

FULL REVIEW

Full Review — Vector Addition and Subtraction — Algebra-Based

Review the essential ideas, relationships, and problem-solving tools for Vector Addition and Subtraction.

 TIME 45–60 minutes	 BEST FOR A complete topic review	 FINISH WITH A readiness check
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After this full review, you'll be able to...

recall the essential ideas, apply them to representative problems, and determine what to study next.

HOW TO USE THIS GUIDE

Work through the stages in order. Write directly in the spaces provided, check your work in the Solutions section, and finish by choosing the next resource that matches your confidence.

Choose how you want to review: work through this guide, follow the online review, or watch the video review.

[Start the Review Online →](#)

[Watch the Video Review →](#)

YOU WILL NEED

Pencil or pen • Calculator if needed • Approximately 45–60 minutes

FR-02 • COURSE ALIGNMENT

Course Alignment

This Physics Sensei Topic Review is an independent learning resource. Use it to reinforce key concepts, prepare for homework, or review before a quiz or exam.

Related Unit Review: If you need to review the complete unit material, review [Vectors and Components here →](#)

RESOURCE: Physics Sensei Topic Review TOPIC ID: MEC-U02-T02 TOPIC: Vector Addition and Subtraction PARENT UNIT: MEC-U02 — Vectors and Components COURSE LEVEL: Algebra-Based	BEST USED ✓ After learning the topic ✓ Before starting homework ✓ Before a quiz or exam
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FR-03 • YOUR REVIEW PLAN

Your Review Plan

Complete these six stages in order. Each stage builds on the previous one and prepares you for the final readiness check.

6 stages • Approximately 45–60 minutes

1 Warm-Up Check Activate prior knowledge.	2 Core Concepts Review the essential ideas.	3 Guided Practice Apply what you learned.
4 Confidence Check Confirm your understanding.	5 Summary Review the key ideas.	6 Next Step Continue your learning.

PRINTING TIP

For student copies, print double-sided and keep the Solutions section after the student activities so learners attempt each activity before checking their work.

FR-04 • STAGE 1 OF 6

Warm-Up Check

Before you begin, take a moment to see what you already remember. Do not worry about getting everything right. This is only a starting point.

ACTIVITY 1**Recall Activity 1**

Answer before revealing the response.

$\vec{A} = (2, -1)$ and $\vec{B} = (-3, 4)$. Find $\vec{A} + \vec{B}$.

ACTIVITY 2**Recall Activity 2**

Answer before revealing the response.

$\vec{A} = (2, -1)$ and $\vec{B} = (-3, 4)$. Find $\vec{A} - \vec{B}$.

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Recall Activity 3

Answer before revealing the response.

If $R^x < 0$ and $R_y > 0$, which quadrant contains $\vec{R}$?

Ready to strengthen your understanding?

You've refreshed what you already know. Next, reinforce the essential concepts that will help you solve problems with confidence.

Continue to Core Concepts →

FR-05 • STAGE 2 OF 6

Core Concepts

Let's rebuild the key ideas one step at a time. Focus on understanding the relationships before worrying about solving problems.

KEY CONCEPT 1

Component-Wise Vector Operations

Once vectors are written in components, addition and subtraction are algebraic: operate on x-components together and y-components together. The signs retain the directional information.

$$R_x = A_x \pm B_x \quad \bullet \quad R_y = A_y \pm B_y$$

EXAMPLE: $\vec{A} = (5, 1)$, $\vec{B} = (2, -3)$: $\vec{A} - \vec{B} = (3, 4)$.

SENSEI NOTE: Use parentheses when a component is negative so subtraction signs are not lost.

KEY CONCEPT 2

Magnitude and Direction of a Resultant

After the resultant components are known, use the Pythagorean relationship for magnitude. Find a reference angle from the component ratio, then use signs to report the correct physical direction.

$$|\vec{R}| = \sqrt{R_x^2 + R_y^2} \quad \bullet \quad \tan \theta = R_y / R_x$$

EXAMPLE: $\vec{R} = (2, 6)$ has $|\vec{R}| = \sqrt{40} \approx 6.32$ and $\theta \approx 71.6^\circ$ above +x.

SENSEI NOTE: Do not trust an inverse-tangent display until you have checked the quadrant.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Order and Grouping of Sums

Vector addition is commutative and associative. You may add several vectors in any order, but subtraction should first be rewritten as addition of the opposite vector.

$$\vec{A} + \vec{B} = \vec{B} + \vec{A} \quad \bullet \quad (\vec{A} + \vec{B}) + \vec{C} = \vec{A} + (\vec{B} + \vec{C})$$

EXAMPLE: For three vectors, summing all x-components and all y-components gives the same result regardless of order.

SENSEI NOTE: Do not treat $\vec{A} - \vec{B}$ as commutative; generally $\vec{A} - \vec{B} \neq \vec{B} - \vec{A}$.

Ready to apply these ideas?

You've reinforced the essential concepts. Now put them into practice by working through guided examples and building your problem-solving confidence.

[Continue to Guided Practice](#) →

FR-06 • STAGE 3 OF 6

Guided Practice

Now it's time to apply what you've reviewed. Work through each activity in order. The examples become gradually more challenging, and each prepares you for the final readiness check.

PRACTICE 1**Worked Example**

Work from components to magnitude and direction.

$\vec{A} = (3, 4)$ and $\vec{B} = (-1, 2)$. Find $\vec{A} + \vec{B}$, $|\vec{R}|$, and θ measured counterclockwise from $+x$.

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

Distribute the subtraction to both components.

$\vec{A} = (5, 1)$, $\vec{B} = (2, -3)$. Find $\vec{A} - \vec{B}$, $|\vec{R}|$, and its direction.

PRACTICE 3

Independent Problem

Add all components before finding the final magnitude.

$\vec{A} = (4, -2)$, $\vec{B} = (-1, 5)$, $\vec{C} = (-2, -1)$. Find $\vec{A} + \vec{B} + \vec{C}$.

Ready to check your understanding?

You've practiced the essential skills with guidance. Now solve a few short problems on your own and confirm you're ready to move forward.

Continue to Confidence Check →

FR-07 • STAGE 4 OF 6

Confidence Check

You've rebuilt the key ideas and practiced them with guidance. Now try these short questions on your own to check your understanding before moving on.

QUICK CHECK 1**Component Sum**

Find the resultant.

$\vec{A} = (-3, 2)$, $\vec{B} = (5, -6)$. Find $\vec{A} + \vec{B}$.

QUICK CHECK 2**Component Difference**

Find the resultant.

$\vec{A} = (4, 1)$, $\vec{B} = (-2, 3)$. Find $\vec{A} - \vec{B}$.

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Magnitude and Direction

Find both quantities.

$\vec{R} = (3, -4)$. Find $|\vec{R}|$ and describe its direction from $+x$.

HOW DID IT GO?

I answered ____ of 3 questions correctly.

Use the Solutions section to check your reasoning, then take one final look at the essential ideas.

You've checked your understanding.

Take one final look at the essential ideas before deciding what to do next.

Continue to Summary →

FR-08 • STAGE 5 OF 6

Summary

Before moving on, take one final look at the most important ideas from this review.

KEY TAKEAWAY 1

Operate Component by Component

Add or subtract corresponding components; signs carry direction information.

KEY TAKEAWAY 2

Reconstruct Magnitude and Direction

Use $|\vec{R}| = \sqrt{R_x^2 + R_y^2}$ and determine the correct quadrant from component signs.

KEY TAKEAWAY 3

Addition Is Flexible; Subtraction Is Not

Vector sums may be reordered and regrouped, but subtraction should be converted to addition of the opposite vector.

MY ONE-SENTENCE SUMMARY

In my own words, the most important idea is:

Ready for your next step?

You've reviewed the essential ideas one last time. Now choose the resource that best matches how confident you feel.

Continue to Next Step →

ANSWER KEY • CHECK AFTER ATTEMPTING

Solutions and Explanations

Use these solutions to check your reasoning—not only your final answer.

WARM-UP • ACTIVITY 1**Recall Activity 1**

$(-1, 3)$.

WHY IT WORKS: Corresponding components add independently.

WARM-UP • ACTIVITY 2**Recall Activity 2**

$(5, -5)$.

WHY IT WORKS: Subtract each B component: $2 - (-3) = 5$ and $-1 - 4 = -5$.

WARM-UP • ACTIVITY 3**Recall Activity 3**

Quadrant II.

WHY IT WORKS: Component signs determine the quadrant before the direction angle is interpreted.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Worked Example

$$\vec{R} = (2, 6); |\vec{R}| = \sqrt{40} \approx 6.32; \theta \approx 71.6^\circ.$$

WHY IT WORKS: The resultant components are calculated first; the magnitude and direction follow from those components.

PRACTICE 2

Guided Problem

$$\vec{R} = (3, 4); |\vec{R}| = 5; \theta = 53.1^\circ \text{ above } +x.$$

WHY IT WORKS: The y result is $1 - (-3) = 4$, which places the resultant in Quadrant I.

PRACTICE 3

Independent Problem

$$\vec{R} = (1, 2); |\vec{R}| = \sqrt{5} \approx 2.24; \theta \approx 63.4^\circ \text{ above } +x.$$

WHY IT WORKS: Summing components first avoids repeatedly converting between magnitude-angle and component forms.

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Component Sum

(2, -4).

WHY IT WORKS: Add signed components independently.

QUICK CHECK 2

Component Difference

(6, -2).

WHY IT WORKS: The x-component is $4 - (-2) = 6$; the y-component is $1 - 3 = -2$.

QUICK CHECK 3

Magnitude and Direction

$|\vec{R}| = 5$; 53.1° below +x, equivalently -53.1° .

WHY IT WORKS: The negative y-component places the vector in Quadrant IV.

READINESS GUIDE

3 correct: You're ready to continue. • 2 correct: Review the missed idea, then continue. • 0–1 correct: Revisit Core Concepts or choose more practice.

FR-09 • STAGE 6 OF 6

Next Step: Continue Learning

Great work! You've completed this review. Choose the next resource that best matches how confident you feel.

 I'm Still Unsure Review the key ideas and examples again. Review Again →	 I Need More Practice Continue with additional practice for this topic. Go to Practice →	 I'm Ready Continue to the next recommended resource. Continue →
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RECOMMENDED LINKS

[Review this topic again →](#)[Find additional practice →](#)[Choose another type of physics help →](#)

Continue reviewing with these companion resources.

[Start the Review Online →](#)[Watch the Video Review →](#)

PHYSICS HELP THAT MAKES SENSE

A Physics Sensei review never ends at the last question. It always guides you toward the next useful step.

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