# 2.5 Parallel and Perpendicular Vectors, The Unit Vector

## PARALLEL AND ORTHOGONAL VECTORS

Two vectors and are **parallel** if the angle between them is 0° or 180°.

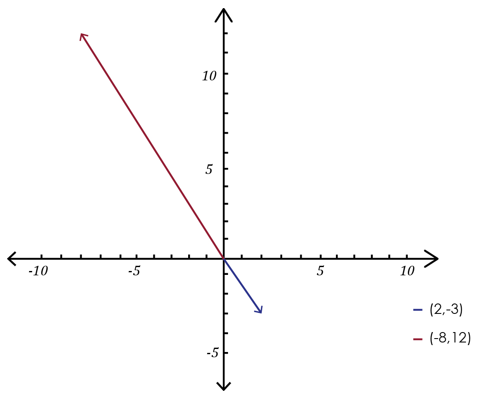
Also, two vectors and are parallel to each other if the vector is some multiple of the vector .That is, they will be parallel if the vector , for some real number . That is, is some multiple of .

Two vectors and are **orthogonal** (perpendicular to each other) if the angle between them is 90° or 180°.

Use this shortcut: Two vectors are perpendicular to each other if their dot product is 0.

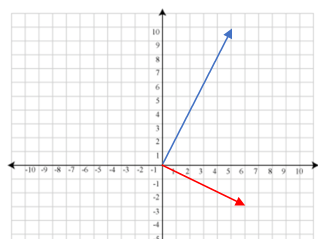
The two vectors and are parallel to each other since the angle between them is .

Example (1)



To show that the two vectors and are orthogonal (perpendicular to each other), we just need to show that their dot product is 0.

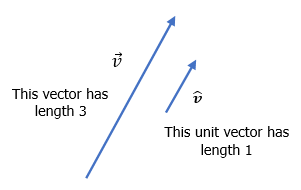
Example (2)



## THE UNIT VECTOR

A unit vector is a vector of length 1.

A unit vector is a vector of length 1. A unit vector in the same direction as the vector is often denoted with a “hat” on it as in . We call this vector “v hat.”



The unit vector corresponding to the vector is defined to be

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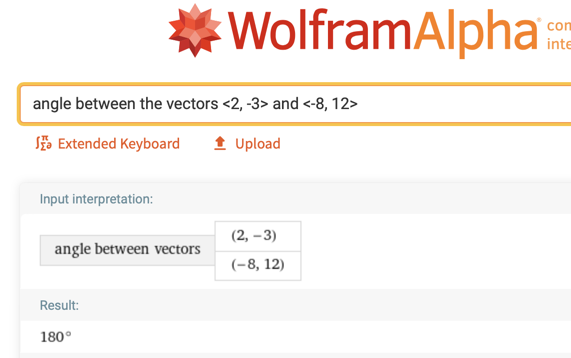
Example (3)

## USING TECHNOLOGY

We can use technology to find the angle between two vectors.

Go to www.wolframalpha.com.

To show that the vectors and are parallel**,** enter angle between the vectors <5, -3> and <2, 4> in the entry field. Wolframalpha tells you what it thinks you entered, then tells you its answer. In this case, , indicating the two vectors are parallel.



## EXAMPLES

1. Determine if the vectors and are parallel to each other, perpendicular to each other, or neither parallel nor perpendicular to each other.

ANS: Parallel

1. Determine if the vectors and are parallel to each other, perpendicular to each other, or neither parallel nor perpendicular to each other.

ANS: Perpendicular

1. Determine if the vectors and are parallel to each other, perpendicular to each other, or neither parallel nor perpendicular to each other.

ANS: Neither parallel nor perpendicular

4.Find the unit vector corresponding to the vector .

ANS:

## NOTE TO INSTRUCTOR

1. Show that and are parallel to each other.

Method 1

Make sure your calculator is in degree mode, not radian mode.

Method 2

Show that .Notice that .

1. Show that the vectors , and are perpendicular to each other.

Method 1

,

The dot product of these two vectors is 0.

Method 2

1. Find the unit vector corresponding to the vector .

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