QUICK REVIEW

Quick Review: Rotational Motion — Calculus-Based

5-minute calculus-based review of rotational motion, emphasizing calculus-based rotational kinematics, distributed inertia, torque, work, and angular momentum modeling.

◷	◎	✓
TIME	**BEST FOR**	**FINISH WITH**
5 minutes	Quick Review	Greater confidence

After this review, you'll be able to…

use derivatives and integrals with rotational kinematics, moment of inertia, torque, work, and angular momentum while maintaining consistent axis and sign conventions.

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 minutes

QR-02 • UNIT ALIGNMENT

Unit Alignment

This Physics Sensei Unit Review covers MEC-U08 — Rotational Motion using the Calculus-Based treatment. Use it to reinforce the unit, prepare for homework, or review before a quiz or exam.

UNIT ID: MEC-U08 **UNIT: Rotational Motion** **TREATMENT: Calculus-Based** **RESOURCE: Unit Review**	**BEST USED** ✓ After reading the chapter ✓ Before starting homework ✓ Before a quiz or exam

Explore Rotational Motion Online →

Physics Sensei Unit Reviews use independent organization, wording, examples, and explanations.

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 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

Complete these statements from memory before revealing the answer.

1) ω is dθ/dt and α is dω/dt. 2) Distributed rotational inertia is $I = \int r^2\, dm$. 3) Net external torque equals the time rate of change of angular momentum.

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 topic. If you remember this idea, the rest will come back much more easily.

ESSENTIAL IDEA

Differentiate motion; integrate distribution

Calculus-based rotation uses derivatives for instantaneous angular rates and integrals for distributed mass and variable torque. Keep the chosen axis fixed throughout a calculation. Use $\tau = dL/dt$ generally, and use $\Sigma\tau = I\alpha$ when a rigid body rotates about a fixed axis with constant I.

$$\omega = d\theta/dt;\ \alpha = d\omega/dt;\ I = \int r^2\, dm;\ W = \int \tau\, d\theta;\ \Sigma\tau_{ext} = dL/dt.$$

EXAMPLE If $\theta(t) = 2t + t^3$, then $\omega = 2 + 3t^2$ and $\alpha = 6t$.

SENSEI NOTE Do not use $\Sigma\tau = I\alpha$ with an I from a different axis, and do not treat I as constant when mass distribution changes.

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

Five-Minute Readiness Check

Answer without notes.

(1) If $\omega(t)=2+3t^2$, what is α at $t=2$ s? (2) Which integral defines I for a continuous body? (3) What condition allows total angular momentum to remain constant?

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

1) ω is dθ/dt and α is dω/dt. 2) Distributed rotational inertia is $I = \int r^2\, dm$. 3) Net external torque equals the time rate of change of angular momentum.

WHY IT WORKS The recall targets axis choice, angular-versus-tangential quantities, torque, and conservation conditions.

CONFIDENCE CHECK

CONFIDENCE CHECK

Five-Minute Readiness Check

(1) 12 rad/s². (2) $I = \int r^2\, dm$. (3) Negligible net external torque about the chosen origin or axis.

WHY IT WORKS These are the central calculus links among θ, ω, α, mass distribution, torque, and angular momentum.

READINESS GUIDE

3 correct: You're ready to continue. • 2 correct: Review the missed idea. • 0–1 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	**I Need More Practice**	**I'm Ready**
Review the essential idea again.	Continue with additional practice for this topic.	Continue to the next recommended resource.
Review again: return to Essential Idea on page 5.	**Go to Practice →**	**Continue →**

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.

PhysicsSensei.com