Vectors: Components, Magnitude, and Unit Vectors

Pre-Calculus / Calculus Worksheet · Grade 10–12

Name: _____ Date: _____

Learning Objectives

- Find the component form of a vector given an initial and terminal point
- Calculate the magnitude (length) of a vector
- Find the unit vector in the direction of a given vector
- Perform vector operations including scalar multiplication and vector addition

Problems

1. Find the component form of the vector with the given initial point P and terminal point Q.

$P = (1, 3), \quad Q = (5, 7)$

2. Find the component form of the vector with the given initial point P and terminal point Q.

$P = (4, -1), \quad Q = (-2, 6)$

3. Find the magnitude of the vector below.

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

4. Find the magnitude of the vector with initial point P and terminal point Q.

$P = (0, -3), \quad Q = (5, 9)$

5. Find both the component form and magnitude of the vector with the initial point P and terminal point Q.

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

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6. Find the unit vector in the direction of the given vector.

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

7. Find the unit vector in the direction of the given vector.

$\vec{v} = \langle -5, 12 \rangle$

8. Given vectors V and W below, find 2V.

$\vec{V} = \langle -2, 5 \rangle, \quad \vec{W} = \langle 3, 4 \rangle$

9. Given vectors V and W below, find W minus V.

$\vec{V} = \langle -2, 5 \rangle, \quad \vec{W} = \langle 3, 4 \rangle$

10. Given vectors V and W below, find V plus W and then find the magnitude of the resulting vector.

$\vec{V} = \langle -2, 5 \rangle, \quad \vec{W} = \langle 3, 4 \rangle$

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Vectors: Components, Magnitude, and Unit Vectors — Answer Key

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Answer Key

1. Answer: \langle 4, 4 \rangle
- Component form = (Q1 - P1, Q2 - P2)
- Q1 - P1 = 5 - 1 = 4
- Q2 - P2 = 7 - 3 = 4
- Component form: (4, 4)

2. Answer: \langle -6, 7 \rangle
- Component form = (Q1 - P1, Q2 - P2)
- Q1 - P1 = -2 - 4 = -6
- Q2 - P2 = 6 - (-1) = 7
- Component form: (-6, 7)

3. Answer: 5
- Magnitude = sqrt(v1^2 + v2^2)
- = sqrt(3^2 + 4^2)
- = sqrt(9 + 16)
- = sqrt(25) = 5

4. Answer: 13
- Component form = (5 - 0, 9 - (-3)) = (5, 12)
- Magnitude = sqrt(5^2 + 12^2)
- = sqrt(25 + 144)
- = sqrt(169) = 13

5. Answer: Component: (-4, 3), Magnitude: 5
- Component form = (-1 - 3, 1 - (-2)) = (-4, 3)
- Magnitude = sqrt((-4)^2 + 3^2)
- = sqrt(16 + 9)
- = sqrt(25) = 5

6. Answer: \langle \frac{3}{5}, \frac{4}{5} \rangle
- Find the magnitude: |v| = sqrt(3^2 + 4^2) = sqrt(25) = 5
- Unit vector = v / |v| = (3, 4) / 5
- Unit vector = (3/5, 4/5)

7. Answer: \langle -\frac{5}{13}, \frac{12}{13} \rangle
- Find the magnitude: |v| = sqrt((-5)^2 + 12^2) = sqrt(25 + 144) = sqrt(169) = 13

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- Unit vector = v / |v| = (-5, 12) / 13
- Unit vector = (-5/13, 12/13)

8. Answer: \langle -4, 10 \rangle

- Scalar multiplication: 2V = 2 * (-2, 5)
- = (2*(-2), 2*5)
- = (-4, 10)

9. Answer: \langle 5, -1 \rangle

- W - V = (3 - (-2), 4 - 5)
- = (3 + 2, 4 - 5)
- = (5, -1)

10. Answer: V + W = \langle 1, 9 \rangle, \quad |V + W| = \sqrt{82}

- V + W = (-2 + 3, 5 + 4) = (1, 9)
- Magnitude = sqrt(1^2 + 9^2)
- = sqrt(1 + 81)
- = sqrt(82)

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