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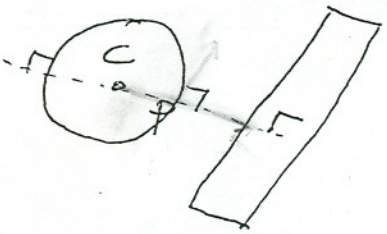
9. Find the distance between $3x + 1y + 3z = 6$ and $3x + 1y + 3z = 10$.

$(2,0,0)$ is on the 1st plane

The distance from $(2,0,0)$ to the second plane is $\dfrac{|6-10|}{\sqrt{9+1+9}}$

10. Find the point on $(x-1)^2 + (y-2)^2 + (z-3)^2 = 9$ which is closest to $2x + 3y + 4z = 1000$.



$\overrightarrow{CP}$ is $\parallel 2\vec{i} + 3\vec{j} + 4\vec{k}$

and has length 3

$\overrightarrow{CP} = \pm \dfrac{3(2\vec{i} + 3\vec{j} + 4\vec{k})}{\sqrt{4+9+16}}$

If $P = (x_0, y_0, z_0)$

then $x_0 = 1 + \dfrac{6}{\sqrt{29}}$ or $1 - \dfrac{6}{\sqrt{29}}$

$y_0 = 2 + \dfrac{9}{\sqrt{29}}$ $\quad 2 - \dfrac{9}{\sqrt{29}}$

$z_0 = 3 + \dfrac{12}{\sqrt{29}}$ $\quad 3 - \dfrac{12}{\sqrt{29}}$

P_1 $\quad P_2$

The distance from P_1 to the plane is $\dfrac{\left|2+6+12+\frac{12+27+48}{\sqrt{29}} - 1000\right|}{\sqrt{4+9+16}}$

The distance from P_2 to the plane is $\dfrac{\left|2+6+12-\frac{12+27+48}{\sqrt{29}} - 1000\right|}{\sqrt{4+9+16}}$

P_1 is closer to the plane

So $P_1 = \left(1+\frac{6}{\sqrt{29}}, 2+\frac{9}{\sqrt{29}}, 3+\frac{12}{\sqrt{29}}\right)$ is the pt on the sphere which is closest to the plane