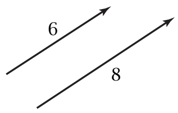
Name: ______________________ Group Members: ______________________________

Exploration 10-4a: Introduction to the Scalar Product of Two Vectors

Date: __________

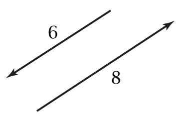
Objective: With guidance from your instructor or text, find out the meaning of the inner product of two vectors.

1. The figure shows two vectors pointing in the same direction, $\vec{a}$ 8 units long and $\vec{b}$ 6 units long. What is the **dot product,** $\vec{a} \cdot \vec{b}$ of these two vectors?



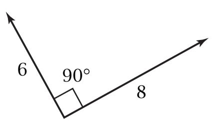
$\vec{a} \cdot \vec{b} =$ ______________________

2. The figure shows two vectors as in Problem 1 but with $\vec{b}$ pointing in the direction *opposite* $\vec{a}$. Find the dot product.



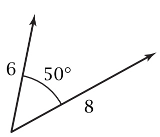
$\vec{a} \cdot \vec{b} =$ ______________________

3. The figure shows two vectors, $\vec{a}$ and $\vec{b}$, at right angles to each other. Find the dot product.



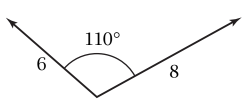
$\vec{a} \cdot \vec{b} =$ ______________________

4. The figure shows two vectors, $\vec{a}$ and $\vec{b}$, placed tail-to-tail, with an angle of 50° between them. Find the dot product.



$\vec{a} \cdot \vec{b} =$ ______________________

5. The figure shows two vectors with an angle of 110° between them when placed tail-to-tail. Find the dot product.



$\vec{a} \cdot \vec{b} =$ ______________________

6. State the definition of *dot product*.

7. Find:

   $\vec{i} \cdot \vec{i} =$ ________, $\vec{j} \cdot \vec{j} =$ ________, $\vec{k} \cdot \vec{k} =$ ________

   $\vec{i} \cdot \vec{j} =$ ________, $\vec{j} \cdot \vec{k} =$ ________, $\vec{i} \cdot \vec{k} =$ ________

8. Let $\vec{a} = 2\vec{i} + 5\vec{j} + 7\vec{k}$.

   Let $\vec{b} = 9\vec{i} + 3\vec{j} + 4\vec{k}$.

   Find $\vec{a} \cdot \vec{b}$.

9. Give two other names for *dot product*.

10. From what you found in Problem 8, there is an easy way to find the dot product of two vectors. Show that you have discovered this way by finding quickly the dot product $\vec{c} \cdot \vec{d}$.

    $\vec{c} = 4\vec{i} - 6\vec{j} + 9\vec{k}$

    $\vec{d} = 2\vec{i} + 5\vec{j} - 3\vec{k}$

11. On the other side of this page, find $|\vec{c}|$ and $|\vec{d}|$. Use the result and the definition of *dot product* to calculate the angle between $\vec{c}$ and $\vec{d}$.