Course Number
Instructor
Date

Section 6.3 Vectors in the Plane

Objective: In this lesson you learned how to write the component forms of vectors, perform basic vector operations, and find the direction angles of vectors.

Important Vocabulary	Define each term or concept.
Vector v in the plane	
Standard position	
Zero vector	
Unit vector	
Standard unit vectors	
Direction angle	

I. Introduction (Page 444)

> ***What you should learn***
> How to represent vectors as directed line segments

A **directed line segment** has an ____________________ and a ______________________.

The magnitude of the directed line segment $\overrightarrow{PQ}$, denoted by ________________, is its ________________. The magnitude of a directed line segment can be found by . . .

II. Component Form of a Vector (Page 445)

> ***What you should learn***
> How to write the component forms of vectors

A vector whose initial point is at the origin (0, 0) can be uniquely represented by the coordinates of its terminal point (v_1, v_2). This is the ____, written $\mathbf{v} = \langle v_1, v_2 \rangle$, where v_1 and v_2 are the __________________ of **v**.

The component form of the vector with initial point $P = (p_1, p_2)$ and terminal point $Q = (q_1, q_2)$ is

$\overrightarrow{PQ} =$ ______________________ = _____________ = **v**.

The **magnitude** (or length) **of v** is:

$\|\mathbf{v}\| = \sqrt{\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_} = \sqrt{\_\_\_\_\_\_\_\_\_\_\_\_}$

Example 1: Find the component form and magnitude of the vector **v** that has (1, 7) as its initial point and (4, 3) as its terminal point.

III. Vector Operations (Pages 446–448)

> ***What you should learn***
> How to perform basic vector operations and represent them graphically

Geometrically, the product of a vector **v** and a scalar *k* is . . .

If *k* is positive, *k***v** has the ______________ direction as **v**, and if *k* is negative, *k***v** has the ______________ direction.

To add two vectors geometrically, . . .

This technique is called the ____________________________ for vector addition because the vector **u** + **v**, often called the ___________________ of vector addition, is . . .

Let $\mathbf{u} = \langle u_1, u_2 \rangle$ and $\mathbf{v} = \langle v_1, v_2 \rangle$ be vectors and let *k* be a scalar (a real number). **Vector addition,** that is, the sum of **u** and **v,** is defined as the following vector:

$\mathbf{u} + \mathbf{v} =$ _________________________

Scalar multiplication, that is, the scalar multiple of *k* times **u,** is defined as the following vector:

$k\mathbf{u} =$ _____________________________

Example 2: Let $\mathbf{u} = \langle 1, 6 \rangle$ and $\mathbf{v} = \langle -4, 2 \rangle$. Find:
(a) $3\mathbf{u}$
(b) $\mathbf{u} + \mathbf{v}$

Let **u**, **v**, and **w** be vectors and *c* and *d* be scalars. Complete the following properties of vector addition and scalar multiplication:

1. **u** + **v** = ________________
2. (**u** + **v**) + **w** = _____________________
3. **u** + **0** = _____________
4. **u** + (– **u**) = _____________
5. *c*(*d***u**) = _________________
6. (*c* + *d*)**u** = _________________
7. *c*(**u** + **v**) = _________________
8. 1(**u**) = _____________
9. 0(**u**) = _____________
10. ||*c***v**|| = _____________________

IV. Unit Vectors (Pages 448–449)

What you should learn
How to write vectors as linear combinations of unit vectors

To find a unit vector **u** that has the same direction as a given nonzero vector **v**, . . .

In this case, the vector **u** is called a _________________________ ______________________.

Example 3: Find a unit vector in the direction of **v** = ⟨– 8, 6⟩.

Let **v** = ⟨v_1, v_2⟩. Then the standard unit vectors can be used to represent **v** as **v** = _________________ , where the scalar v_1 is called the _________________________________ and the scalar v_2 is called the _______________________________. The vector sum v_1**i** + v_2**j** is called a ___________________________ of the vectors **i** and **j**.

Example 4: Let **v** = ⟨– 5, 3⟩. Write **v** as a linear combination of the standard unit vectors **i** and **j**.

Example 5: Let **v** = 3**i** – 4**j** and **w** = 2**i** + 9**j**. Find **v** + **w**.

V. Direction Angles (Page 450)

> ***What you should learn***
> How to find the direction angles of vectors

If **u** is a unit vector and q is its direction angle, the terminal point of **u** lies on the unit circle and

$\mathbf{u} = \langle x, y \rangle =$ ____________________ = ________________________

Now, if **v** is any vector that makes an angle q with the positive x-axis, it has the same direction as **u** and

$\mathbf{v} =$ ________________________ = ____________________________

If **v** can be written as $\mathbf{v} = a\mathbf{i} + b\mathbf{j}$, then the direction angle q for **v** can be determined from tan q = ______________.

Example 6: Let $\mathbf{v} = -4\mathbf{i} + 5\mathbf{j}$. Find the direction angle for **v**.

VI. Applications of Vectors (Pages 451–452)

> ***What you should learn***
> How to use vectors to model and solve real-life problems

Describe several real-life applications of vectors.

Homework Assignment

Page(s)

Exercises