

1. 4 Please indicate True or False.
- (a) **T** / **F**: The planes $x + 2y + 3z = 1$ and $x + 2y + 3z = -1$ are orthogonal.
- (b) **T** / **F**: $\phi = \frac{\pi}{2}$ in spherical coordinates describes the xy -plane.
- (c) **T** / **F**: The first octant can be describe in spherical coordinates as $0 \leq \phi \leq \pi, 0 \leq \theta \leq \pi$.
- (d) **T** / **F**: $x = \rho \cos \theta \cos \phi$ is a conversion between spherical and rectangular coordinates.
2. 6 The points $(1, 2, 3)$ and $(3, 2, 1)$ are on the line $\mathbf{r}(t) = \langle 2t - 3, 2, 7 - 2t \rangle$. Find an equation for the plane containing the line $\mathbf{r}(t)$ and the origin.

+2 $\vec{OP} = \langle 1, 2, 3 \rangle$
 $\vec{OQ} = \langle 2, 0, -2 \rangle$

+2 $\vec{OP} \times \vec{OQ} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 3 \\ 2 & 0 & -2 \end{vmatrix} = \langle -4, 8, -4 \rangle$

so $\vec{n} = \langle 1, -2, 1 \rangle$ is a normal vector

+2 $x - 2y + z = 0$ is the plane

[so is

$$-4(x-1) + 8(y-2) - 4(z-3) = 0$$

3. 4 Find a vector representation for the curve of intersection of the cylinder $x^2 + y^2 = 4$ and the plane $x + y + z = 2$.

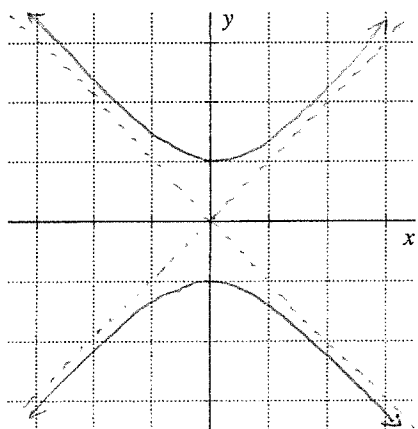
let $x = 2 \cos t$

$y = 2 \sin t$

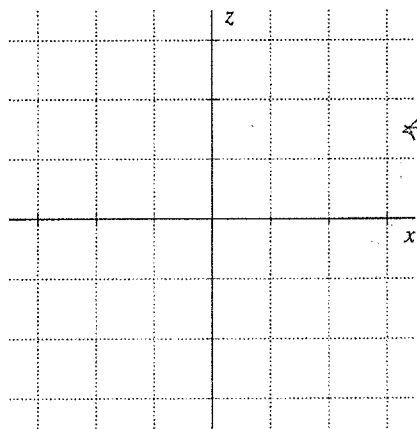
so $z = 2 - 2 \cos t - 2 \sin t$

$$\langle 2 \cos t, 2 \sin t, 2 - 2 \cos t - 2 \sin t \rangle$$

4. [4] Provide a reasonably clear sketch of the following traces for the quadric surface $x^2 + z^2 = y^2 - 1$ in the specified planes.

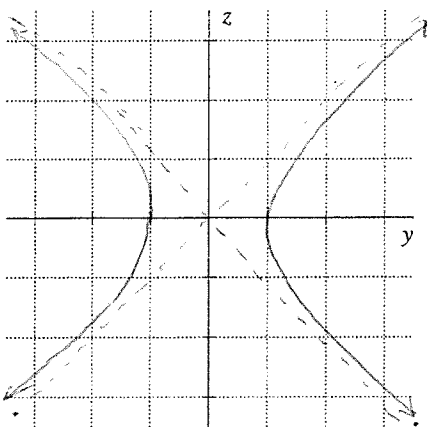


xy -plane $x^2 - y^2 = -1$
 so $y^2 - x^2 = +1$

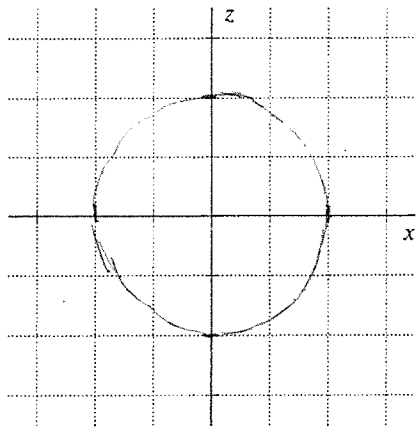


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xz -plane $x^2 + z^2 = -1$



yz -plane $z^2 - y^2 = -1$
 so $y^2 - z^2 = +1$



The plane $y = \sqrt{5}$ $x^2 + z^2 = 4$

5. [2] Based on the traces you found above, identify the graph of $x^2 + z^2 = y^2 - 1$ from the choices below by circling the Figure number.

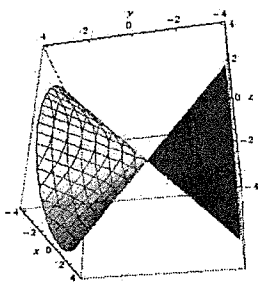


Figure 1:

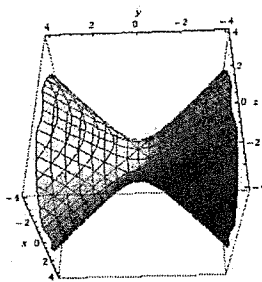


Figure 2:

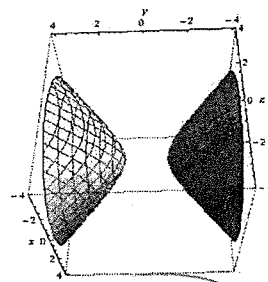


Figure 3: