Math 2414 **Homework Set 10 – Solutions** **10 Points**

3. (2 pts) We can get the parallel vector from the given line : $\vec{v} = \langle -3, 1, -4 \rangle$. The equation of the line is then,

$$\vec{r}(t) = \langle 4 - 3t, -8 + t, 3 - 4t \rangle \qquad x = 4 - 3t, \quad y = -8 + t, \quad z = 3 - 4t$$

5. (3 pts) If the new plane is parallel to the given plane then we know that any normal vector to the given plane must also be normal to the new plane. Therefore, $\vec{n} = \langle 5, -1, -9 \rangle$. Also, the new plane must contain the given line and so any point that is on the line is also in the plane and we can easily pick off a point on the line, $P = (4, 2, -6)$. The equation of the plane is then,

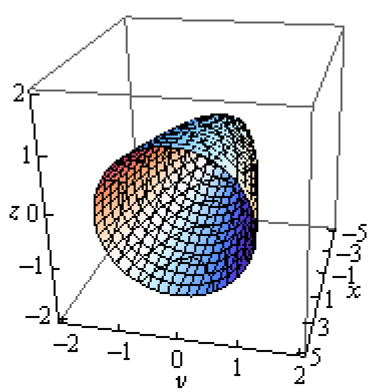
$$5(x-4) - (y-2) - 9(z+6) = 0 \qquad \boxed{5x - y - 9z = 72}$$

6. (3 pts) We can get normal vectors from each plane : $\vec{n}_1 = \langle 5, -9, 0 \rangle$ and $\vec{n}_2 = \langle 3, 12, -6 \rangle$. Now, we can see that these can't be scalar multiplies (check out the third component to see this). Therefore, the normal vectors aren't parallel and this in turn means that the two planes are also not parallel. Next,

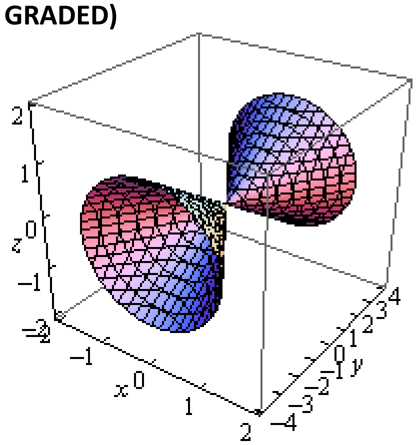
$$\vec{n}_1 \bullet \vec{n}_2 = -93 \neq 0$$

The two normal vectors are then not orthogonal and so this means that the two planes are also not orthogonal. Therefore, the two planes are **neither** parallel or orthogonal.

7. (2 pts)



8. (NOT GRADED)



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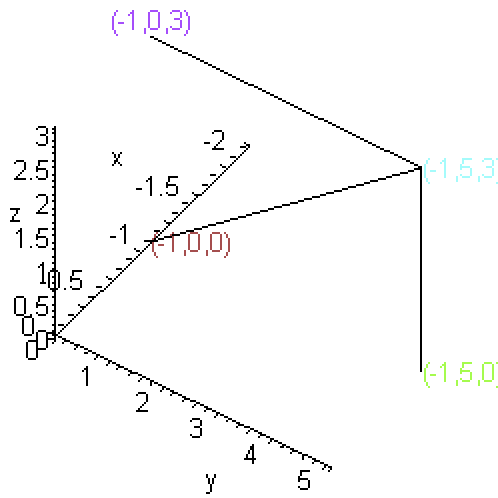
Not Graded

1. Here's a quick sketch of the given point and the closest point on the plane/axis.



(a) Closest point is (-1, 5, 0) and the distance is $d=\sqrt{(-1+1)^2+(5-5)^2+(3-0)^2}=3$

(b) Closest point is (-1, 0, 3) and the distance is $d=\sqrt{(-1+1)^2+(5-0)^2+(3-3)^2}=5$

(c) Closest point is (-1, 0, 0) and the distance is $d=\sqrt{(-1+1)^2+(5-0)^2+(3-0)^2}=\sqrt{34}$

2. We can use the two points to get a parallel vector and then we'll use the 1st (could use either) to get the equation of the line. Calling *P*=(4, 5, -2) and *Q*=(-3, 7, 2) we get : $\vec{v}=\overrightarrow{PQ}=\langle -7,2,4\rangle$.

$$\vec{r}(t)=\langle 4,5,-2\rangle+t\langle -7,2,4\rangle=\langle 4-7t,5+2t,-2+4t\rangle \qquad x=4-7t,\quad y=5+2t,\quad z=-2+4t$$

4. *P*=(0, 5, 3), *Q*=(-1, -3, 3) and *R*=(0, 4, -5). Form two vectors out of these, take a cross product to get a normal vector and then we'll use *P* to find the equation of the plane.

$$\overrightarrow{QP}=\langle 1,8,0\rangle \qquad \overrightarrow{RP}=\langle 0,1,8\rangle$$

$$\vec{n}=\overrightarrow{QP}\times\overrightarrow{RP}=\begin{vmatrix}\vec{i} & \vec{j} & \vec{k}\\ 1 & 8 & 0\\ 0 & 1 & 8\end{vmatrix}=64\vec{i}-8\vec{j}+\vec{k}$$

$$64(x-0)-8(y-5)+1(z-3)=0 \qquad \boxed{64x-8y+z=-37}$$