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1. Find the center and radius of the circle $x^2 + 6x + y^2 - 4y = -4$. What are the perimeter and the area? Leave the answers in the terms of π .

Solution: The equation of a circle in the standard form is:

$$(x - a)^2 + (y - b)^2 = r^2 \quad (1)$$

r – Radius of a circle

$(a;b)$ – Center coordinates

We should represent the given equation in the text as (1):

$$x^2 + 6x + y^2 - 4y = -4$$

$$x^2 + 6x + 9 - 9 + y^2 - 4y + 4 = 0$$

So if we want our equation to be the same as (1), we should write it as complete square, like $a^2 + 2ab + b^2 = (a + b)^2$. That's why I add and then subtract 9 to $x^2 + 6x$ (if I add and then subtract the same number, nothing will change. Now we have $x^2 + 6x + 9$, that is the same as $(x + 3)^2$) and transfer -4 to the left side of the equation and write it after $y^2 - 4y$ (Now, $y^2 - 4y + 4 = (y - 2)^2$).

$$(x + 3)^2 + (y - 2)^2 = 9$$

Note, that in (1) equation in front of a and b there are negative signs, so we should write:

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

With (1) pattern $a = -3$, $b = 2$, $r = 3$.

The center = $(-3; 2)$, the radius $r = 3$.

Circumference (perimeter) of a circle:

$$C = 2\pi r \quad (2)$$

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