

KEY

Math 225: Quiz the ~~SECOND~~^{THIRD}

This exam is closed book and closed notes. You shouldn't need a calculator on this quiz. You have until 5 minutes before the hour to finish.

1. Which of the following expressions are well defined? If an expression is well defined, tell whether it is a scalar or a vector.

(a) $(\mathbf{a} \times \mathbf{b}) \cdot \mathbf{c}$

$\vec{a} \times \vec{b} \rightarrow \text{vector}$

$\text{vector} \cdot \text{vector} = \text{scalar}$

(b) $\mathbf{a} \times (\mathbf{b} \cdot \mathbf{c})$

$\vec{b} \cdot \vec{c} = \text{scalar}$

$\text{vector} \times \text{scalar} \rightarrow \text{nonsense}$

(c) \mathbf{a}^2 ?

\vec{a} times $\vec{a} \leftarrow \text{NO!!!}$

nonsense

(d) $\|\mathbf{a}\|^2 \mathbf{b}$

$\|\vec{a}\|^2 = \text{scalar}$

$\text{scalar times vector} \rightarrow \left(\begin{array}{l} \text{scalar multiplication} \\ \text{vector} \end{array} \right)$

2. Can parallel lines have different direction vectors? Explain.

Yes and no. Two parallel lines have direction vectors which are scalar multiples of each other.

3. Consider the lines $\frac{x-1}{3} = y+1 = \frac{z-4}{2}$ and $x = 1 + 2s, y = -1 + 3s, z = 4 - s$.

(a) Where do these lines intersect? (Hint: This shouldn't be too hard!)

rewrite first:

$$\begin{aligned} x &= 3t+1 \\ y &= t-1 \\ z &= 2t+4 \end{aligned}$$

Intersection (both have same given point!)
 $(1, -1, 4)$

(b) Find the equation of the plane containing both of these lines.

Direction 1 $\rightarrow \langle 3, 1, 2 \rangle$

Direction 2 $\rightarrow \langle 2, 3, -1 \rangle$

Cross Product for normal $\rightarrow \langle -1-6, \cancel{9-2}, 9-2 \rangle$
 $= \langle -7, 7, 7 \rangle$

Plane
 $: -7(x-1) + 7(y+1) + 7(z-4) = 0$
 or a variation thereof.

4. What is the angle of intersection of the planes $2x - y + 5z = 4$ and $3x - 4y - 2z = 7$?

$\vec{n}_1 = \langle 2, -1, 5 \rangle$

$\vec{n}_2 = \langle 3, -4, -2 \rangle$

$\vec{n}_1 \cdot \vec{n}_2 = 6 + 4 - 10 = 0$

so the planes are perpendicular

$\theta = 90^\circ$

EXTRA CREDIT: Would you like one point or three points? (Note: If more than 25% of you pick three points, no one gets anything).

Good Luck. ☺ (My friend's class didn't score).

Sorry. 17/40 chose 3.