Course Number
Instructor
Date

Section 6.3 Vectors in the Plane

Objective: In this lesson you learned how to represent vectors as directed line segments, perform mathematical operations on vectors, and find 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 424)

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

A **directed line segment** $\overrightarrow{PQ}$, has ___________________ P and ______________________ Q.

The **magnitude,** or _______________, of the directed line segment $\overrightarrow{PQ}$, is denoted by _______________ and can be found by . . .

II. Component Form of a Vector (Page 425)

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:

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

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 426–428)

> ***What you should learn***
> How to perform basic vector operations and represent vectors 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 **u** and **v** 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). The **sum** of **u** and **v,** is the vector

u + **v** = ________________________

The **scalar multiple** of k times **u,** is the vector:

k**u** = ______________________________

Example 2: Let $\mathbf{u} = \langle 1, 6\rangle$ and $\mathbf{v} = \langle -4, 2\rangle$. Find:
(a) 3**u**
(b) **u** + **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**) = ____________ , 0(**u**) = ____________
9. ||c**v**|| = ___________________

IV. Unit Vectors (Pages 428–429)

> ***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 430)

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

If **u** is a unit vector and θ is the angle (measured counterclockwise) from the positive x-axis to **u**, the terminal point of **u** lies on the unit circle and

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

Now, if $\mathbf{v} = a\mathbf{i} + b\mathbf{j}$ is any vector that makes an angle θ with the positive x-axis, then it has the same direction as **u** and

$\mathbf{v} =$ __________________________ = ____________________________

Because $\mathbf{v} = a\mathbf{i} + b\mathbf{j}$, then the direction angle θ for **v** can be determined from $\tan \theta =$ ______________.

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

VI. Applications of Vectors (Pages 431–432)

> ***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