You can draw here

GET READY: Go here and make sure you see the “Are you Ready” Sli.do Q

Canvas -> Course Content -> Lecture (under Week 3 - Chapter 3)

Physics 111 - Lecture 3

September 24, 2020

Do not draw in/on this box!

You can draw here

You can draw here

Course Structure and weekly deadlines

The grading scheme for this course is here:

Item	Weight	Due date(s)
Learning Logs	10% (10 x 1%)	Fridays at 18:00
Homework Assignments	20% (10 x 2%)	Wednesdays at 18:00
Labs	20% (8 x 2.5%)	Variable
Tests (& Bonus Tests)	30% (5 x 6%)	Thursday at 18:00 to Saturday at 18:00
Final Exam	20%	In the exam period

Reminders/Announcements

	Homework (due Wed 6 pm)	Test/Bonus Test (Thurs 6pm - Sat 6pm)	Learning Log (Fri 6pm)
Week 1	-	-	-
Week 2	HW01 - Intro to Mastering Physics **(not for marks)**	Test 0 **(not for marks)**	Learning Log 1 **(yes for marks!)**
Week 3 (this week!)	HW02 - Chapter 2 HW03 - Chapter 3	Test 1 (on Chapters 2 & 3)	Learning Log 2
Week 4	HW04 - Chapter 4	Bonus Test 1	Learning Log 3
Week 5			

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Week 4	HW04 - Chapter 4	Bonus Test 1	Learning Log 3
Week 5			

FAQ about Test 1

- Tests will be done on Canvas; no Mastering Physics trickery
- You can use ANY resource except CHEGG, Course Hero, SLADER and other similar websites that have Q&A or answer questions
- Copying the question text and googling **IS CHEATING**
- Using google to search for concepts is **NOT cheating**
- If you come across the same or similar question on google, resist the temptation to keep reading, and close your browser tab

FAQ about Test 1

- I am trusting you to do this course with integrity, there will be an integrity pledge you have to read and sign

- Don’t be anxious, if you don’t do well - review the material and try again next week!

- You will have 60 minutes to complete the test

- You can start the test anytime from Thursday 6PM - Saturday 6 PM

FAQ about Test 1

- You will not be able to ask us questions during the quiz - do your best with your best interpretation

- You will not have access to the questions or find out which questions you got right or wrong until after the testing window is complete

- Do NOT take pictures of the questions and share them with your friends - that IS CHEATING

- You must complete the test BY YOURSELF.

Summary of comments from Homework 3 (Chapter 3)

Reading and Video overview

Part A

Which topics or areas in your assigned readings and videos did you find the most confusing? Which concepts would you like spend more time on in class?

In case everything was clear to you, what did you find most interesting about the material ?

Much better this week!

Students Completed

174 / 319

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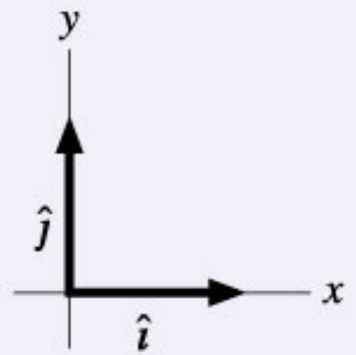
174 / 319

- Drawing vectors on Pearson's systems: Fail.
- **Unit vectors: i^, j^, k^**
- Tension and Trigonometry
- Question 3.03
- Tilted Axis!

Unit Vectors

Unit vectors have magnitude 1 and no units. Unit vectors $\hat{i}$ and $\hat{j}$ define the directions of the x- and y-axes.



And $\hat{k}$ for the z-axis!

Summary of comments from Homework 3 (Chapter 3)

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- Question 3.03
- Tilted Axis!

Dee is on a swing in the playground. The chains are 2.5 m long, and the tension in each chain is 250 N when Dee is 55 cm above the lowest point of her swing. Tension is a vector directed along the chain, measured in *newtons*, abbreviated N.

Part A

What is the magnitude of the horizontal component of the tension at this point in the swing?

Summary of comments from Homework 3 (Chapter 3)

Reading and Video overview

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174 / 319

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- **Question 3.03**
- Tilted Axis!

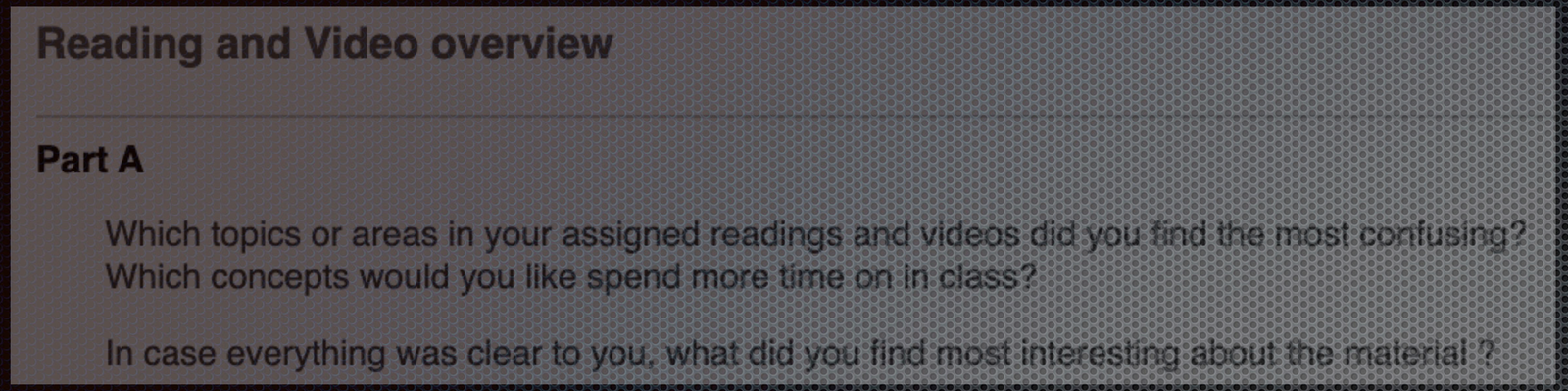
Under what condition is $|\vec{A} - \vec{B}| = A + B$?

Check all that apply.

ANSWER:

- [ ] Vectors $\vec{A}$ and $\vec{B}$ are in perpendicular directions.
- [x] Vectors $\vec{A}$ and $\vec{B}$ are in opposite directions.
- [x] The magnitude of vector $\vec{B}$ is zero.
- [ ] Vectors $\vec{A}$ and $\vec{B}$ are in the same direction.
- [ ] The statement is never true.

Summary of comments from Homework 3 (Chapter 3)



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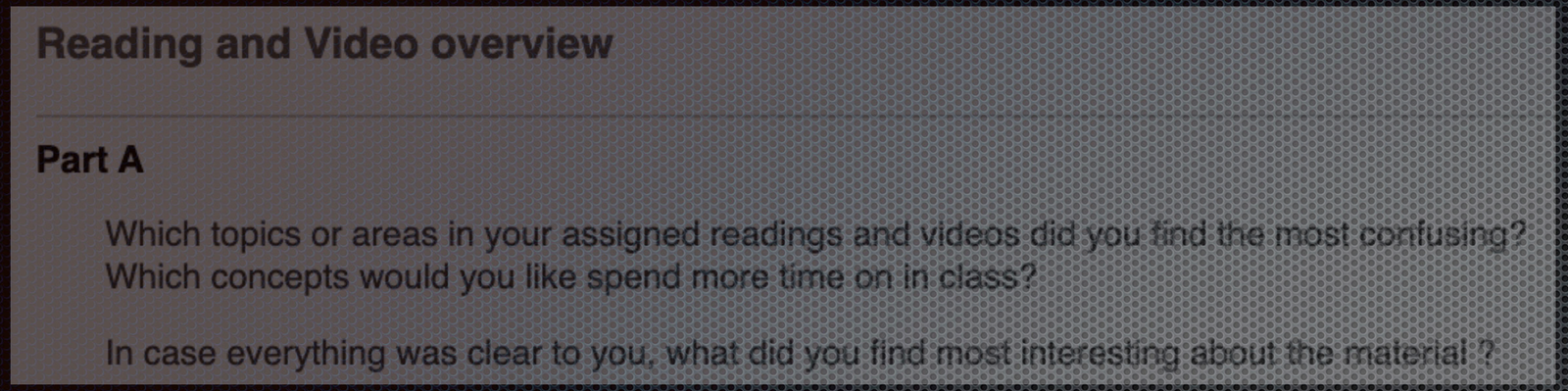

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- Question 3.03
- **Tilted Axis!**

"Quote of the week" QOTW

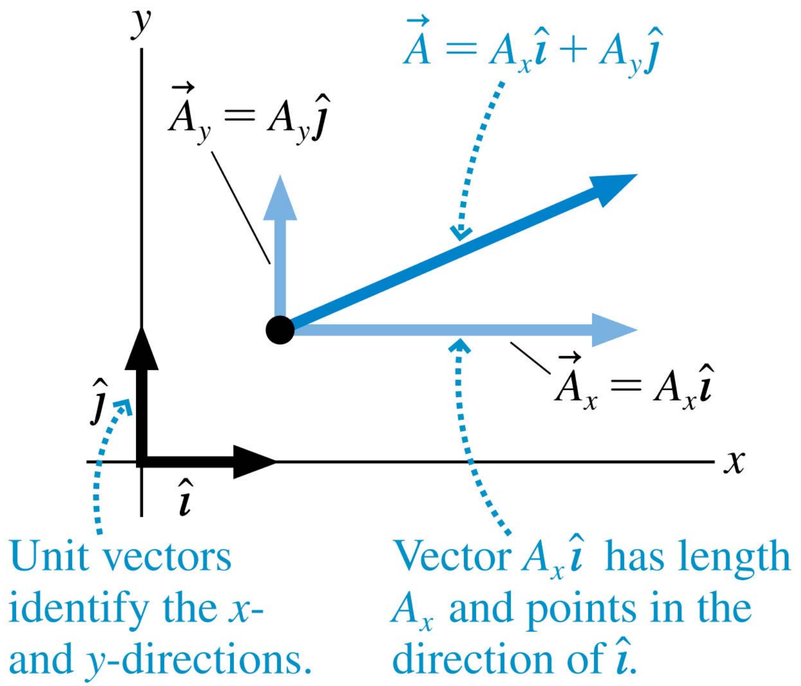
"The tilted axis questions had me sweating; I would say that I found those the most confusing."

Vector Algebra

- When decomposing a vector, unit vectors provide a useful way to write component vectors:

$$\vec{A}_x = A_x \hat{\imath}$$

$$\vec{A}_y = A_y \hat{\jmath}$$



- The full decomposition of the vector $\vec{A}$ can then be written

$$\vec{A} = \vec{A}_x + \vec{A}_y = A_x \hat{\imath} + A_y \hat{\jmath}$$

Chapter 3
Clicker Questions

QuickCheck 3.6

Vector $\vec{C}$ can be written

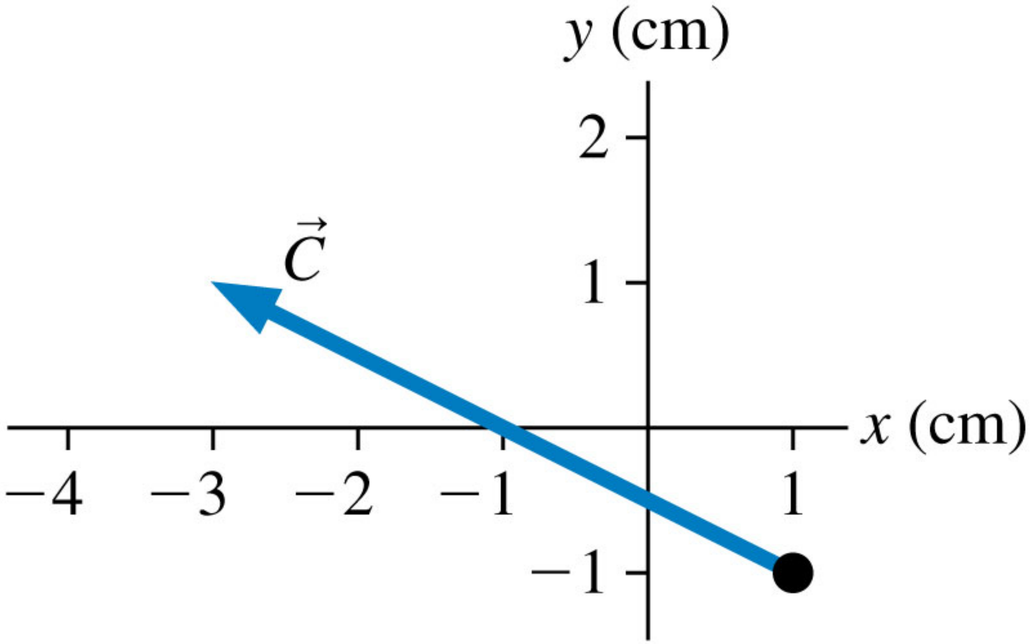
A. $-3\hat{\imath} + \hat{\jmath}$.

B. $-4\hat{\imath} + 2\hat{\jmath}$.

C. $\hat{\imath} - 3\hat{\jmath}$.

D. $2\hat{\imath} - 4\hat{\jmath}$.

E. $\hat{\imath} - \hat{\jmath}$.



QuickCheck 3.6

Vector $\vec{C}$ can be written

A. $-3\hat{\imath} + \hat{\jmath}$.

B. $-4\hat{\imath} + 2\hat{\jmath}$.

C. $\hat{\imath} - 3\hat{\jmath}$.

D. $2\hat{\imath} - 4\hat{\jmath}$.

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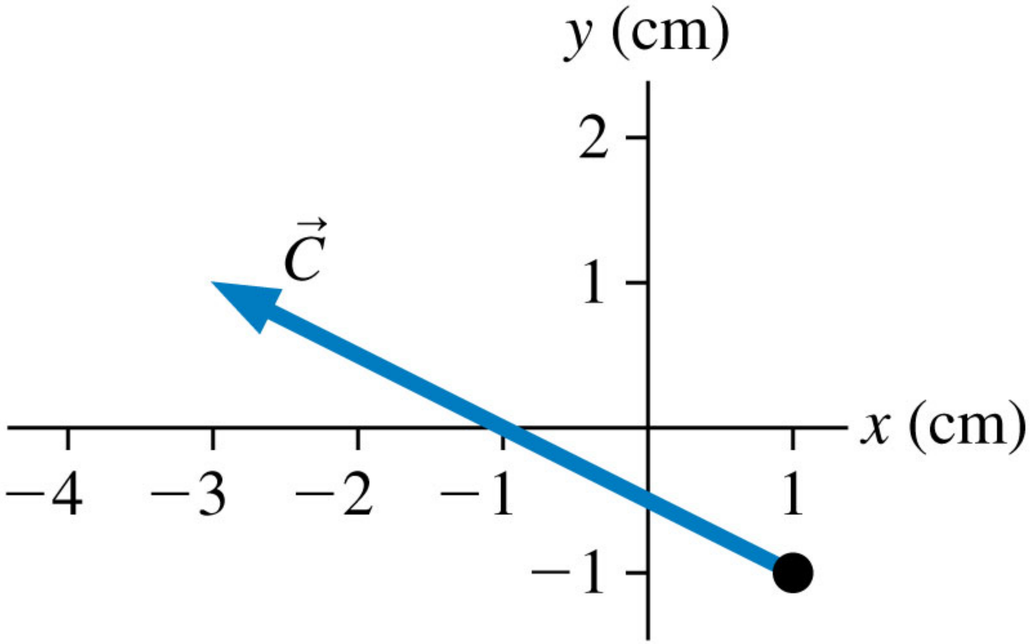


QuickCheck 3.7

The angle Φ that specifies the direction of vector $\vec{C}$ is

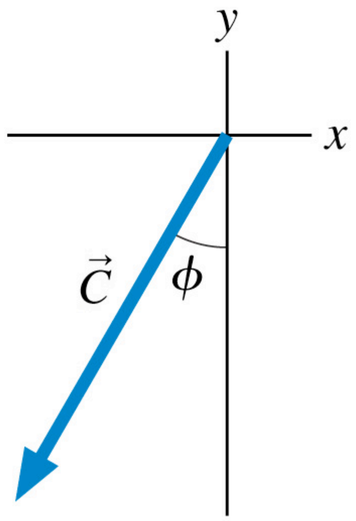
A. $\tan^{-1}(C_x/C_y)$

B. $\tan^{-1}(C_y/C_x)$

C. $\tan^{-1}(|C_x|/C_y)$

D. $\tan^{-1}(|C_x|/|C_y|)$

E. $\tan^{-1}(|C_y|/|C_x|)$



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The angle Φ that specifies the direction of vector $\vec{C}$ is

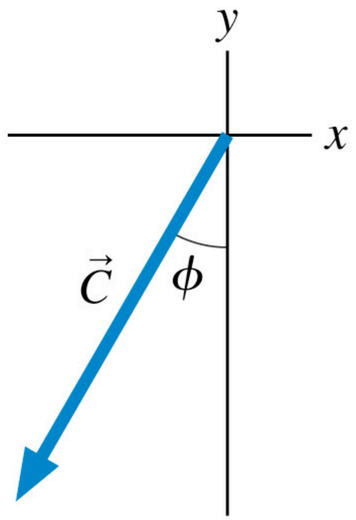
A. $\tan^{-1}(C_x/C_y)$

B. $\tan^{-1}(C_y/C_x)$

C. $\tan^{-1}(|C_x|/C_y)$

✔ **D. $\tan^{-1}(|C_x|/|C_y|)$**

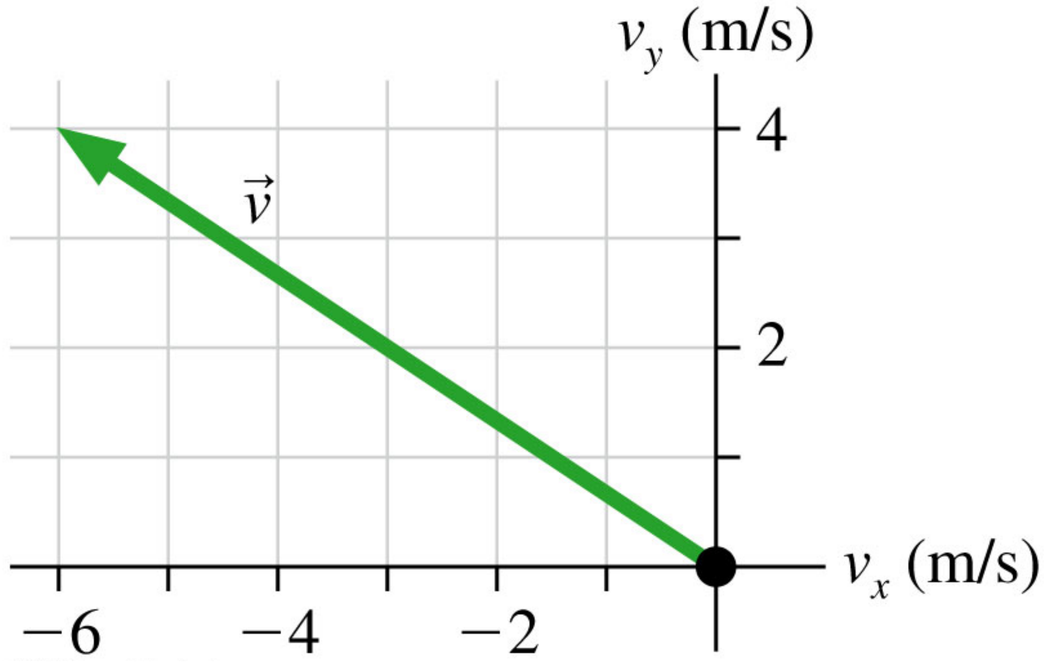
E. $\tan^{-1}(|C_y|/|C_x|)$



Example 3.4 Finding the Direction of Motion

EXAMPLE 3.4 | **Finding the direction of motion**

FIGURE 3.14 shows a car's velocity vector $\vec{v}$. Determine the car's speed and direction of motion.



Example 3.4 Finding the Direction of Motion

EXAMPLE 3.4 | **Finding the direction of motion**

VISUALIZE **FIGURE 3.15** shows the components v_x and v_y and defines an angle θ with which we can specify the direction of motion.

SOLVE We can read the components of $\vec{v}$ directly from the axes: $v_x = -6.0$ m/s and $v_y = 4.0$ m/s. Notice that v_x is negative. This is enough information to find the car's speed v, which is the magnitude of $\vec{v}$:

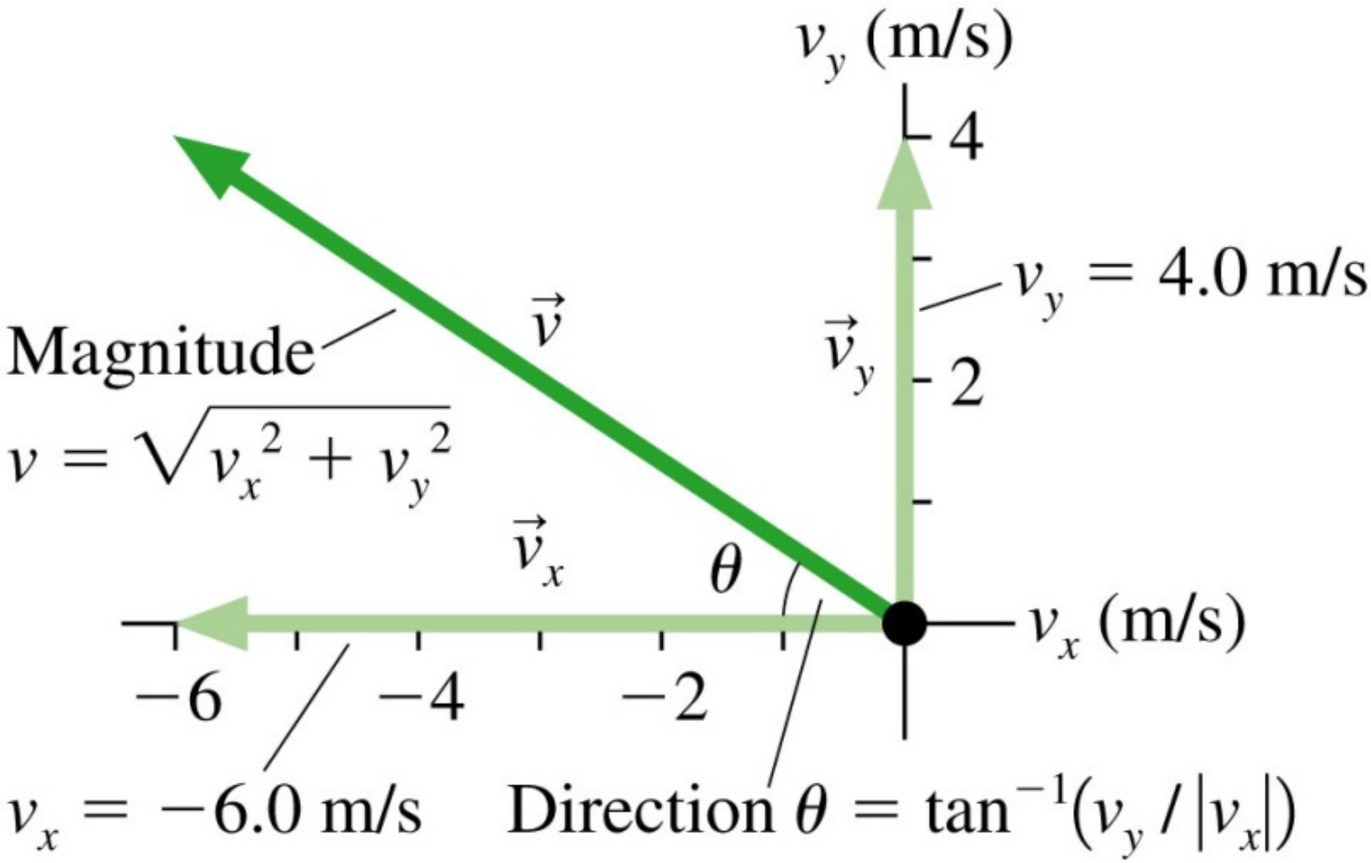
$$v = \sqrt{v_x^2 + v_y^2} = \sqrt{(-6.0 \text{ m/s})^2 + (4.0 \text{ m/s})^2} = 7.2 \text{ m/s}$$

From trigonometry, angle θ is

$$\theta = \tan^{-1}\left(\frac{v_y}{|v_x|}\right) = \tan^{-1}\left(\frac{4.0 \text{ m/s}}{6.0 \text{ m/s}}\right) = 34°$$

The absolute value signs are necessary because v_x is a negative number. The velocity vector $\vec{v}$ can be written in terms of the speed and the direction of motion as

$$\vec{v} = (7.2 \text{ m/s}, 34° \text{ above the negative } x\text{-axis})$$



Chapter 3
Important Concepts

Important Concepts

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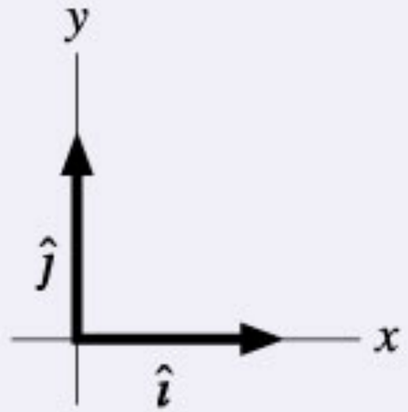

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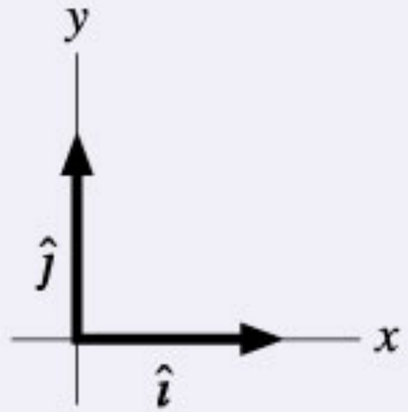


Using Vectors

Components

The component vectors are parallel to the x- and y-axes:

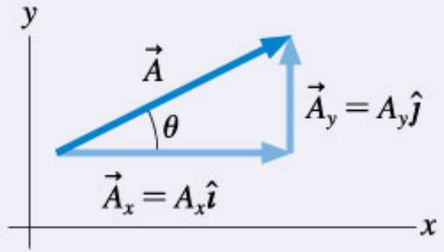
$$\vec{A} = \vec{A}_x + \vec{A}_y = A_x\hat{\imath} + A_y\hat{\jmath}$$

In the figure at the right, for example:

$$A_x = A\cos\theta \qquad A = \sqrt{A_x^2 + A_y^2}$$

$$A_y = A\sin\theta \qquad \theta = \tan^{-1}(A_y/A_x)$$

- Minus signs need to be included if the vector points down or left.



y	
$A_x < 0$ $A_y > 0$	$A_x > 0$ $A_y > 0$
$A_x < 0$ $A_y < 0$	$A_x > 0$ $A_y < 0$

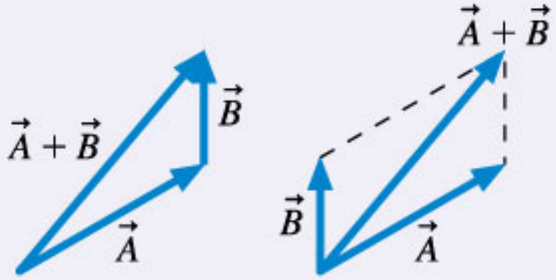
x

The components A_x and A_y are the magnitudes of the component vectors $\vec{A}_x$ and $\vec{A}_y$ *and* a plus or minus sign to show whether the component vector points toward the positive end or the negative end of the axis.

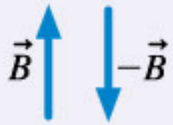
Using Vectors

Working Graphically

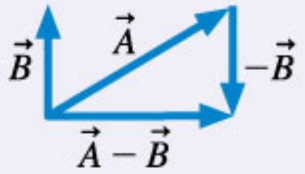
Addition



Negative



Subtraction



Multiplication

Using Vectors

Working Algebraically

Vector calculations are done component by component: $\vec{C} = 2\vec{A} + \vec{B}$ means $\begin{cases} C_x = 2A_x + B_x \\ C_y = 2A_y + B_y \end{cases}$

The magnitude of $\vec{C}$ is then $C = \sqrt{C_x^2 + C_y^2}$ and its direction is found using $\tan^{-1}$.