

FULL REVIEW

Full Review: Uniform Circular Motion — Algebra-Based

Review the essential ideas, relationships, and problem-solving tools for Uniform Circular Motion.

 TIME 45–60 minutes	 BEST FOR A complete topic review	 FINISH WITH 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 • 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: Algebra-Based	BEST USED ✓ After learning the unit ✓ Before starting homework ✓ Before a quiz or exam
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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 stages in order. Each stage builds on the previous one and prepares you for the final readiness check.

6 stages • Approximately 45–60 minutes

1 Warm-Up Check — page 4 Activate prior knowledge.	2 Core Concepts — page 6 Review the essential ideas.	3 Guided Practice — page 8 Apply what you learned.
4 Confidence Check — page 10 Confirm your understanding.	5 Summary — page 12 Review the key ideas.	6 Next Step — page 16 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**

Sketch velocity and acceleration directions.

An object moves counterclockwise. At the rightmost point, give the directions of velocity and centripetal acceleration.

ACTIVITY 2**Recall Activity 2**

Use $v=2\pi r/T$.

An object moves on a circle of radius 2.5 m with period 4.0 s. Find its speed.

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Recall Activity 3

Apply the radial form of Newton's second law.

A 1200 kg car travels at 15 m/s on a flat curve of radius 50 m. Find the required inward net force.

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 — page 6 →

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

Circular kinematics: period, frequency, angular speed, and linear speed

Use $f=1/T$, $\omega=2\pi/T=2\pi f$, and $v=\omega r=2\pi r/T$. Select the equation that connects the known quantities instead of using every relation automatically.

$$f=1/T; \omega=2\pi/T=2\pi f; v=\omega r=2\pi r/T.$$

EXAMPLE For $r=2.5$ m and $T=4.0$ s, $v=3.93$ m/s.

SENSEI NOTE Linear speed and angular speed are related but not identical. Points at different radii can share the same angular speed while having different linear speeds.

KEY CONCEPT 2

Centripetal acceleration: changing direction at constant speed

The magnitude is $a_c=v^2/r=\omega^2 r$. At fixed radius, doubling speed makes the acceleration four times larger. At fixed speed, increasing radius decreases the acceleration.

$$a_c=v^2/r=\omega^2 r.$$

EXAMPLE For $v=3.93$ m/s and $r=2.5$ m, $a_c=6.18$ m/s².

SENSEI NOTE A statement about how acceleration changes with radius is incomplete unless you also state what is held constant: speed, angular speed, or period.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Radial force modeling: the inward net force

Draw the free-body diagram first. Then use $\Sigma F_r = mv^2/r$, taking inward as the positive radial direction if convenient. Do not add a separate centripetal-force arrow.

$$\Sigma F_r = mv^2/r = m\omega^2 r.$$

EXAMPLE For a 1200 kg car at 15 m/s on a 50 m curve, the required inward net force is 5400 N.

SENSEI NOTE “Centripetal” describes the required inward net-force direction. It is not the name of an additional physical interaction.

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 — page 8 →

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**

Connect period, angular speed, and linear speed; keep units visible.

A platform has radius 1.8 m and frequency 0.50 Hz. Find ω and the speed at the edge.

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

Draw the free-body diagram, identify the inward direction, and then apply the radial equation.

A 1200 kg car travels at 15 m/s on a 50 m flat curve. Find the required friction force and the minimum μ_s .

PRACTICE 3

Independent Problem

Separate vertical balance from radial acceleration.

A 0.50 kg mass on a 1.5 m string moves at 30° from vertical. Find the circle radius, tension, speed, and angular speed.

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 — page 10 →

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**Direction check**

Answer without drawing a separate centripetal-force arrow.

At the rightmost point of counterclockwise motion, where do v and a_c point?

QUICK CHECK 2**Scaling check**

State what is held constant before giving the factor.

At fixed speed, what happens to a_c if radius doubles?

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Force-model check

Name the real interaction and the radial equation.

Should a car-on-a-flat-curve free-body diagram contain both friction and a separate centripetal force?

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 — page 12 →

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**Connect T , f , ω , and v before calculating**

One revolution is 2π radians and a distance $2\pi r$. Use $f=1/T$, $\omega=2\pi/T$, and $v=\omega r$ to translate between cycle, angular, and linear descriptions.

KEY TAKEAWAY 2**Velocity is tangent; acceleration is inward**

Constant speed can coexist with nonzero acceleration because velocity direction changes. Use $a_c=v^2/r=\omega^2 r$ and always identify the center first.

KEY TAKEAWAY 3**Model the real forces, then impose the radial requirement**

Draw the free-body diagram with actual interactions. Their inward components must satisfy $\Sigma F_r=mv^2/r$; never add a duplicate “centripetal force.”

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 16 →

ANSWER KEY • CHECK AFTER ATTEMPTING

Solutions and Explanations

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

WARM-UP • ACTIVITY 1**Recall Activity 1**

Velocity is upward; acceleration is left, toward the center.

WHY IT WORKS Velocity is tangent to the path; centripetal acceleration points inward.

WARM-UP • ACTIVITY 2**Recall Activity 2**

$v = 2\pi(2.5)/4.0 = 3.93 \text{ m/s}$.

WHY IT WORKS One revolution covers $2\pi r$ in one period T .

WARM-UP • ACTIVITY 3**Recall Activity 3**

$F_c = mv^2/r = 5400 \text{ N}$ inward.

WHY IT WORKS The real horizontal forces must combine to produce mv^2/r toward the center.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Worked Example**

$$\omega = 2\pi f = 3.14 \text{ rad/s}; v = \omega r = 5.65 \text{ m/s}.$$

WHY IT WORKS Frequency sets angular speed; multiplying by radius gives linear speed.

PRACTICE 2**Guided Problem**

$$F_f = 5400 \text{ N inward}; \mu_s = v^2/(rg) = 0.459.$$

WHY IT WORKS Static friction supplies mv^2/r ; μ_{sN} is the maximum available static friction, with $N=mg$ on a flat road.

PRACTICE 3**Independent Problem**

$$r = 0.75 \text{ m}; T = 5.66 \text{ N}; v = 2.06 \text{ m/s}; \omega = 2.75 \text{ rad/s}.$$

WHY IT WORKS Vertical acceleration is zero while radial acceleration is v^2/r . Combining the component equations gives $\tan\theta = v^2/(rg)$.

SOLUTIONS • CONFIDENCE CHECK**QUICK CHECK 1****Direction check**

Velocity upward; acceleration left.

WHY IT WORKS Velocity is tangent to the path; centripetal acceleration is radial and inward.

QUICK CHECK 2**Scaling check**

It becomes half as large.

WHY IT WORKS Use $a_c = v^2/r$ when speed is controlled and $a_c = \omega^2 r$ when angular speed is controlled.

QUICK CHECK 3**Force-model check**

No. Static friction is the real force that can supply the inward net force.

WHY IT WORKS Centripetal force is not an additional interaction; it is the inward net-force requirement.

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.

 I'm Still Unsure Review the key ideas and examples again. Review again: return to Warm-Up Check on page 4.	 I Need More Practice Continue with additional practice for this topic. Go to Practice →	 I'm Ready Continue to the next recommended resource. Continue →
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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.

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