

**MATH 231: Calculus of Several Variables**  
**Section 1, 107 Ag Sc & Ind Bldg,**  
**TR 9:05 AM - 9:55 AM**

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**Homework 3:** Due Tuesday, Sept 10

1. Read the Notes "The Dot Product"
2. Find the dot product of the following sets of vectors.

(a)  $\vec{a} = \langle 6, -2, 3 \rangle$  and  $\vec{b} = \langle 2, 5, -1 \rangle$

(b)  $\vec{a} = 2\vec{i} + \vec{j}$  and  $\vec{b} = \vec{i} - \vec{j} + 2\vec{k}$

(c)  $\vec{a} = \langle x, y, 0 \rangle$  and  $\vec{b} = \langle y, -x, 0 \rangle$

3. For vectors  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$ , does the expression

$$\vec{a} \cdot \vec{b} + \vec{c}$$

make mathematical sense?

4. Is the triangle described by the points  $P(1, -3, -2)$ ,  $Q(2, 0, -4)$ , and  $R(6, -2, -5)$  a right triangle?
5. Find the scalar and vector projection of  $\vec{a}$  onto  $\vec{b}$ , where

$$\vec{a} = \langle 1, 1, 1 \rangle, \quad \vec{b} = \langle 1, -1, 1 \rangle$$

6. Find the value  $x$  such that the angle between two vectors below is  $90^\circ$ .

$$\langle 2, 1, -1 \rangle, \quad \langle 1, x, 0 \rangle$$

7. What is the angle between the two lines

$$2x - y = 3, \quad 3x + y = 7$$

Hint: Find the point of intersection of the two lines and try to create two vectors.

8. Find the work done by a force  $F = \langle 8, 6, 9 \rangle$  that moves an object from the point  $(0, 10, 8)$  to the point  $(6, 12, 20)$  along a straight line. The distance is measured in meters and the force in newtons. (Hint: Work equals force times distance.)