

## FULL REVIEW

# Full Review — Newton's Laws of Motion — Algebra-Based

Review the essential ideas, relationships, and problem-solving tools for Newton's Laws of Motion.

|                                                                                                                   |                                                                                                                                 |                                                                                                                                |
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| <br><b>TIME</b><br>45–60 minutes | <br><b>BEST FOR</b><br>A complete topic review | <br><b>FINISH WITH</b><br>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 Newton's Laws and Free-Body Diagrams here → <https://physicssensei.com/full-unit-review-newtons-laws-and-free-body-diagrams-algebra-based/>

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| RESOURCE: Physics Sensei Topic Review<br>TOPIC ID: MEC-U05-T01<br>TOPIC: Newton's Laws of Motion<br>PARENT UNIT: MEC-U05 — Newton's Laws and Free-Body Diagrams<br>COURSE LEVEL: Algebra-Based | BEST USED<br>✓ After learning the topic<br>✓ Before starting homework<br>✓ Before a quiz or exam |
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**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

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

*Write the condition for translational equilibrium and state what it means for acceleration.*

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**ACTIVITY 2****Recall Activity 2**

Answer before revealing the response.

A 5 kg object has forces of 20 N right and 20 N left. Find its acceleration.

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## FR-04 • WARM-UP CHECK CONTINUED

## ACTIVITY 3

**Recall Activity 3**

Answer before revealing the response.

*A hand pushes a box. Name the Newton's third-law partner to the force of the hand on the box.*

**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****Newton's First Law and Inertia**

Newton's first law is the equilibrium condition: when the vector sum of external forces is zero, acceleration is zero and velocity remains constant. A free-body diagram helps distinguish zero net force from zero individual forces.

$$\Sigma \mathbf{F} = 0 \rightarrow \mathbf{a} = 0$$

EXAMPLE Check the net force on one chosen object before deciding how its motion changes.

SENSEI NOTE Constant velocity means zero acceleration; it does not require the object to be at rest.

**KEY CONCEPT 2****Newton's Second Law: Net Force and Motion**

Newton's second law is applied component by component. Choose axes, resolve forces, compute the net force in each direction, and use the mass to determine acceleration. The net-force vector and acceleration vector point in the same direction.

$$\Sigma \mathbf{F} = m \mathbf{a}$$

EXAMPLE Use object labels on interaction forces so third-law partners stay on different free-body diagrams.

SENSEI NOTE Do not pair weight and normal force as a third-law pair; both can act on the same object.

## FR-05 • CORE CONCEPTS CONTINUED

## KEY CONCEPT 3

**Newton's Third Law: Interaction Pairs**

Newton's third law requires explicit object labels. The force of A on B and the force of B on A are equal in magnitude and opposite in direction. They do not cancel because each belongs to a different object's free-body diagram.

$$\mathbf{F}_{A \rightarrow B} = -\mathbf{F}_{B \rightarrow A}$$

EXAMPLE Compare force direction with acceleration or momentum-change direction.

SENSEI NOTE Equal third-law forces can produce different accelerations when masses differ.

**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 model solution and identify the law used.

*A 12 kg box is pulled right by 70 N and experiences 22 N friction left. Find the net force and acceleration.*

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## FR-06 • GUIDED PRACTICE CONTINUED

## PRACTICE 2

**Guided Problem**

Use the checkpoints, then complete the calculation or explanation.

*A 5.0 kg hanging object has weight 49 N downward and tension 34 N upward. Find its acceleration.*

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## PRACTICE 3

**Independent Problem**

Solve independently and state the Newton's-law reasoning.

*A 75 kg person and a 50 kg person push apart with a 150 N interaction force. Find each acceleration magnitude and state why the forces are a third-law pair.*

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**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

#### Newton's Laws Check 1

Solve and justify your conclusion.

*A 4.0 kg cart has 26 N right and 10 N left. Find its acceleration.*

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### QUICK CHECK 2

#### Newton's Laws Check 2

Solve and justify your conclusion.

*A 2.0 kg object accelerates downward at  $3.0 \text{ m/s}^2$ . Find the net force magnitude and direction.*

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## FR-07 • CONFIDENCE CHECK CONTINUED

## QUICK CHECK 3

**Newton's Laws Check 3**

Solve and justify your conclusion.

*If A exerts 80 N east on B, what force does B exert on A?*

## 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

**Zero net force means no change in velocity.**

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### KEY TAKEAWAY 2

**Net external force determines acceleration or momentum change.**

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### KEY TAKEAWAY 3

**Third-law forces are equal/opposite and act on different objects.**

Third-law forces are equal/opposite and act on different objects.

### 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. Replace each placeholder with a concise answer and the essential explanation.

## WARM-UP • ACTIVITY 1

**Recall Activity 1**

$\Sigma \mathbf{F} = 0$ , so  $\mathbf{a} = 0$ .

WHY IT WORKS The result follows by isolating one object and applying the net-force rule or the correct interaction pair.

## WARM-UP • ACTIVITY 2

**Recall Activity 2**

The forces cancel:  $F_{\text{net}} = 0$ , so  $\mathbf{a} = 0$ .

WHY IT WORKS The result follows by isolating one object and applying the net-force rule or the correct interaction pair.

## WARM-UP • ACTIVITY 3

**Recall Activity 3**

The box exerts an equal-magnitude, opposite-direction force on the hand.

WHY IT WORKS The result follows by isolating one object and applying the net-force rule or the correct interaction pair.

## SOLUTIONS • GUIDED PRACTICE

## PRACTICE 1

**Worked Example**

$$F_{\text{net}} = 70 - 22 = 48 \text{ N right}; a = 48/12 = 4.0 \text{ m/s}^2 \text{ right.}$$

WHY IT WORKS The result follows by isolating one object and applying the net-force rule or the correct interaction pair.

## PRACTICE 2

**Guided Problem**

$$F_{\text{net}} = 49 - 34 = 15 \text{ N downward}; a = 15/5.0 = 3.0 \text{ m/s}^2 \text{ downward.}$$

WHY IT WORKS The result follows by isolating one object and applying the net-force rule or the correct interaction pair.

## PRACTICE 3

**Independent Problem**

Each force has magnitude 150 N. Accelerations are  $2.0 \text{ m/s}^2$  and  $3.0 \text{ m/s}^2$ . The forces are equal/opposite and act on different people.

WHY IT WORKS The result follows by isolating one object and applying the net-force rule or the correct interaction pair.

## SOLUTIONS • CONFIDENCE CHECK

## QUICK CHECK 1

**Newton's Laws Check 1** $F_{\text{net}} = 16 \text{ N right}; a = 4.0 \text{ m/s}^2 \text{ right.}$ 

WHY IT WORKS The result follows by isolating one object and applying the net-force rule or the correct interaction pair.

## QUICK CHECK 2

**Newton's Laws Check 2** $F_{\text{net}} = ma = 6.0 \text{ N downward.}$ 

WHY IT WORKS The result follows by isolating one object and applying the net-force rule or the correct interaction pair.

## QUICK CHECK 3

**Newton's Laws Check 3**

80 N west on A.

WHY IT WORKS The result follows by isolating one object and applying the net-force rule or the correct interaction pair.

## 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.

|                                                                                                                                                                                            |                                                                                                                                                                                                           |                                                                                                                                                                                     |
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| <br><b>I'm Still Unsure</b><br>Review the key ideas and examples again.<br><a href="#">Review Again →</a> | <br><b>I Need More Practice</b><br>Continue with additional practice for this topic.<br><a href="#">Go to Practice →</a> | <br><b>I'm Ready</b><br>Continue to the next recommended resource.<br><a href="#">Continue →</a> |
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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**