Vector Operations: Magnitude, Components, Unit Vectors, and Arithmetic

Precalculus Worksheet · Grade 11-12 · numberbender.com

Name: _____ Date: _____ Score: / 10

Learning Objectives

- Find the component form and magnitude of a vector given initial and terminal points
- Compute the unit vector in the direction of a given vector
- Perform vector addition, subtraction, and scalar multiplication
- Apply vector operations to solve combined expressions

Solve each problem, showing all work and expressing answers in exact simplified form.

1. Find the component form of the vector with initial point (3, -2) and terminal point (-1, 1).

$P = (3, -2),\ Q = (-1, 1)$

Answer: _____

2. Find the magnitude of the vector with initial point (3, -2) and terminal point (-1, 1).

$\vec{v} = \langle -4,\ 3 \rangle$

Answer: _____

3. Find the unit vector in the direction of v = (3, 4).

$\vec{v} = \langle 3,\ 4 \rangle$

Answer: _____

4. Given v = (-2, 5) and w = (3, 4), find v + w.

$\vec{v} + \vec{w}$

Answer: _____

5. Given v = (-2, 5) and w = (3, 4), find v - w.

$\vec{v} - \vec{w}$

Answer: _____

6. Given v = (-2, 5), find the scalar multiple 3v.

$3\vec{v}$

Answer: _____

7. Given v = (-2, 5) and w = (3, 4), compute 2v + 3w.

$2\vec{v} + 3\vec{w}$

Answer: _____

Scan to watch

8. Find the magnitude of w = (3, 4).

$\vec{w} = \langle 3,\ 4 \rangle$

Answer: _____

9. Find the unit vector in the direction of v = (-2, 5).

$\vec{v} = \langle -2,\ 5 \rangle$

Answer: _____

10. Given v = (-2, 5) and w = (3, 4), compute 4w - 2v.

$4\vec{w} - 2\vec{v}$

Answer: _____

Scan to watch

Vector Operations: Magnitude, Components, Unit Vectors, and Arithmetic

ANSWER KEY & SOLUTIONS

Precalculus Worksheet · Grade 11-12 · numberbender.com

This worksheet covers the topics from the video: writing a vector in component form from its initial and terminal points, computing magnitude, finding unit vectors, and performing vector arithmetic (addition, subtraction, and scalar multiplication) with vectors such as v = (-2, 5) and w = (3, 4).

Solutions

1. Find the component form of the vector with initial point (3, -2) and terminal point (-1, 1).

$P = (3, -2),\ Q = (-1, 1)$

→ *Subtract the initial point coordinates from the terminal point coordinates.*
→ *The x-component is negative one minus three, which equals negative four.*
→ *The y-component is one minus negative two, which equals three.*
→ *Write the vector in component form as negative four, three.*

Answer: $\vec{v} = \langle -4,\ 3 \rangle$

---

2. Find the magnitude of the vector with initial point (3, -2) and terminal point (-1, 1).

$\vec{v} = \langle -4,\ 3 \rangle$

→ *Use the magnitude formula: the square root of the sum of the squares of the components.*
→ *Square negative four to get sixteen, and square three to get nine.*
→ *Add sixteen and nine to get twenty-five.*
→ *Take the square root of twenty-five to get five.*

Answer: lVert vec v rVert = 5

---

3. Find the unit vector in the direction of v = (3, 4).

$\vec{v} = \langle 3,\ 4 \rangle$

→ *Compute the magnitude as the square root of three squared plus four squared.*
→ *This gives the square root of twenty-five, which is five.*
→ *Divide each component of the vector by the magnitude five.*
→ *The unit vector is three-fifths, four-fifths.*

Answer: $\hat{u} = \left\langle \frac{3}{5},\ \frac{4}{5} \right\rangle$

---

4. Given v = (-2, 5) and w = (3, 4), find v + w.

$\vec{v} + \vec{w}$

→ *Add the corresponding components of the two vectors.*
→ *Negative two plus three equals one.*
→ *Five plus four equals nine.*
→ *The resulting vector is one, nine.*

Answer: $\vec{v} + \vec{w} = \langle 1,\ 9 \rangle$

Scan to watch

5. Given v = (-2, 5) and w = (3, 4), find v - w.

$\vec{v} - \vec{w}$

→ *Subtract the components of w from the corresponding components of v.*
→ *Negative two minus three equals negative five.*
→ *Five minus four equals one.*
→ *The resulting vector is negative five, one.*

Answer: $\vec{v} - \vec{w} = \langle -5,\ 1 \rangle$

---

6. Given v = (-2, 5), find the scalar multiple 3v.

$3\vec{v}$

→ *Multiply each component of v by the scalar three.*
→ *Three times negative two equals negative six.*
→ *Three times five equals fifteen.*
→ *The resulting vector is negative six, fifteen.*

Answer: $3\vec{v} = \langle -6,\ 15 \rangle$

---

7. Given v = (-2, 5) and w = (3, 4), compute 2v + 3w.

$2\vec{v} + 3\vec{w}$

→ *Multiply v by two to get negative four, ten.*
→ *Multiply w by three to get nine, twelve.*
→ *Add the corresponding components: negative four plus nine equals five.*
→ *Add the y-components: ten plus twelve equals twenty-two.*

Answer: $2\vec{v} + 3\vec{w} = \langle 5,\ 22 \rangle$

---

8. Find the magnitude of w = (3, 4).

$\vec{w} = \langle 3,\ 4 \rangle$

→ *Apply the magnitude formula using the components three and four.*
→ *Square three to get nine and square four to get sixteen.*
→ *Add nine and sixteen to get twenty-five.*
→ *Take the square root of twenty-five to get five.*

Answer: lVert vec w rVert = 5

---

9. Find the unit vector in the direction of v = (-2, 5).

$\vec{v} = \langle -2,\ 5 \rangle$

→ *Compute the magnitude as the square root of negative two squared plus five squared.*
→ *This simplifies to the square root of twenty-nine.*
→ *Divide each component by the square root of twenty-nine.*
→ *Rationalize the denominators to obtain negative two root twenty-nine over twenty-nine and five root twenty-nine over twenty-nine.*

Answer: $\hat{u} = \left\langle \frac{-2\sqrt{29}}{29},\ \frac{5\sqrt{29}}{29} \right\rangle$

Scan to watch

10. Given v = (-2, 5) and w = (3, 4), compute 4w - 2v.

$4\vec{w} - 2\vec{v}$

→ *Multiply w by four to get twelve, sixteen.*
→ *Multiply v by two to get negative four, ten.*
→ *Subtract the second vector from the first by components: twelve minus negative four equals sixteen.*
→ *Subtract the y-components: sixteen minus ten equals six.*

Answer: $4\vec{w} - 2\vec{v} = \langle 16,\ 6 \rangle$

Scan to watch