FULL REVIEW

Full Review: Motion in One Dimension

Review straight-line motion through physical meaning, direction, signs, motion graphs, and qualitative reasoning before relying on heavy calculation.

TIME	BEST FOR	FINISH WITH
45–60 minutes	A complete unit review	A readiness check

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

explain what position, velocity, acceleration, and motion graphs mean physically and use those ideas to predict one-dimensional motion.

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 • 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-U02 — Motion in One Dimension SCOPE: Unit Review PHYSICS LEVEL: Foundational	BEST USED ✓ Before algebra-heavy kinematics homework ✓ When graph meaning or signs feel confusing ✓ When you want to understand the physics before calculating

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 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 — page 4** Activate prior knowledge.	2 **Core Concepts — page 6** Review the essential ideas.	3 **Guided Practice — page 8** Apply what you learned.
4 **Confidence Check — page 10** Confirm your understanding.	5 **Summary — page 12** Review the key ideas.	6 **Next Step — page 16** 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

Separate path length from net change in position.

A student walks from x = 2 m to x = 8 m, then back to x = 5 m. What are the displacement and the total distance traveled?

ACTIVITY 2

Recall Activity 2

Compare the signs of velocity and acceleration.

A car is moving to the right but slowing down. If +x points right, what are the signs of velocity and acceleration?

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Recall Activity 3

Translate graph slope into a physical statement.

What does a horizontal tangent on a position–time graph mean at that instant?

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 — page 6 →

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

Position and displacement tell where you are and how your position changed

Position is measured relative to a chosen origin. Displacement is the signed change from initial to final position. Distance is the total path length and is never negative.

$$\Delta x = x_2 - x_1 \quad \cdot \quad v\_avg = \Delta x/\Delta t$$

EXAMPLE Δx = x_f – x_i. Example: moving from x = –2 m to x = +4 m gives Δx = +6 m, even if the path traveled was longer than 6 m.

SENSEI NOTE Always define the positive direction before interpreting a sign.

KEY CONCEPT 2

Velocity and acceleration describe different features of motion

Velocity tells how position changes and includes direction. Acceleration tells how velocity changes. An object speeds up when velocity and acceleration have the same sign and slows down when they have opposite signs.

$$v = v_0 + at \quad \cdot \quad \Delta x = v_0 t + \tfrac{1}{2}at^2$$

EXAMPLE a_avg = Δv/Δt. Example: a cart moving left has v < 0. If it slows while moving left, acceleration points right, so a > 0.

SENSEI NOTE Negative acceleration does not automatically mean slowing down. Compare the signs of velocity and acceleration.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Motion graphs connect position, velocity, and acceleration

The slope of a position–time graph tells velocity. The slope of a velocity–time graph tells acceleration. The signed area under a velocity–time graph tells displacement.

slope(x–t) → v • slope(v–t) → a • area(v–t) → Δx

EXAMPLE slope(x–t) → v; slope(v–t) → a; area under v–t → Δx. A horizontal v–t line above zero represents constant positive velocity.

SENSEI NOTE A graph's height, slope, and area answer different questions. Read the axes before interpreting it.

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 — page 8 →

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

Read a motion story in pieces and combine the signed displacements.

A walker moves at +2 m/s for 4 s, rests for 2 s, then moves at −1 m/s for 3 s. Find the net displacement and describe the motion.

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

Use the turning point to distinguish zero velocity from zero acceleration.

A ball is thrown straight upward. At the highest point, what are its velocity and acceleration if +y is upward?

PRACTICE 3

Independent Problem

Connect constant acceleration to the shape of a velocity–time graph.

A cyclist moves at 4 m/s and speeds up uniformly at 2 m/s² for 3 s. What is the final velocity, and what does the v–t graph look like?

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 — page 10 →

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

Speeding up or slowing down?

Compare the signs of v and a.

An object has $v = -6$ m/s and $a = +2$ m/s². Is it speeding up or slowing down?

QUICK CHECK 2

Read the shape of x(t)

Use the sign of the slope and how the slope changes.

An x–t graph rises and becomes progressively steeper. What are the signs of velocity and acceleration?

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Use signed area

Multiply the constant velocity by the elapsed time.

A v–t graph stays at –3 m/s for 4 s. What displacement occurs?

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 — page 12 →

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

Signs describe direction

Define the positive axis first; then let the signs of position, velocity, and acceleration carry physical meaning.

KEY TAKEAWAY 2

Velocity and acceleration are not the same thing

Velocity describes how position changes; acceleration describes how velocity changes.

KEY TAKEAWAY 3

Graphs tell the same motion story in different ways

Use slope and signed area to connect position, velocity, and acceleration.

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 16 →

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 m displacement; 9 m distance.

WHY IT WORKS Displacement uses final minus initial position: 5 – 2 = +3 m. Distance adds the path lengths: 6 m + 3 m = 9 m.

WARM-UP • ACTIVITY 2

Recall Activity 2

$v > 0$ and $a < 0$.

WHY IT WORKS The car moves in +x, so velocity is positive. Because its positive velocity is decreasing, acceleration points in the opposite direction.

WARM-UP • ACTIVITY 3

Recall Activity 3

The instantaneous velocity is zero.

WHY IT WORKS Velocity is represented by the slope of the position–time graph. A horizontal tangent has zero slope.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Worked Example

Net displacement = +5 m.

WHY IT WORKS The three displacements are +8 m, 0 m, and –3 m. Their signed sum is +5 m. The walker moves in +x, pauses, then returns partway.

PRACTICE 2

Guided Problem

v = 0 for an instant; a = –g.

WHY IT WORKS The ball momentarily stops changing position upward before reversing, but gravity continues to act downward the entire time.

PRACTICE 3

Independent Problem

Final velocity = 10 m/s; the v–t graph is a straight rising line.

WHY IT WORKS Constant positive acceleration means velocity increases by the same amount each second: 4 → 6 → 8 → 10 m/s.

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Speeding up or slowing down?

It is slowing down.

WHY IT WORKS Velocity and acceleration have opposite signs, so the magnitude of velocity decreases.

QUICK CHECK 2

Read the shape of x(t)

$v > 0$ and $a > 0$.

WHY IT WORKS The positive slope gives positive velocity. Because the slope becomes more positive, velocity is increasing, so acceleration is positive.

QUICK CHECK 3

Use signed area

–12 m.

WHY IT WORKS Signed area under v(t) is $v\Delta t = (-3)(4) = -12$ m.

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	**I Need More Practice**	**I'm Ready**
Review the key ideas and examples again.	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