MAT 397, Section 001, Spring 2016 *Solutions* Quiz 3, February 8

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Problem 1 (10 points)

a) Compute the cross product of the vectors $\langle 1,3,4\rangle$ and $\langle 2,3,4\rangle$.

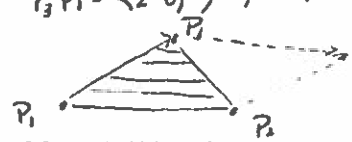
$$\langle 1,3,4\rangle \times \langle 2,3,4\rangle = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 3 & 4 \\ 2 & 3 & 4 \end{vmatrix}$$

$$= \hat{i}(12-12) - \hat{j}(4-8) + \hat{k}(3-6)$$
$$= 0\hat{i} + 4\hat{j} - 3\hat{k}$$
$$= \langle 0,4,-3\rangle$$

b) What is the area of the triangle with vertices $P_1(0,0,0)$, $P_2(1,3,4)$, and $P_3(2,3,4)$?

$\overrightarrow{P_2P_1} = \langle 1-0, 3-0, 4-0\rangle = \langle 1,3,4\rangle$

$\overrightarrow{P_3P_1} = \langle 2-0, 3-0, 4-0\rangle = \langle 2,3,4\rangle$



$\overrightarrow{P_2P_1} \times \overrightarrow{P_3P_1} = \langle 0,4,-3\rangle$

$\|\overrightarrow{P_2P_1} \times \overrightarrow{P_3P_1}\| = \sqrt{4^2+3^2+0^2} = \sqrt{25} = 5$

So the area is $5/2$

Problem 2 (10 points)

a) Find symmetric equations for the line through the point $P(1,0,-1)$ parallel to the vector $\langle 3,2,1\rangle$.

$r(t) = \langle 3,2,1\rangle t + \langle 1,0,-1\rangle$
$= \langle 3t+1, 2t+0, t-1\rangle$

So $x = 3t+1$
$y = 2t$
$z = t-1$

$$\frac{x-1}{3} = \frac{y-0}{2} = \frac{z+1}{1}$$

b) At what point does this line intersect the xy-plane?

In the xy-plane, $z=0$ so...

$z=0$
$t-1=0$
$t=1$

Then
$x = 3t+1 = 3(1)+1 = 4$
$y = 2t = 2(1) = 2$

So the point of intersection is $(4,2,0)$