



# Precalculus

## Topic: Vectors in Two Dimensions

### Instructions

Solve the following problems related to vectors in two dimensions. Show all work clearly and check your solutions.

### Practice Problems

1. Sketch the given vector with initial point  $(4, 3)$ , and find the terminal point.

(i)  $\mathbf{u} = \langle 2, 4 \rangle$

(iii)  $\mathbf{u} = \langle 4, -3 \rangle$

(ii)  $\mathbf{u} = \langle -1, 2 \rangle$

(iv)  $\mathbf{u} = \langle -8, -1 \rangle$

2. Sketch representations of the given vector with initial points at  $(0, 0)$ ,  $(2, 3)$ , and  $(3, 5)$ .

(i)  $\mathbf{u} = \langle 3, 5 \rangle$

(iii)  $\mathbf{u} = \langle 0, -9 \rangle$

(ii)  $\mathbf{u} = \langle -7, 2 \rangle$

(iv)  $\mathbf{u} = \langle 3, 0 \rangle$

3. Write the given vector in terms of  $i$  and  $j$ .

(i)  $\mathbf{u} = \langle 1, 4 \rangle$

(iii)  $\mathbf{u} = \langle 3, 0 \rangle$

(ii)  $\mathbf{u} = \langle -2, -10 \rangle$

(iv)  $\mathbf{u} = \langle 0, -5 \rangle$

4. Find  $2\mathbf{u}$ ,  $-3\mathbf{v}$ ,  $\mathbf{u} + \mathbf{v}$ , and  $3\mathbf{u} - 4\mathbf{v}$  for the given vectors  $\mathbf{u}$  and  $\mathbf{v}$ .

- (i)  $\mathbf{u} = \langle 2, 7 \rangle, \mathbf{v} = \langle 3, 1 \rangle$  (iii)  $\mathbf{u} = \langle 0, -1 \rangle, \mathbf{v} = \langle -2, 0 \rangle$   
(ii)  $\mathbf{u} = \langle -2, -5 \rangle, \mathbf{v} = \langle 2, -8 \rangle$  (iv)  $\mathbf{u} = i, \mathbf{v} = -2j$

5. Find  $|\mathbf{u}|$ ,  $|\mathbf{v}|$ ,  $2|\mathbf{v}|$ ,  $|\mathbf{u} + \mathbf{v}|$ , and  $|\mathbf{u} - \mathbf{v}|$ .

- (i)  $\mathbf{u} = 2i + j, \mathbf{v} = 3i - 2j$  (iii)  $\mathbf{u} = \langle 4, -5 \rangle, \mathbf{v} = \langle 5, 6 \rangle$   
(ii)  $\mathbf{u} = \langle 2, -1 \rangle, \mathbf{v} = \langle -3, 1 \rangle$  (iv)  $\mathbf{u} = \langle -1, 4 \rangle, \mathbf{v} = \langle 3, -2 \rangle$

6. Find the horizontal and vertical components of the vector with the given length and direction, and write the vector in terms of  $i$  and  $j$ .

- (i)  $|\mathbf{v}| = 40, \theta = 30^\circ$  (iii)  $|\mathbf{v}| = 80, \theta = 150^\circ$   
(ii)  $|\mathbf{v}| = 60, \theta = 120^\circ$  (iv)  $|\mathbf{v}| = 100, \theta = 90^\circ$

7. Find the magnitude and direction of the following vectors.

- (i)  $\mathbf{v} = \langle 10, 6 \rangle$  (vi)  $\mathbf{v} = \langle \frac{-\sqrt{2}}{2}, \frac{-\sqrt{2}}{2} \rangle$   
(ii)  $\mathbf{v} = \langle -6, 8 \rangle$  (vii)  $\mathbf{v} = \langle -12, 5 \rangle$   
(iii)  $\mathbf{v} = \langle 5, -7 \rangle$  (viii)  $\mathbf{v} = \langle 40, 9 \rangle$   
(iv)  $\mathbf{v} = \langle -4, -2 \rangle$  (ix)  $\mathbf{v} = i + \sqrt{3}j$   
(v)  $\mathbf{v} = \langle 3, 4 \rangle$  (x)  $\mathbf{v} = i + j$

## Multiple Choice Questions

(1) What is the parametric form of the equation of a circle with radius 3 centered at the origin?

- (a)  $x = 3 \cos t, y = 3 \sin t$   
(b)  $x = 3 \cos t, y = 3 \cos t$   
(c)  $x = 3 \sin t, y = 3 \cos t$   
(d)  $x = 3 \cos t, y = -3 \sin t$

(2) What is the rectangular equation obtained by eliminating the parameter from the following parametric equations?

$$x = t^2, y = 2t + 1$$

- (a)  $x = y^2 - 1$   
(b)  $x = y^2 + 1$   
(c)  $x = 2y^2 + 1$   
(d)  $x = y^2 - 2$

(3) For the parametric equations  $x = 2t, y = t^2$ , what is the shape of the graph?

- (a) Circle

- (b) Parabola
  - (c) Ellipse
  - (d) Hyperbola
- (4) Which of the following parametric equations represents the equation of a straight line with slope 3 passing through the origin?
- (a)  $x = t, y = 3t$
  - (b)  $x = 3t, y = t$
  - (c)  $x = t + 3, y = 3t + 3$
  - (d)  $x = t^2, y = 3t^2$

Visit our website: [Mathhaversity.com](https://mathhaversity.com)