Challenge Set #2

1) Answers vary:

a point on both planes is $A(-1,2,2)$

a direction vector that works for both planes is $\vec{d}_1 = (1,-2,5)$

We are not limitted by anything else so:

a direction vector for π_1 is any non-collinear vector $\vec{d}_2$ so that $\vec{d}_2 \neq n\vec{d}_1$

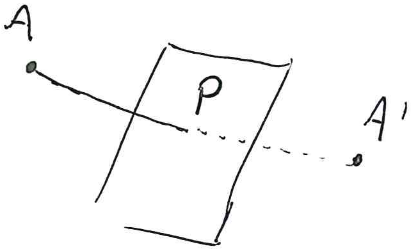
a direction vector for π_2 is any non collinear vector $\vec{d}_3$ so that $\vec{d}_3 \neq n\vec{d}_1$ and $\vec{d}_3 \neq m\vec{d}_2$

and

$$(\vec{d}_1 \times \vec{d}_2) \cdot \vec{d}_3 \neq 0 \quad (\text{why?})$$

you should have 2 direction vectors and a pt which is enough to find the eq.

2.



$\overline{AP} = \overline{PA}$

$\bar{n}$ of π is $\bar{d}$ of line AP

$\therefore l: (x, y, z) = (3, 5, -1) + t(1, -2, 3)$

Intersect l & π to find P

$$(3+t) - 2(5-2t) + 3(-1+3t) - 2 = 0$$

$$-12 + 14t = 0$$

$$t = \frac{6}{7}$$

$$\therefore A' = (3, 5, -1) + 2\left(\frac{6}{7}\right)(1, -2, 3)$$

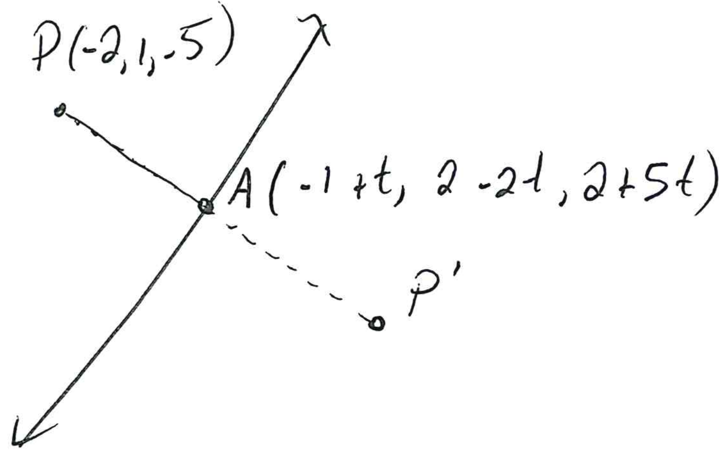
$$= \left(\frac{33}{7}, \frac{11}{7}, \frac{29}{7}\right)$$

Note: $|\overline{AP}| = |\overline{PA'}|$

and

$\overline{AP} = \overline{PA'}$

3



$$\overline{PA} = (1+t,\ 1-2t,\ 7+5t)$$

$$\overline{PA} \cdot \overline{d} = 0$$

$$(1+t,\ 1-2t,\ 7+5t)\cdot(1,-2,5) = 0$$

$$1+t-2+4t+35+25t = 0$$

$$30t + 34 = 0$$

$$t = \frac{-17}{15}$$

$$\overline{PA} = \left(\frac{-2}{15},\ \frac{49}{15},\ \frac{4}{3}\right)$$

$$\therefore P' = (-2,1,-5) + 2\overline{PA}$$

$$P' = \left(\frac{-34}{15},\ \frac{113}{15},\ \frac{-7}{3}\right)$$

4. If I want two lines to intersect, I need to make up any plane. As long as the pts I use are in the plane, the lines intersect

If I want skew, I use some pts not on the plane or use pts from parallel planes.