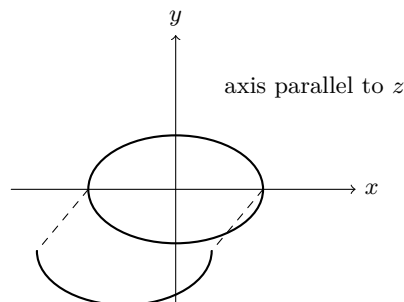


Question 7

Classify $9x^2 + 4y^2 - 18x + 16y - 11 = 0$, describe its axis, and find the area of a cross-section perpendicular to that axis. Does the surface intersect the z -axis?

Question 7 – Solution

Strategy Because z is absent, any planar curve in xy is extruded parallel to the z -axis.



Standard form Completing squares yields

$$9(x-1)^2 + 4(y+2)^2 = 36, \quad \boxed{\frac{(x-1)^2}{4} + \frac{(y+2)^2}{9} = 1}.$$

This is an elliptic cylinder parallel to the z -axis.

Cross-section Its semiaxes are 2 and 3, so each perpendicular cross-section has area $\boxed{6\pi}$.

z -axis test At $x = y = 0$, the left side of the original equation is $-11 \neq 0$, so the cylinder does not meet the z -axis.