

Question 4

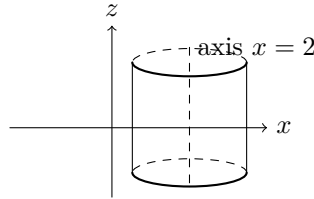
Describe the surface $r = 4 \cos \theta$ in Cartesian coordinates.

Tasks

1. Convert without dividing by r .
2. Identify the surface and its axis.
3. State its intersections with the coordinate axes.

Question 4 – Solution

Strategy. Multiply by r and use $r^2 = x^2 + y^2$ and $r \cos \theta = x$.



Step 1: Convert From $r = 4 \cos \theta$,

$$r^2 = 4r \cos \theta \implies x^2 + y^2 = 4x.$$

Completing the square,

$$\boxed{(x - 2)^2 + y^2 = 4}.$$

Step 2: Identify Since z is unrestricted, this is a circular cylinder of radius 2 whose axis is the vertical line $x = 2, y = 0$.

Step 3: Axis intersections In the xy -plane it meets the x -axis at $(0, 0, 0)$ and $(4, 0, 0)$ and the y -axis only at the origin. More generally, the cylinder contains the vertical lines $(0, 0, z)$ and $(4, 0, z)$.