

Solutions to Math 126A Quiz 3

1. (a) Find an equation of the plane passing through the points  $A(3, -1, 2)$ ,  $B(8, 2, 4)$ ,  $C(-1, -2, -3)$ .

Two vectors parallel to the plane are  $AB = \langle 5, 3, 2 \rangle$  and  $AC = \langle -4, -1, -5 \rangle$ .

A vector normal to the plane is  $\mathbf{n} = AB \times AC = \langle -13, 17, 7 \rangle$ .

The equation of the plane is

$$-13(x - 3) + 17(y + 1) + 7(z - 2) = 0,$$

$$-13x + 17y + 7z = -42.$$

- (b) Find an equation of the line passing through the points  $A(3, -1, 2)$ ,  $D(2, 3, 5)$ .

A vector parallel to the line is  $AD = \langle -1, 4, 3 \rangle$ .

Parametric equation of the line is

$$x = 3 - t,$$

$$y = -1 + 4t,$$

$$z = 2 + 3t.$$

- (c) Is the line from (b) perpendicular to the plane from (a)?

If a line is perpendicular to a plane, then it is parallel to the plane's normal vector.

Since  $AD = \langle -1, 4, 3 \rangle$  is not a scalar multiple of  $\mathbf{n} = \langle -13, 17, 7 \rangle$ ,  $AD$  is not parallel to  $\mathbf{n}$ , so the line from (b) is not perpendicular to the plane from (a).

Caution:  $AD \cdot \mathbf{n} \neq 0$  just implies  $AD$  and  $\mathbf{n}$  are not perpendicular but that doesn't answer question(c).