Math 8
Equation of Lines and Planes

Practice Problems

1) Find both vector and parametric equations for the line...

a) through the point $(6, -5, 2)$ and parallel to the vector $< 1, 3, -4 >$.

b) through the point $(0, 14, -3)$ and parallel to the line $x = -1+2t$, $y = 6-3t$, $z = 3+9t$.

c) through the origin and perpendicular to the plane $x + 7y - 2z = 1$.

2) Is the line through $(-4, -6, 1)$ and $(-2, 0, -3)$ parallel to the line through $(10, 18, 4)$ and $(5, 3, 14)$?

3) Is the line through $(-2, 4, 0)$ and $(1, 1, 1)$ perpendicular to the line through $(2, 3, 4)$ and $(2, -1, -8)$?

4) Determine whether each statement is true or false,

a) Two planes either intersect or are parallel.

b) Two lines either intersect or are parallel.

c) Two lines parallel to a third line are parallel.

d) Two lines perpendicular to a third line are parallel.

e) A plane and a line either intersect or are parallel.

5) Find the equation of a plane that has normal vector $< 1, 4, -1 >$ and contains the point $(-1, 2, -4)$.

6) Find the equation of a plane that contains the points $A = (0, 0, 3)$, $B = (0, 2, 0)$, $C = (1, 0, 0)$.

7) Find the equation of a plane that passes through the point $(-1, 2, 1)$ and contains the line of intersection of the planes $x + y - z = 2$ and $2(x - 1) - y + 3(z - 2) = 0$.

8) Find the equation of a plane that contains the point $(1, 5, 1)$ and is perpendicular to the planes

$$2x + y - 2z = 2 \qquad \text{and} \qquad x + 3z = 4.$$

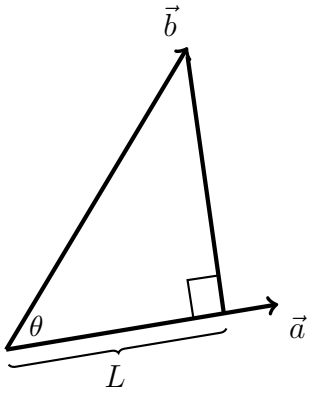
9)

a. Find an equation for the line of intersection of the planes $x+y+z = 1$ and $x+2y+2z = 1$.

b. What is the angle between these two planes?

Problems to Turn In

Let $\vec{a}$ and $\vec{b}$ be two vectors where θ is the angle between them.



Recall from class, that L is the length of the shadow projected orthogonally by $\vec{b}$ onto $\vec{a}$. By the dot product formula we know that

$$\cos\theta = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}||\vec{b}|},$$

and therefore

$$L = |\vec{b}|\cos\theta = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}|}.$$

Mathematically, L is called the **scalar projection** of $\vec{b}$ onto $\vec{a}$. Use this idea of scalar projection to solve the following two problems.

1) Find the distance from the point $(1, -2, 4)$ to the line $x = 1+t$, $y = 3-2t$, and $z = 4-3t$..

2) Find the distance from the point $(1, -2, 4)$ to the plane $3x + 2y + 6z = 5$.