Math 3113 - Multivariable Calculus

Quiz #3 - 2006.02.06

Solutions

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1. Find the equation of the plane which passes through the points $P(2,3,1)$, $Q(-2,0,4)$ and $R(-1,1,-0)$.

Let $\overrightarrow{PR} = (-3,-2,-1)$ and $\overrightarrow{PQ} = (-4,-3,-3)$. Then the normal direction to the plane is given by $\overrightarrow{n} = \overrightarrow{PR} \times \overrightarrow{PQ} = \langle -9, 13, 1\rangle$. The equation of the plane is thus given by

$$-9(x-2) + 13(y-3) + (z-1) = 0$$

2. Find the symmetric equations for the line of intersection of the two planes $x + y + z = 1$ and $x - 2y + 3z = 1$.

First, one needs a point P which lies on the line in question. Thus, setting $z = 0$, one has the equations $x + y = 1$ and $x - 2y = 1$. This gives the point $P(1,0,0)$.

The normal directions of the given planes are $\langle 1,1,1\rangle$ and $\langle 1,-2,3\rangle$. Since the line is perpendicular to both normal directions of the plane, the direction of the line is given by $\langle 1,1,1\rangle \times \langle 1,-2,3\rangle = \langle 5,-2,-3\rangle$. Thus, the symmetric equations are given by

$$\frac{x-1}{5} = \frac{y}{-2} = \frac{z}{-3}.$$