FOCUSED REVIEW

Focused Review: Torque and Rotational Dynamics — Algebra-Based

Review the most important algebra-based ideas, reinforce the essential skills, and confirm you're ready to move on.

◷ TIME	◎ BEST FOR	✓ FINISH WITH
15 minutes	Focused review	Greater confidence

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

recognize the key concepts, reinforce your problem-solving skills, and continue with greater confidence.

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 15 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: Algebra-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 six focused stages in order. Each stage reinforces your understanding and prepares you for a final confidence check.

6 stages • Approximately 15–20 minutes

1 **Warm-Up Check** Refresh key ideas.	2 **Core Concepts** Reinforce the essentials.	3 **Guided Practice** Strengthen key skills.
4 **Confidence Check** Confirm your understanding.	5 **Summary** Remember the essentials.	6 **Next Step** Choose your next step.

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 minute to reactivate what you already know. This quick warm-up will help you focus on the most important ideas before moving on.

WARM-UP 1

Key Ideas

Write the equations $\tau = rF\sin\theta$ and $\sum\tau = I\alpha$. Identify the units of torque, moment of inertia, and angular acceleration.

Write your response in the space below.

WARM-UP 2

Common Mistakes

Explain the errors: using $\tau = rF$ when $\theta \neq 90°$, and adding all torque magnitudes without signs.

Write your response in the space below.

FR-04 • WARM-UP CHECK CONTINUED

WARM-UP 3

Quick Application

A 15 N force acts perpendicular to a 0.40 m lever arm. Estimate the torque before calculating it.

Write your response in the space below.

Ready to strengthen your understanding?

You've refreshed the most important ideas. Now reinforce the concepts you'll use most often.

Continue to Core Concepts →

FR-05 • STAGE 2 OF 6

Core Concepts

Let's reinforce the most important concepts you'll need to solve problems with confidence. Focus on the ideas that appear most often in homework, quizzes, and exams.

KEY CONCEPT 1

Torque Magnitude and Sign

For a force at distance r from the axis, $\tau = rF\sin\theta$. Equivalently, $\tau = Fd_\perp$ where $d_\perp$ is the perpendicular lever arm. Assign signs according to clockwise/counterclockwise rotational tendency.

$$\tau = rF\sin\theta = Fd_\perp \quad \bullet \quad \sum\tau = I\alpha$$

EXAMPLE A 12 N perpendicular force at 0.50 m gives $|\tau| = 6.0$ N·m.

SENSEI NOTE The angle θ is between r and F, not an arbitrary angle drawn in the picture.

KEY CONCEPT 2

Net Torque and Angular Acceleration

Sum all signed torques about the selected axis, then use $\sum\tau = I\alpha$. A larger moment of inertia means a smaller angular acceleration for the same net torque.

$$\tau = rF\sin\theta = Fd_\perp \quad \bullet \quad \sum\tau = I\alpha$$

EXAMPLE If $\sum\tau = 9$ N·m and $I = 3$ kg·m^2, $\alpha = 3$ rad/s^2.

SENSEI NOTE Choose an axis that simplifies unknown forces whenever the problem allows it.

Ready to apply these ideas?

You've reinforced the essential concepts. Now strengthen your problem-solving skills by working through a few guided examples.

Continue to Guided Practice →

FR-06 • STAGE 3 OF 6

Guided Practice

Now apply the key concepts you've just reviewed. Work through these focused practice activities to reinforce your problem-solving skills before the final confidence check.

PRACTICE 1

Guided Example

A 25 N force acts perpendicular to a wrench 0.20 m from the bolt. Find the torque magnitude.

Show your setup and reasoning in the space below.

PRACTICE 2

Independent Check

A wheel has $I = 4.0\ \text{kg·m}^2$. Torques of $+18$ N·m and -6 N·m act on it. Find α.

Show your setup and reasoning in the space below.

Ready for a confidence check?

You've reinforced the essential skills through focused practice. Now confirm your understanding with two short questions.

Continue to Confidence Check →

FR-07 • STAGE 4 OF 6

Confidence Check

You've reinforced the key concepts and practiced the essential skills. Now confirm you're ready to move forward by completing these short confidence checks.

CONFIDENCE CHECK 1

Angled Force

Answer without looking back.

A 10 N force is applied 0.50 m from the axis at 30° to the radius. Find the torque magnitude.

CONFIDENCE CHECK 2

Moment of Inertia Effect

Answer without looking back.

The same 12 N·m net torque acts on objects with $I = 2$ and $6\ kg \cdot m^2$. Which has the greater α?

HOW DID IT GO?

I answered ____ of 2 questions correctly.

Use the Solutions section to check your reasoning, then take one final look at the essential ideas.

You've confirmed your understanding.

Take one final look at the essential ideas before choosing your next step.

Continue to Summary →

FR-08 • STAGE 5 OF 6

Summary

Before moving on, take one final look at the essential ideas you'll want to remember.

KEY TAKEAWAY 1

Torque: $\tau = rF \sin\theta$

Use the force geometry correctly; the perpendicular component is what produces rotation.

KEY TAKEAWAY 2

Dynamics: $\Sigma\tau = I\alpha$

Add signed torques first, then connect the net torque to angular 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 →

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

Key Ideas

Torque/rotation relationships recalled correctly. Use the unit's core definitions and equations appropriate to this treatment.

WHY IT WORKS These are the minimum ideas needed for the rest of the review.

WARM-UP • ACTIVITY 2

Common Mistakes

Correct the misconception by checking force geometry, torque sign, and the chosen rotation axis.

WHY IT WORKS Most rotational-dynamics errors begin in the setup, before any arithmetic.

WARM-UP • ACTIVITY 3

Quick Application

$\tau = rF = (0.20\ \text{m})(25\ \text{N}) = 5.0\ \text{N·m}$.

WHY IT WORKS The torque definition determines the rotational effectiveness of the force.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Guided Example

$\tau = rF = (0.20\ \text{m})(25\ \text{N}) = 5.0\ \text{N·m}$.

WHY IT WORKS The solution applies the current Unit 20 torque/rotational-dynamics relationships consistently.

PRACTICE 2

Independent Check

$\sum\tau = 18 - 6 = 12\ \text{N·m}$. Then $\alpha = 12/4.0 = 3.0\ \text{rad/s}^2$ in the positive rotational direction.

WHY IT WORKS The solution applies the current Unit 20 torque/rotational-dynamics relationships consistently.

SOLUTIONS • CONFIDENCE CHECK

CONFIDENCE CHECK 1

Angled Force

$\tau = rF\sin\theta = (0.50)(10)\sin30° = 2.5$ N·m.

WHY IT WORKS Only the component perpendicular to the radius contributes to torque.

CONFIDENCE CHECK 2

Moment of Inertia Effect

The $I = 2$ kg·m^2 object: $\alpha = 6$ rad/s^2 versus 2 rad/s^2.

WHY IT WORKS From $\alpha = \sum\tau/I$, angular acceleration is inversely proportional to I for fixed torque.

READINESS GUIDE

2 correct: You're ready to continue. • 1 correct: Review the missed idea, then continue. • 0 correct: Revisit Core Concepts or choose more practice.

FR-09 • STAGE 6 OF 6

Next Step: Continue Learning

Great work! You've completed this focused 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 focused review again to strengthen the essential concepts.	Build confidence with additional practice problems.	Continue to the next topic or learning 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