

QUICK REVIEW

Quick Review: Newton's Laws and Free-Body Diagrams

Express Newton's laws as vector differential equations and use integration or differential-equation models when forces vary with time, position, or velocity.

 TIME 5–10 minutes	 BEST FOR A rapid unit refresh	 FINISH WITH Key ideas refreshed
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After this quick review, you'll be able to...

move fluently between free-body diagrams, vector differential equations, impulse, and variable-force motion models while preserving the physical meaning of every force.

HOW TO USE THIS GUIDE

Work through the four stages in order. Write directly in the spaces provided, check your work in the Quick Answers 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 5–10 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-U05 — Newton's Laws and Free-Body Diagrams SCOPE: Unit Review PHYSICS LEVEL: Calculus-Based	BEST USED ✓ Before calculus-based dynamics homework ✓ When forces vary with time or velocity ✓ When you need to connect FBDs to differential equations
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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 four stages to quickly refresh the essential ideas and confirm you're ready to continue.

4 stages • Approximately 5–10 minutes

1 Quick Recall — page 4 Refresh what you already know.	2 Essential Idea — page 5 Review the most important concept.
3 Confidence Check — page 6 Confirm you're ready to move on.	4 Next Step — page 8 Continue your learning.

PRINTING TIP

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

FR-04 • STAGE 1 OF 4

Quick Recall

Let's quickly refresh what you already know. This short recall activity will bring the most important ideas back to mind before you review them.

QUICK RECALL

Recall Activity

Recognize what an ODE solution needs.

After a free-body diagram gives $m \, dv/dt = F(t)$, what additional information is needed to determine a unique velocity function?

Ready to refresh the essentials?

Great! Now review the most important idea you'll want to remember.

Continue to Essential Idea — page 5 →

FR-05 • STAGE 2 OF 4

Essential Idea

Take one last look at the most important concept from this unit. If you remember this idea, the rest will come back much more easily.

ESSENTIAL IDEA

Integrals connect force, momentum, velocity, and position

Integrating net force over time gives impulse and momentum change. Integrating acceleration gives velocity; integrating velocity gives position, with constants fixed by initial conditions.

$$\Sigma F_{\text{ext}} = dp/dt$$

EXAMPLE $J = \int \Sigma F dt = \Delta p$. For constant mass, $\Delta v = (1/m) \int \Sigma F dt$.

SENSEI NOTE An integral is not decorative calculus; it is required when the force or acceleration varies over the interval.

Ready to check your memory?

You've refreshed the essential idea. Now see how much you remember before moving on.

[Continue to Confidence Check — page 6 →](#)

FR-06 • STAGE 3 OF 4

Confidence Check

You've refreshed the essential idea. Now answer this quick confidence check to confirm you're ready to move on.

CONFIDENCE CHECK

Momentum form

Identify the general law.

What is the most general compact form of Newton's second law for a particle system with momentum p ?

Ready for your next step?

Great work! You've refreshed the essential idea. Now choose the resource that best matches what you'd like to do next.

Continue to Next Step — page 8 →

QUICK ANSWERS • CHECK AFTER ATTEMPTING

Quick Answers and Explanations

Use these concise answers to check your recall and confidence—not only your final response.

QUICK RECALL**Recall Activity**

An initial velocity (or another equivalent velocity condition).

WHY IT WORKS Integrating acceleration introduces a constant of integration that is fixed by the initial condition.

CONFIDENCE CHECK**CONFIDENCE CHECK****Momentum form**

$\Sigma F_{\text{ext}} = dp/dt$.

WHY IT WORKS The momentum form remains the fundamental statement; $m dv/dt$ follows for constant mass.

READINESS GUIDE

1 correct: You're ready to continue. • 0 correct: Revisit the Essential Idea or choose more practice.

FR-07 • STAGE 4 OF 4

Next Step: Continue Learning

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

? I'm Still Unsure Review the essential idea again. Review again: return to Essential Idea on page 5.	🕒 I Need More Practice Continue with additional practice for this unit. Go to Practice →	✓ I'm Ready Continue to the next recommended resource. Continue →
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RECOMMENDED LINKS

Review again: return to Essential Idea on page 5.

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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