Converting Rates

Students convert a rate by changing one unit at a time, each change a multiply or divide by a conversion fact, with a sense check (bigger or smaller?) after every step. No dimensional analysis.

TIME	25 minutes (one student with a parent or tutor)
WHO	7th grade, about age 12. Follows Lesson 6, What a Point Means.
MATERIALS	Student worksheet (PDF), the Deep Dive 5 page for this lesson (conversion facts box, sense-check questions), pencil, calculator for the decimals.
PRIOR KNOWLEDGE	Converting one unit (6th grade, NC.6.RP.4); unit rates (Lesson 1).
STANDARDS	NC.7.RP.3.
KEEP OUT	Dimensional analysis, the long chain of fractions with units crossed out. The unpacking says it is not expected. Students are not expected to memorize conversion facts.

Learning goals

1. Convert a rate by changing one unit, then the other.
2. Predict before each step whether the number gets bigger or smaller, and say why.
3. Use a conversion fact from a reference box without memorizing it.
4. Keep the rate's units written at every step.

Vocabulary: say both, every time

The rule for the whole lesson: whenever the adult or the student says a math word, they follow it with the plain-English version. Proper term first, plain English second, until the student does it without being asked.

TERM	LOOKS LIKE	PLAIN ENGLISH
Convert	miles per hour to feet per minute	Change the units, not the amount.
Conversion fact	1 mile = 5,280 feet	Look it up.
Sense check	bigger or smaller?	Smaller units: more of them. Shorter time: less happens.

> THE ONE SENTENCE TO SAY OUT LOUD
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> One unit at a time. Bigger or smaller?

Lesson timeline (25 minutes)

0:00 to 0:04	Warm-up. 3 feet is how many inches? One unit. Then: a rate has two units. Say the thread sentence.
0:04 to 0:12	Zoomy. Miles to feet, sense check, hours to minutes, sense check. The student predicts the direction before each computation.
0:12 to 0:17	The sprint and the faucet. Predict, compute, check. Show the facts box and say nobody memorizes it.
0:17 to 0:22	Practice. The sense-check questions, then the practice problems or Worksheet Parts A to C.
0:22 to 0:25	Exit ticket. Worksheet Part D. Success looks like 900 feet per minute with bigger said before computing.

Misconceptions to listen for

- **Both units change at once.** One at a time, each its own step.
- **More minutes than hours means multiply.** There are more minutes, but less happens in each one: divide. The sense check settles it.
- **A rate is just a number.** Keep the units written: feet per hour, then feet per minute.
- **You must know the facts.** Use the box.

Support and stretch

Support

Have the student say the direction out loud before every computation, and write the units after every number. If a step goes the wrong way, the sense check shows it immediately.

Stretch

Ask for a rate that takes three changes, like inches per second to miles per hour. Ask the student to write their own sense-check rule in one sentence.

Where this goes next

Lesson 8: unit rate problems. Everything in the unit comes together on recipes, shopping, sports, and travel, two ways that always agree.

> THE HABIT TO BUILD
>
> Predict the direction, then compute. Units on every number.