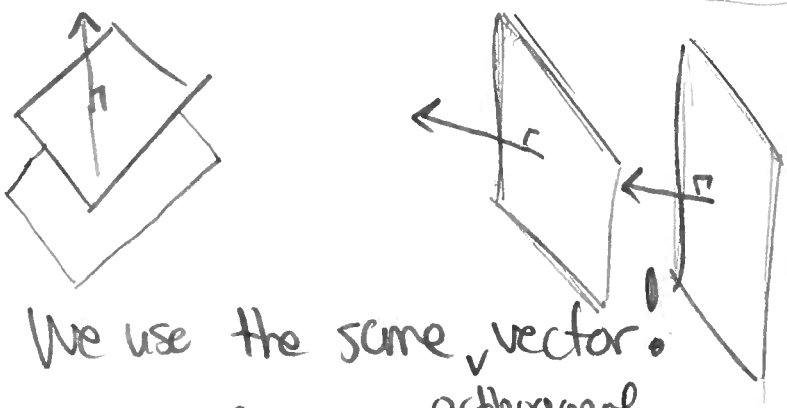
	Required knowledge	Formula
eqt of line:	a point on line, a vector parallel to line	$\vec{r}(t) = \vec{p} + \vec{v}t$
eqt of plane:	a point $P=(p_1,p_2,p_3)$; vector $\vec{v}$ perpendicular to plane $\langle v_1,v_2,v_3\rangle$	$\vec{v}\cdot\vec{PQ}=0$

$Q=(x,y,z)$ variable pt on plane

$\vec{PQ} = \langle x-p_1, y-p_2, z-p_3\rangle$

$v_1(x-p_1)+v_2(y-p_2)+v_3(z-p_3)=0$

Ex: Find eqt of plane going thru $(2,9,8)$ that is parallel to plane $x-2y+z-5=0$.



Soln: We use the same vector $\vec{v}$.

Here: $\vec{v}$ comes from orthogonal coeffs of x, y, and z.

$\vec{v}=\langle 1,-2,1\rangle$

Use this w/ point $P=(2,9,8)$ + we get

$\langle 1,-2,1\rangle \cdot \langle x-2, y-9, z-8\rangle = 0$

$x-2-2(y-9)+z-8=0$

Ex: Find eqt of line that goes between the points $A=(1,-7,6)$ and $B=(2,8,1)$.

Soln: Find parallel vector

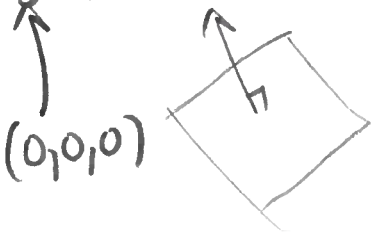
$$\overrightarrow{AB} = \langle 2-1, 8-(-7), 1-6 \rangle$$

$$= \langle 1, 15, -5 \rangle$$

$$\vec{r}(t) = \langle 1,-7,6 \rangle + t\langle 1, 15, -5 \rangle$$

$$= \langle 1+t, -7+15t, 6-5t \rangle$$

Ex: Find eqt of plane thru origin perpendicular to $\langle 1,9,-3 \rangle$.

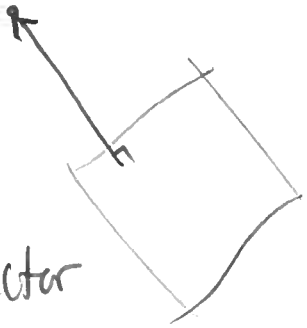


Soln:

$$\langle 1,9,-3 \rangle \cdot \langle x,y,z \rangle = 0$$

$$x+9y-3z=0$$

Ex: Find eqt of line thru $(1,8,6)$ and is orthogonal to $3x-2y+z=7$.



Soln: Here, orthog vector to plane is $\vec{v}=\langle 3,-2,1\rangle$.

This $\vec{v}$ serves as the parallel vector for our line:

$$\vec{r}(t)=\langle 1,8,6\rangle + t\langle 3,-2,1\rangle$$
$$=\langle 1+3t, 8-2t, 6+t\rangle$$

Ex: Find eqt for the line of intersection of planes $x-y+z=2$ and $x+2z=3$.

Soln:

$x=3-2z$

$(3-2z)-y+z=2$

$-z-y=-1$

$y=0$

$-z=-1$

$z=1$

$x=3-2(1)=1$

$(1,0,1)$

$y=1$

$-z-1=-1$

$-z=0$

$z=0$

$x=3$

$(3,1,0)$

Cont Find eqt of line containing the points (4)

$(1,0,1)$ and $(3,1,0)$.

$\vec{v} = \langle 2,1,-1 \rangle$

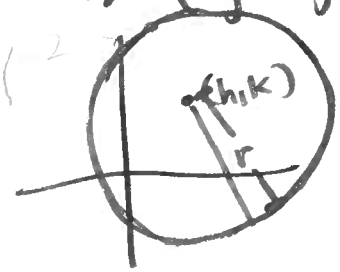
$\vec{r}(t) = \langle 1,0,1 \rangle + t\langle 2,1,-1 \rangle$

$= \langle 1+2t, t, 1-t \rangle$

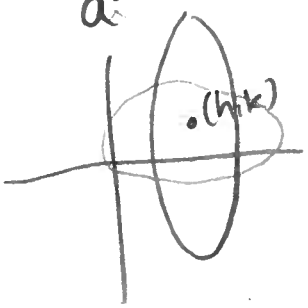
Circles, ellipses, & hyperbolas

$x^2+y^2=r^2$

$(x-h)^2+(y-k)^2=r^2$



$\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$



$\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1$