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| Instructor |
| Date |

## Section 6.4 Vectors and Dot Products

**Objective:** In this lesson you learned how to find the dot product of two vectors and find the angle between two vectors.

| **Important Vocabulary** | Define each term or concept. |
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| **Angle between two nonzero vectors** | |
| **Orthogonal vectors** | |
| **Vector components** | |

### I. The Dot Product of Two Vectors (Pages 458–459)

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| ***What you should learn*** How to find the dot product of two vectors and use the Properties of the Dot Product |

The **dot product** of **u** = $\langle u_1, u_2 \rangle$ and **v** = $\langle v_1, v_2 \rangle$ is
________________________. This product yields a ____________.

Let **u**, **v**, and **w** be vectors in the plane or in space and let $c$ be a scalar. Complete the following properties of the dot product:

1. **u** • **v** = ________________
2. **0** • **v** = _____________
3. **u** • (**v** + **w**) = ______________________
4. **v** • **v** = _________________
5. $c$(**u** • **v**) = ________________ = _________________

**Example 1:** Find the dot product: ⟨5, – 4⟩ • ⟨9, – 2⟩.

### II. The Angle Between Two Vectors (Pages 459–461)

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| ***What you should learn*** How to find the angle between two vectors and how to determine whether two vectors are orthogonal |

If $q$ is the angle between two nonzero vectors **u** and **v**, then $q$ can be determined from ______________________________________.

**Example 2:** Find the angle between **v** = ⟨5, – 4⟩ and **w** = ⟨9, – 2⟩.

An alternative way to calculate the dot product between two vectors **u** and **v**, given the angle *q* between them, is

______________________________.

Two vectors **u** and **v** are orthogonal if ________________.

**Example 3:** Are the vectors **u** = ⟨1, – 4⟩ and **v** = ⟨6, 2⟩ orthogonal?

## III. Finding Vector Components (Pages 461–462)

> ***What you should learn***
> How to write a vector as the sum of two vector components

Let **u** and **v** be nonzero vectors such that $\mathbf{u} = \mathbf{w}_1 + \mathbf{w}_2$, where $\mathbf{w}_1$ and $\mathbf{w}_2$ are orthogonal and $\mathbf{w}_1$ is parallel to (or a scalar multiple of) **v**. The vectors $\mathbf{w}_1$ and $\mathbf{w}_2$ are called ____________________ ____________. The vector $\mathbf{w}_1$ is the **projection** of **u** onto **v** and is denoted by ____________________. The vector $\mathbf{w}_2$ is given by ___________________.

Let **u** and **v** be nonzero vectors. The projection of **u** onto **v** is given by $\text{proj}_{\mathbf{v}}\,\mathbf{u}$ = ______________________________.

## IV. Work (Page 463)

> ***What you should learn***
> How to use vectors to find the work done by a force

The work *W* done by a constant force **F** as its point of application moves along the vector $\overrightarrow{PQ}$ is given by either of the following:

**1.**

**2.**

**Homework Assignment**

Page(s)

Exercises