{13}{8} + \frac{13}{8}$$

$$\left(x - \frac{5}{4}\right)^2 + \left(y + \frac{1}{4}\right)^2 = 0$$

The right side of the equation is equal to zero, so the graph of the equation is a point.

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