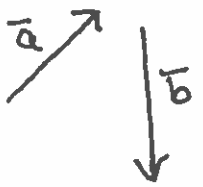
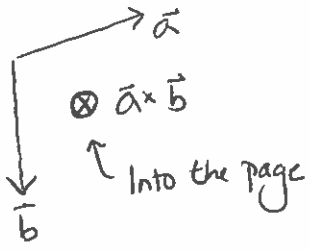
Math 397 Spring 2016 **Quiz 5** Name Caleb McWhorter
Section 4

Show all work. Incomplete answers may receive little or no credit.

1. The vectors **a** and **b** are shown. Suppose $|\mathbf{a}| = 5$, $|\mathbf{b}| = 8$, and the angle between them is $\theta = 2\pi/3$. Find $|\mathbf{a} \times \mathbf{b}|$ and determine whether $\mathbf{a} \times \mathbf{b}$ is directed into the page or out of the page.



$|\vec{a} \times \vec{b}| = |\vec{a}||\vec{b}|\sin\theta$
$= 5 \cdot 8 \cdot \sin\frac{2\pi}{3}$
$= 5 \cdot 8 \cdot \frac{\sqrt{3}}{2}$
$= 20\sqrt{3}$



2. Suppose **u**, **v**, and **w** are nonzero vectors, while c is a nonzero real number. For each of the following expressions does it make sense (Yes or No)? If not, state briefly why not.

(a) $\mathbf{u} \cdot (\mathbf{v} \cdot \mathbf{w})$ Yes **No** $\vec{v} \cdot \vec{w}$ is a scalar. So $\vec{u} \cdot$ scalar makes no sense

(b) $\mathbf{u} \cdot (\mathbf{v} \times c)$ Yes **No** $\vec{v} \times$ scalar makes no sense.

(c) $c\mathbf{u} \times c\mathbf{w}$ **Yes** No $c\vec{u}, c\vec{w}$ are vectors, so vector × vector makes sense.

3. (a) Find parametric equations of the line containing the points $P(1, -2, 3)$ and $Q(2, 1, 1)$.

$\overrightarrow{PQ} = \langle 2-1, 1-(-2), 1-3 \rangle = \langle 1, 3, -2 \rangle$

So $r(t) = \langle 1, 3, -2 \rangle t + \langle 2, 1, 1 \rangle$
$= \langle t, 3t, -2t \rangle + \langle 2, 1, 1 \rangle$
$= \langle \underbrace{t+2}_{x}, \underbrace{3t+1}_{y}, \underbrace{-2t+1}_{z} \rangle$

$$\begin{cases} x = t+2 \\ y = 3t+1 \\ z = -2t+1 \end{cases}$$

Note this is not the only possible equation for the line!

(b) Find the (x,y,z) point at which the line from part (a) intersects the xy-plane.

In the xy-plane, $z = 0$

$z = -2t + 1$
$0 = -2t + 1$
$-2t = -1$
$t = 1/2$

Then $x = t + 2 = 1/2 + 2 = 1/2 + \frac{4}{2} = 5/2$
$y = 3t + 1 = 3 \cdot 1/2 + 1 = 3/2 + 1 = \frac{3}{2} + \frac{2}{2} = 5/2$

So the line intersects the xy-plane at the point $(5/2, 5/2, 0)$