Irina Muhhametshanova

"QUIZ" for Lecture 3

E-MAILSCANNED .pdf OF COMPLETED QUIZ to DrZcalc3@gmail.com (Attachment: q3FirstLast.pdf) ASAP BUT NO LATER THAN Sept. 15, 8:00pm

NAME:

1. Find an equation of the plane that passes through the points $(0,1,1)$, $(1,0,1)$, $(1,1,0)$.

We can find the cross product of two vectors on the plane to find a vector perpendicular to the plane

$\vec{v}_1 = \langle 1-0, 0-1, 1-1\rangle = \langle 1,-1,0\rangle$ $\quad \vec{v}_2 = \langle 1-1, 1-0, 0-1\rangle = \langle 0,1,-1\rangle$

$$\vec{v}_1 \times \vec{v}_2 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 0 \\ 0 & 1 & -1 \end{vmatrix} = \hat{i}(1\cdot(-1) - 1\cdot 0) - \hat{j}(1\cdot(-1) - 0\cdot 0) + \hat{k}(1\cdot 1 - (-1)\cdot 0) =$$

$$= \hat{i}(1-0) - \hat{j}(-1-0) + \hat{k}(1-0) = \hat{i} + \hat{j} + \hat{k} = \langle 1,1,1\rangle$$

To find the equation of the plane, we can see what vectors are perpendicular to that vector. We can use a point $(0,1,1)$ on the plane:

$v_1(x-0) + v_2(y-1) + v_3(z-1) = 0 \rightarrow (x) + (y-1) + (z-1) = 0 \rightarrow$

$\rightarrow \boxed{x + y + z - 2 = 0}$

2. Find the intersection of the line

$$\mathbf{r}(t) = \langle 1,1,0\rangle + t\langle 0,2,4\rangle$$

and the plane

$$x + y + z = 14 \quad .$$

Because the equation of the line is a parametric equation, we can represent its x, y, and z values as equations in terms of t.

$x = 1 + 0t$

$y = 1 + 2t$

$z = 0 + 4t$

We can plug them into the equation of the plane to see for what value of t the equations match

$x + y + z = 14 \rightarrow (1) + (1+2t) + (0+4t) = 14 \rightarrow 2 + 6t = 14 \rightarrow 6t = 12 \rightarrow t = 2$

Plug $t=2$ to find the intersection: $x=1$, $y=5$, $z=8 \rightarrow \boxed{(1,5,8)}$