

FULL REVIEW

Full Review — Two-Dimensional Kinematics with Components — Foundational

Review the essential ideas, relationships, and problem-solving tools for Two-Dimensional Kinematics with Components.

 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 [Motion in Two Dimensions here →](#)

RESOURCE: Physics Sensei Topic Review
TOPIC ID: MEC-U04-T01
TOPIC: Two-Dimensional Kinematics with Components
PARENT UNIT: MEC-U04 — Motion in Two Dimensions
COURSE LEVEL: Foundational

BEST USED

- ✓ After learning the topic
- ✓ Before starting homework
- ✓ Before a quiz or exam

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.

A displacement is $\langle 4, 3 \rangle$ m. What does each component represent?

ACTIVITY 2**Recall Activity 2**

Answer before revealing the response.

Why is the magnitude of $\langle 3, 4 \rangle$ m not 7 m?

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Recall Activity 3

Answer before revealing the response.

A point has constant component velocities 2 m/s horizontally and -1 m/s vertically. What component displacement occurs in 5 s ?

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**Vectors as component pairs**

Two-dimensional kinematics keeps vector information organized by resolving quantities along perpendicular axes. A position can be represented by $\langle x, y \rangle$, and changes in position, velocity, and acceleration can be represented the same way. Signs indicate direction relative to the chosen positive axes.

$$\Delta \mathbf{r} = \langle \Delta x, \Delta y \rangle$$

EXAMPLE Moving 4 m east and 3 m north gives $\Delta \mathbf{r} = \langle 4, 3 \rangle$ m.

SENSEI NOTE Choose and state positive directions before assigning signs.

KEY CONCEPT 2**Independent evolution along each axis**

The x- and y-components of one motion are analyzed separately over the same time. If a component velocity is constant, its displacement along that axis is that component velocity multiplied by time. If a component changes, only that axis needs the corresponding acceleration information.

$$\text{average velocity} = \langle \Delta x / \Delta t, \Delta y / \Delta t \rangle$$

EXAMPLE A displacement $\langle 10, -4 \rangle$ m over 2 s gives average velocity $\langle 5, -2 \rangle$ m/s.

SENSEI NOTE Do not use a different elapsed time for the two axes of the same motion.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Recombining the components

After solving component changes, interpret the ordered pair as one vector. The overall magnitude comes from right-triangle geometry, while the signs and relative component sizes determine the direction.

$$|\Delta \mathbf{r}| = \sqrt{[(\Delta x)^2 + (\Delta y)^2]}$$

EXAMPLE For $\Delta \mathbf{r} = \langle 6, 8 \rangle$ m, the magnitude is 10 m.

SENSEI NOTE Magnitude is nonnegative; direction information remains in the component signs.

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**

Follow the component changes for the full time interval.

A cart moves with constant component velocities 3 m/s east and 2 m/s north for 4 s. Find its displacement components and magnitude.

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

Use signed component changes and explain the result.

A drone starts at $\langle 2, 1 \rangle$ m and ends at $\langle -4, 7 \rangle$ m. Find its displacement components.

PRACTICE 3

Independent Problem

Solve the components first, then find the magnitude.

A point changes position by 9 m east and 12 m south. Find the displacement components and magnitude.

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 signs

Use east as $+x$ and north as $+y$.

Write the displacement for 5 m west and 3 m south.

QUICK CHECK 2

Average velocity components

Divide each component displacement by the same time.

An object changes position by $\langle 8, 6 \rangle$ m in 2 s. Find its average velocity components.

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Vector magnitude

Use the component magnitude relationship.

Find the magnitude of a displacement $\langle 5, 12 \rangle$ m.

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**Components preserve direction**

Ordered pairs keep perpendicular direction information visible through component values and signs.

KEY TAKEAWAY 2**The axes share the same clock**

Analyze x and y separately, but use the same time interval for one physical motion.

KEY TAKEAWAY 3**Recombine only after solving components**

Once component results are known, use geometry to find magnitude or infer the overall direction.

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. Compare your approach with the concise reasoning below.

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

The first number is horizontal change; the second is vertical change.

WHY IT WORKS The ordered pair assigns the change along each chosen axis.

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

Because the components are perpendicular, the vector magnitude follows right-triangle geometry, not scalar addition.

WHY IT WORKS Perpendicular components form the legs of a right triangle.

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

$\Delta x = 10 \text{ m}$ and $\Delta y = -5 \text{ m}$.

WHY IT WORKS Each constant component velocity acts over the same 5 s.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Worked Example**

$\Delta x = 12 \text{ m}$, $\Delta y = 8 \text{ m}$, and $|\Delta r| = \sqrt{(12^2 + 8^2)} \approx 14.4 \text{ m}$.

WHY IT WORKS Solve the two axis displacements first, then apply the magnitude formula.

PRACTICE 2**Guided Problem**

$\Delta r = \langle -6, 6 \rangle \text{ m}$.

WHY IT WORKS Final minus initial position gives each signed component.

PRACTICE 3**Independent Problem**

$\Delta r = \langle 9, -12 \rangle \text{ m}$ and $|\Delta r| = 15 \text{ m}$.

WHY IT WORKS South is negative y; 9-12-15 is a right triangle.

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Component signs

$\langle -5, -3 \rangle$ m.

WHY IT WORKS West and south are negative component directions.

QUICK CHECK 2

Average velocity components

Average velocity = $\langle 4, 3 \rangle$ m/s.

WHY IT WORKS Divide both component displacements by the same 2 s interval.

QUICK CHECK 3

Vector magnitude

$|\Delta r| = 13$ m.

WHY IT WORKS $\sqrt{(5^2 + 12^2)} = 13$.

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.

PhysicsSensei.com