Today is Thurs., 1-31-08

I. Back to § 13.7 — Cylindrical Coords. p.875.

A. Transformation
\[ x = r \cos \theta, \quad y = r \sin \theta, \quad z = z \]

B. Inverse Equations
\[ r^2 = x^2 + y^2, \quad \tan \theta = \frac{y}{x}, \quad z = z \]

C. Format for Cylin. \((r, \theta, z)\)

II. Problems — p.878

#3 Find rectangular coords. \((2, \frac{\pi}{4}, 1)\)

**Solution**
\[ x = r \cos \theta = 2 \cos \left( \frac{\pi}{4} \right) = 2 \cdot \frac{1}{\sqrt{2}} = \sqrt{2} \]
and \[ y = r \sin \theta = 2 \sin \left( \frac{\pi}{4} \right) = \frac{\sqrt{2}}{2} \]

\(2\) \(\text{cyl} \quad \rightarrow \quad \text{rect} \)

\[ (2, \frac{\pi}{4}, 1)_{\text{cyl}} \rightarrow (\sqrt{2}, \sqrt{2}, 1)_{\text{rect}} \]

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**Note:** The image includes handwriting and mathematical equations. The text is clear and legible, allowing for accurate transcription.
#38 Identify the surface: \( r = 4 \sin \theta \) (\(*\))

Sol. 1. Suggestion — Transform (\(*\)) into rectangular.

\[
    r^2 = x^2 + y^2, \quad \tan \theta = \frac{y}{x}
\]

2. Try squaring (\(*\)): \( r^2 = 16 \sin^2 \theta \)

\[
    \frac{1}{4} \text{ subs: } \quad x^2 + y^2 = 16 \sin^2 \theta \quad \ldots \quad \text{(brick wall!)}
\]

3. Try mult. b.s. of (\(*\)) by \( r \)

\[
    r^2 = 4r \sin \theta \\
    x^2 + y^2 = 4y
\]

\[
    x^2 + y^2 - 4y = 0 \\
    x^2 + y^2 - 4y + 4 = 4 \\
    x^2 + (y - 2)^2 = 4
\]

(\text{in } z \text{-space a circle w/ } r = 2 \text{ \& } z = 0 \text{ \& } C(0, 2))

4. The surface is a right circular cylinder w/ vertical axis.