FOCUSED REVIEW

Focused Review: Uniform Circular Motion — Calculus-Based

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

TIME	BEST FOR	FINISH WITH
15–20 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 15–20 minutes

FR-02 • TOPIC ALIGNMENT

Topic Alignment

This bundle is aligned to the approved Physics Sensei topic specification below. Use it to recover the topic structure, reinforce key decisions, and confirm readiness for the next study task.

TEXTBOOK: Independent Physics Sensei Unit Review **CHAPTER: Mechanics • MEC-U16** **TOPIC: Uniform Circular Motion** **COURSE LEVEL: Calculus-Based**	**BEST USED** ✓ **After learning the unit** ✓ **Before starting homework** ✓ **Before a quiz or exam**

Review Prerequisites →

Physics Sensei is an independent educational resource designed to complement independently authored Physics Sensei materials. Physics Sensei content is independently authored and organized under the approved topic architecture.

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 — page 4** Refresh key ideas.	2 **Core Concepts — page 6** Reinforce the essentials.	3 **Guided Practice — page 7** Strengthen key skills.
4 **Confidence Check — page 8** Confirm your understanding.	5 **Summary — page 10** Remember the essentials.	6 **Next Step — page 14** 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

Recall the tangent-versus-inward rule.

For circular motion, what geometric relationship holds between r and v?

WARM-UP 2

Common Mistakes

Check the inward-acceleration model.

Complete a=−(?)r for UCM.

FR-04 • WARM-UP CHECK CONTINUED

WARM-UP 3

Quick Application

Identify the force model.

Write Newton's second law for UCM in radial vector form.

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 — page 6 →

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

Circular relationships and inward acceleration

Differentiate the parametric circular position to obtain tangent velocity and a second derivative $a=-\omega^2 r$.

$$r(t)=r\cos(\omega t)i+r\sin(\omega t)j;\ a(t)=-\omega^2 r(t).$$

EXAMPLE The second derivative is proportional to the negative radial position function.

SENSEI NOTE Constant speed does not mean zero acceleration; acceleration responds to changes in the full velocity vector, including direction.

KEY CONCEPT 2

Radial force modeling

Use $\Sigma F=-m\omega^2 r$ in the radial direction and combine with other component equations as needed.

$$\Sigma F=-m\omega^2 r.$$

EXAMPLE With outward radial direction positive, the required friction vector is –3600 N radially.

SENSEI NOTE "Centripetal" describes the net inward requirement; it does not identify a separate interaction.

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 — page 7 →

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

Connect the circular-motion quantities and check direction.

For the same motion, use $\omega=2\pi/T$ and $a_c=\omega^2 r$.

PRACTICE 2

Independent Check

Draw actual forces, then apply the radial equation.

Write the required friction force using outward radial direction as positive.

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 — page 8 →

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

Direction and scaling readiness check

Answer from memory.

What relation shows the acceleration vector is inward?

CONFIDENCE CHECK 2

Force-model readiness check

Identify the real force and avoid double counting.

What must the sum of real forces equal in radial vector form?

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 — page 10 →

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

Tangent velocity, inward acceleration

Use period/frequency to find angular and linear speed, then recognize that the velocity is tangent and $a_c = v^2/r = \omega^2 r$ points inward.

KEY TAKEAWAY 2

Real forces create the inward net force

Draw the free-body diagram first. Tension, friction, gravity, or normal-force components—not a new centripetal interaction—must satisfy the radial equation.

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 — page 14 →

ANSWER KEY • CHECK AFTER ATTEMPTING

Solutions and Explanations

Use these solutions to check your reasoning—not only your final answer.

WARM-UP • ACTIVITY 1

Key Ideas

$r \cdot v = 0$.

WHY IT WORKS Velocity is tangent to the circular path and changes direction continuously.

WARM-UP • ACTIVITY 2

Common Mistakes

$a = -\omega^2 r$.

WHY IT WORKS Centripetal acceleration is radial inward; its magnitude can be written v^2/r or $\omega^2 r$.

WARM-UP • ACTIVITY 3

Quick Application

$\Sigma F = -m\omega^2 r$.

WHY IT WORKS Real interactions combine to produce the required inward net force.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Guided Example

$\omega = 2.09$ rad/s; $a_c = 6.58$ m/s².

WHY IT WORKS The linear-speed and angular-speed descriptions must give the same inward acceleration.

PRACTICE 2

Independent Check

$F_f = -3600$ N radially.

WHY IT WORKS Static friction is the physical interaction that can satisfy the inward net-force requirement.

SOLUTIONS • CONFIDENCE CHECK

CONFIDENCE CHECK 1

Direction and scaling readiness check

$a=-\omega^2 r$.

WHY IT WORKS Direction and scaling should be recognized before any multi-step circular-motion calculation.

CONFIDENCE CHECK 2

Force-model readiness check

$\Sigma F=-m\omega^2 r$.

WHY IT WORKS The actual interactions already present in the free-body diagram must produce the inward net force.

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: return to Warm-Up Check on page 4.	**Go to Practice →**	**Continue →**

RECOMMENDED LINKS

Review again: return to Warm-Up Check on page 4.

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