Name:

By handing in this quiz you assert that you understand and have followed IIT's guidelines for academic integrity.

(1) Find equations (vector, parametric, or symmetric) for the line that is the intersection of the planes $3x - y + z = 5$ and $x + 2y - z = 4$.

direction is $\perp$ to both $\langle 3, -1, 1 \rangle$ & $\langle 1, 2, -1 \rangle$

so $\langle 3, -1, 1 \rangle \times \langle 1, 2, -1 \rangle = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & -1 & 1 \\ 1 & 2 & -1 \end{vmatrix}$

$= \langle -1, 4, 7 \rangle$ works

For a point, need $\begin{cases} 3x - y + z = 5 \\ x + 2y - z = 4 \end{cases}$, choose (arbitrarily) $x = 0$

$\Rightarrow \begin{cases} -y + z = 5 \\ 2y - z = 4 \end{cases} \Rightarrow y = 9$

$\Rightarrow z = 14$

$$\boxed{\ell(t) = \langle 0, 9, 14 \rangle + t \langle -1, 4, 7 \rangle}$$

(2) Find an equation for, and identify by name, the surface consisting of all points P such that the distance from P to the point $(0, 0, 3)$ is twice the distance from P to the x-axis.

Let $P = \langle x, y, z \rangle$ $= \sqrt{x^2 + y^2 + (z-3)^2}$ $= \sqrt{y^2 + z^2}$

$\therefore \sqrt{x^2 + y^2 + (z-3)^2} = 2\sqrt{y^2 + z^2}$

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

$x^2 + 9 = 3y^2 + 3z^2 + 6z$

$x^2 + 9 = 3y^2 + 3(z+1)^2 - 3$

$x^2 + 12 = 3y^2 + 3(z+1)^2$

is a hyperboloid of one sheet