

# Calc 3 HW: Distances + Intersections

Note Title

2/7/2013

① Find the point of intersection of the lines  $l_1(t) = \langle 1, 1, 0 \rangle + t \langle 1, -1, 2 \rangle$  and  $l_2(s) = \langle 2, 0, 2 \rangle + s \langle -1, 1, 0 \rangle$ . Then find the equation of the plane containing both lines.

② Which of these planes are parallel:

$$P_1: 4x - 2y + 6z = 3$$

$$P_2: 4x - 2y - 2z = 6$$

$$P_3: -6x + 3y - 9z = 5$$

$$P_4: z = 2x - y - 9$$

③ Where does the line through  $(1, 0, 1)$  and  $(4, -2, 2)$  intersect the plane  $x + y + z = 6$

④ Find the following distances:

a) between  $P(2, -5, 5)$  and the plane  $x - 2y - 2z = 2$

b) between  $P(3, -2, 2)$  and  $4x - 6y - z = 5$

c) between  $P(1, 2, 3)$  and  $l(t) = \langle 2, 1, -3 \rangle + t \langle 2, 2, -1 \rangle$

d) between planes  $x + 2y - z = 1$  and  $3x + 6y - 3z = 5$

e) between planes  $3x + 6y - 9z = 4$  and  $x - 2y + z = 3$

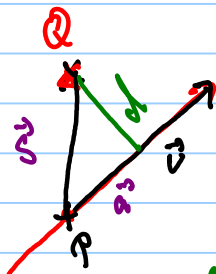
f) between  $P(-3, 4)$  and line  $y = 2x - 5$

⑤ Find equation of a plane with  $x$ -intercept  $A$ ,  $y$ -intercept  $B$ , and  $z$ -intercept  $C$ .

⑥ Equation of line through  $(1, 0, 6)$  and perpendicular to the plane  $x + 3y + z = 5$

⑦ Find line of intersection between planes  $x + y + z = 1$  and  $x - 2y + 3z = 1$

⑧ Show that the distance of  $Q$  to a line  $l(t) = P + t\vec{v}$  is 
$$d = \frac{\|\vec{v} \times \vec{PQ}\|}{\|\vec{v}\|}$$



Hint:  $d$  is the distance we want  
 $\vec{a} = \text{proj}_{\vec{v}}(\vec{PQ})$ ,  $\vec{s} = \vec{PQ}$

Use the Fact:  $\vec{a} \times (\vec{s} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{s} - (\vec{a} \cdot \vec{s})\vec{c}$