10.2 Vectors

Vector names:

$\mathbf{v}$ bold print

$\vec{v}$

$\overrightarrow{v}$

$\hat{v}$

Mar 8-9:20 PM

#231

component form: shows the components of the vector (Δx and Δy) from standard position

(sometimes called the postion vector)

(x_1, y_1) tail

(x_2, y_2) head

$\langle (x_2 - x_1), (y_2 - y_1) \rangle$

$\langle \Delta x, \Delta y \rangle$

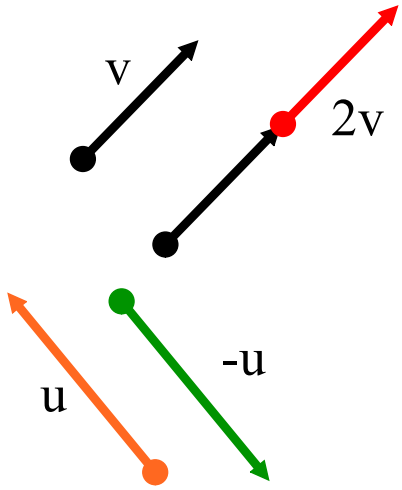
Magnitude: length of the vector (use distance formula)

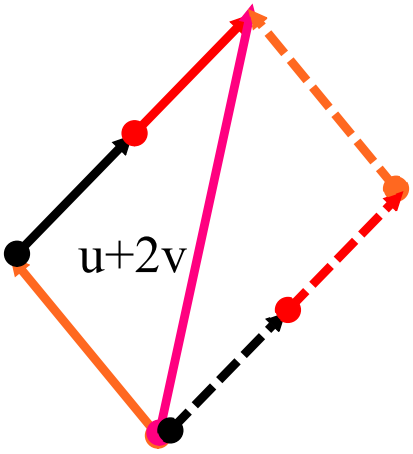
$|u|$ ← magnitude of vector u

Zero vector: has 0 length and no direction

Feb 26-9:15 AM

Operations with Vectors #232





vector addition and subtraction: add or subtract the components

scalars: distribute to both the x and y components

Feb 26-9:33 AM

Example: $u = \langle 1, 4 \rangle \quad v = \langle -4, 5 \rangle$

$3v =$

$2u - 3v =$

$u + v =$

Feb 26-9:39 AM

#231a

Unit Vector: vector with magnitude of 1

to change to a unit vector in the direction of u:

$$\frac{u}{|u|}$$

direction vector

Standard Unit Vectors: $i = \langle 1, 0 \rangle$ $j = \langle 0, 1 \rangle$

all vectors can be written using a linear combination of the standard unit vectors

$v = \langle a, b \rangle$ $v = ai + bj$

Feb 26-9:38 AM

$\langle \Delta x, \Delta y \rangle$

direction: θ

Find the magnitude and direction of v: $v = \langle 5, 4 \rangle$

Write a unit vector for v:

Find the component form of the vector with magnitude 5 and direction 200°.

Mar 8-9:19 PM

A ship is heading 20° west of south at 15mph. A current is flowing southeast at 3 mph. Find the new speed and direction of the ship.

Mar 2-10:12 AM

Vectors and Calculus

$r(t) = \langle x(t), y(t) \rangle$ is the position vector at any time t.

$v(t) = \langle x'(t), y'(t) \rangle$ is the velocity vector at any time t.

$a(t) = \langle x''(t), y''(t) \rangle$ is the acceleration vector at any time t.

speed is: $|v(t)| = \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}$ or the magnitude of the velocity vector

direction vector: $\frac{\boldsymbol{u}}{|\boldsymbol{u}|}$ or $\left\langle \frac{x}{|u|}, \frac{y}{|u|} \right\rangle$ or $\frac{x}{|u|}i + \frac{y}{|u|}j$

distance traveled: $\int_a^b \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$

final position: $\left(x_o + \int_a^b \frac{dx}{dt}, y_o + \int_a^b \frac{dy}{dt} \right)$

Mar 8-9:09 PM

Given the position vector, find the velocity vector, acceleration vector, speed, and the direction vector.

$r(t) = \langle 2t^3 + 1, 4t^2 \rangle$

Mar 9-9:40 AM

A particle moves in the *xy*-plane so that at any time *t*, the position of the particle is given by

$x(t) = 2t^3 - 15t^2 + 36t + 5,\ y(t) = t^3 - 3t^2 + 1,$ where $t \geq 0.$

For what value(s) of *t* is the particle at rest?

Mar 9-10:08 AM

A particle moves in the xy-plane in such a way that its velocity vector is $\langle 3t^2 - 4t,\ 8t^3 + 5 \rangle$.

If the position vector at $t = 0$ is $\langle 7, -4 \rangle$, find the position of the particle at $t = 1$. Find the distance the particle moves from $t = 0$ to 3.

Mar 9-10:03 AM