QUICK REVIEW

Quick Review: Torque and Rotational Dynamics — Calculus-Based

Refresh the most important calculus-based ideas, formulas, and problem-solving strategies for Torque and Rotational Dynamics in just a few minutes.

◷	◎	✓
TIME	**BEST FOR**	**FINISH WITH**
5 minutes	A rapid refresh	Key ideas refreshed

> **After this quick review, you'll be able to…**
> quickly recall the essential concepts, formulas, and problem-solving strategies needed to move forward with confidence.

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

FR-02 • COURSE ALIGNMENT

Course Alignment

This Physics Sensei Unit Review is an independent learning resource. Use it to reinforce key concepts, prepare for homework, or review before a quiz or exam.

RESOURCE: Physics Sensei Unit Review **UNIT ID: MEC-U20** **TOPIC: Torque and Rotational Dynamics** **COURSE LEVEL: Calculus-Based**	**BEST USED** ✓ **After learning the unit** ✓ **Before starting homework** ✓ **Before a quiz or exam**

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** Refresh what you already know.	2 **Essential Idea** Review the most important concept.
3 **Confidence Check** Confirm you're ready to move on.	4 **Next Step** 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

Vector Torque and Rotational Dynamics

Refresh the vector and calculus relationships behind rigid-body rotation.

Recall: $\vec{\tau} = \vec{r} \times \vec{F}$, $|\tau| = rF\sin\theta$, and $\sum \tau = I\alpha$ for fixed-axis rotation. For a continuous body, $I = \int r^2\, dm$. Angular acceleration is $\alpha = d\omega/dt$.

Ready to refresh the essentials?

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

Review the Essential Idea →

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

Torque Connects Force Geometry to Angular Acceleration

Torque is the cross product $\vec{\tau} = \vec{r} \times \vec{F}$. Its direction follows the right-hand rule and its magnitude is $rF\sin\theta$. For a rigid body about a fixed axis, the relevant component satisfies $\sum\tau = I\alpha$. The moment of inertia $I = \int r^2\,dm$ captures how mass distribution affects the angular response.

$$\vec{\tau} = \vec{r} \times \vec{F} \quad \bullet \quad I = \int r^2\,dm \quad \bullet \quad \sum\tau = dL/dt$$

EXAMPLE If $\vec{r}$ points +x and $\vec{F}$ points +y, $\vec{\tau}$ points +z. A 0.40 m lever arm with 10 N perpendicular force gives $|\tau| = 4.0$ N·m.

SENSEI NOTE Use the torque component about the actual rotation axis; a full vector torque may contain components irrelevant to a constrained axis.

Ready to check your memory?

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

Start the Confidence Check →

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

From Net Torque to dω/dt

Solve or explain briefly.

A rigid body has $I = 3.0\ kg{\cdot}m^2$ and constant net torque $+12\ N{\cdot}m$ about its axis. Find $\alpha = d\omega/dt$.

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.

Choose Your Next Step →

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

Vector Torque and Rotational Dynamics

$\vec{\tau} = \vec{r} \times \vec{F}$; $|\tau| = rF \sin\theta$; $\sum\tau = I\alpha$; $I = \int r^2\, dm$; $\alpha = d\omega/dt$.

WHY IT WORKS These expressions connect force, mass distribution, and the time rate of change of angular velocity.

CONFIDENCE CHECK

CONFIDENCE CHECK

From Net Torque to dω/dt

$\alpha = \sum\tau/I = 12/3.0 = 4.0\ rad/s^2$.

WHY IT WORKS For fixed-axis rigid-body rotation, the axial net torque equals I times dω/dt.

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	**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 →	**Go to Practice →**	**Continue →**

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