FOCUSED REVIEW

Focused Review: Motion in Two Dimensions

Reinforce high-leverage vector components, projectile motion, and relative-velocity skills.

TIME	BEST FOR	FINISH WITH
15–20 minutes	Focused review	Greater confidence

After this focused review, you'll be able to…

use the core constant-acceleration relationships, interpret motion graphs, and confirm readiness for the next study task.

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 15–20 minutes

FR-02 • UNIT ALIGNMENT

Unit Alignment

This bundle is aligned to the approved Physics Sensei unit specification below. Use it to recover the unit structure, reinforce key decisions, and confirm readiness for the next study task.

ARCHITECTURE: Physics Sensei Independent Mechanics UNIT: MEC-U03 — Motion in Two Dimensions SCOPE: Unit Review PHYSICS LEVEL: Algebra-Based	BEST USED ✓ Before homework on two-dimensional kinematics ✓ Before a quiz or exam ✓ When components, launch angles, or relative velocity feel uncertain

Review Prerequisites →

Physics Sensei is an independent educational resource. This review is independently authored and organized under the approved Physics Sensei mechanics architecture.

FR-03 • YOUR REVIEW PLAN

Your Review Plan

Complete these six focused stages in order. Each stage reinforces your understanding and prepares you for a final confidence check.

6 stages • Approximately 15–20 minutes

1 **Warm-Up Check — page 4** Refresh key ideas.	2 **Core Concepts — page 6** Reinforce the essentials.	3 **Guided Practice — page 7** Strengthen key skills.
4 **Confidence Check — page 8** Confirm your understanding.	5 **Summary — page 10** Remember the essentials.	6 **Next Step — page 14** Choose your next step.

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 minute to reactivate what you already know. This quick warm-up will help you focus on the most important ideas before moving on.

WARM-UP 1

Recall Activity 1

Use vector displacement to calculate average velocity.

A drone moves 12 m east and 5.0 m north in 4.0 s. Find the magnitude and direction of its average velocity.

WARM-UP 2

Recall Activity 2

Subtract velocity vectors component by component.

Velocity changes from ⟨8.0,2.0⟩ m/s to ⟨2.0,8.0⟩ m/s in 3.0 s. Find average acceleration.

FR-04 • WARM-UP CHECK CONTINUED

WARM-UP 3

Recall Activity 3

Use independent horizontal and vertical equations.

A ball launches horizontally at 10.0 m/s from a 19.6 m ledge. Find flight time and range.

Ready to strengthen your understanding?

You've refreshed the most important ideas. Now reinforce the concepts you'll use most often.

Continue to Core Concepts — page 6 →

FR-05 • STAGE 2 OF 6

Core Concepts

Let's reinforce the most important concepts you'll need to solve problems with confidence. Focus on the ideas that appear most often in homework, quizzes, and exams.

KEY CONCEPT 1

Vectors, components, velocity, and acceleration

Choose x and y axes first. Resolve vectors into components, analyze components independently, then recombine them for magnitude and direction.

$$\Sigma F_x = 0 \quad \bullet \quad \Sigma F_y = 0$$

EXAMPLE $\Delta x = x_f - x_i$; $v_{avg} = \Delta x/\Delta t$. Example: from $x = +3$ m to $x = -9$ m in 4 s, $\Delta x = -12$ m and $v_{avg} = -3$ m/s.

SENSEI NOTE Component signs describe axis directions; vector magnitudes are nonnegative.

KEY CONCEPT 2

Constant acceleration applies component by component

Apply constant-acceleration equations separately to x and y. One shared time connects the component motions.

$$\Sigma \tau_O = 0 \quad \bullet \quad \tau = Fd_\perp$$

EXAMPLE $x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$ and $y = y_0 + v_{0y}t + \frac{1}{2}a_y t^2$. For projectiles, $a_x = 0$ and $a_y = -g$.

SENSEI NOTE Do not assign separate times to the horizontal and vertical parts of one motion.

Ready to apply these ideas?

You've reinforced the essential concepts. Now strengthen your problem-solving skills by working through a few guided examples.

Continue to Guided Practice — page 7 →

FR-06 • STAGE 3 OF 6

Guided Practice

Now apply the key concepts you've just reviewed. Work through these focused practice activities to reinforce your problem-solving skills before the final confidence check.

PRACTICE 1

Worked Example

Resolve the launch velocity, then use the shared flight time.

A projectile launches at 20.0 m/s, 30.0° above horizontal from level ground. Find flight time, maximum height, and range.

PRACTICE 2

Guided Problem

Add perpendicular relative-velocity vectors.

A boat moves north at 4.0 m/s relative to water while the river flows east at 3.0 m/s. Find velocity relative to shore.

Ready for a confidence check?

You've reinforced the essential skills through focused practice. Now confirm your understanding with two short questions.

Continue to Confidence Check — page 8 →

FR-07 • STAGE 4 OF 6

Confidence Check

You've reinforced the key concepts and practiced the essential skills. Now confirm you're ready to move forward by completing these short confidence checks.

CONFIDENCE CHECK 1

Identify the constant component

Use the acceleration components.

Which velocity component stays constant in ideal projectile motion, and why?

CONFIDENCE CHECK 2

Recombine components

Use magnitude and direction.

A vector has components ⟨6.0,8.0⟩ m. Find magnitude and direction above +x.

HOW DID IT GO?

I answered ____ of 2 questions correctly.

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

You've confirmed your understanding.

Take one final look at the essential ideas before choosing your next step.

Continue to Summary — page 10 →

FR-08 • STAGE 5 OF 6

Summary

Before moving on, take one final look at the essential ideas you'll want to remember.

KEY TAKEAWAY 1

Define both axes before the algebra

Resolve all vectors in one coordinate system before substituting numbers.

KEY TAKEAWAY 2

Match each component equation to the model

Use one time variable and the correct acceleration component in each axis.

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 — page 14 →

ANSWER KEY • CHECK AFTER ATTEMPTING

Solutions and Explanations

Use these solutions to check your reasoning—not only your final answer. Compare your setup, signs, units, and interpretation with the explanations below.

WARM-UP • ACTIVITY 1

Recall Activity 1

3.25 m/s at 22.6° north of east.

WHY IT WORKS $\Delta x = x_f - x_i = -7.0 - 5.0 = -12.0$ m. Then $v_{avg} = \Delta x/\Delta t = -12.0/4.0 = 3.25$ m/s at 22.6° north of east.

WARM-UP • ACTIVITY 2

Recall Activity 2

$\langle -2.0, 2.0 \rangle$ m/s².

WHY IT WORKS $a_{avg} = (v_f - v_i)/\Delta t = (6.0 - 18)/3.0 = \langle -2.0, 2.0 \rangle$ m/s². The negative sign is consistent with the positive velocity decreasing.

WARM-UP • ACTIVITY 3

Recall Activity 3

2.00 s; 20.0 m.

WHY IT WORKS $19.6 = \frac{1}{2}gt^2$ gives $t = 2.00$ s; range $= (10.0)(2.00) = 20.0$ m.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Worked Example

Time 2.04 s; height 5.10 m; range 35.3 m.

WHY IT WORKS $v_{0x}=17.3$ and $v_{0y}=10.0$ m/s. $T=2v_{0y}/g=2.04$ s, $H=v_{0y}^2/(2g)=5.10$ m, $R=v_{0x}T=35.3$ m.

PRACTICE 2

Guided Problem

5.0 m/s at 53.1° north of east.

WHY IT WORKS $\mathbf{v}_{shore}=\langle 3,4\rangle$ m/s; magnitude 5.0 m/s and angle $\tan^{-1}(4/3)=53.1°$.

SOLUTIONS • CONFIDENCE CHECK

CONFIDENCE CHECK 1

Identify the constant component

v_x; because $a_x=0$.

WHY IT WORKS Zero horizontal acceleration means the horizontal velocity component is constant.

CONFIDENCE CHECK 2

Recombine components

10.0 m at 53.1°.

WHY IT WORKS Magnitude $\sqrt{(6^2+8^2)}=10.0$ m; angle $\tan^{-1}(8/6)=53.1°$.

READINESS GUIDE

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

FR-09 • STAGE 6 OF 6

Next Step: Continue Learning

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

?	◎	✓
I'm Still Unsure	**I Need More Practice**	**I'm Ready**
Review the focused review again to strengthen the essential concepts.	Continue with additional practice for this unit.	Continue to the next recommended resource.
Review again: return to Warm-Up Check on page 4.	**Go to Practice →**	**Continue →**

RECOMMENDED LINKS

Review again: return to Warm-Up Check on page 4.

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