More Than One Change

Three tiles, about 7 minutes each with its Let me try a few, then the exit ticket. Students apply two or more percent changes one at a time, in order, and discover that percents do not add.

TIME	25 minutes: three tiles at about 7 minutes each, then the exit ticket
WHO	7th grade, about age 12. Follows Lesson 5, Percent Increase and Decrease.
MATERIALS	The Deep Dive 5 lesson hub and its three tiles (receipt, stacking table, predict-then-check), the worksheet (PDF), pencil, a calculator for the cents.
PRIOR KNOWLEDGE	One multiplier for tax, tips, discounts, markups, and percent change (Lessons 3 to 5).
STANDARDS	NC.7.RP.3, NC.7.EE.3.
KEEP OUT	Compound interest, even though it is the same idea. Percent error.

Learning goals

1. Work a problem with tax and a tip one step at a time, saying what each percent is a percent of.
2. Stack several changes by multiplying in order.
3. Explain why up 10 percent then down 10 percent lands below the start.
4. Explain why two discounts do not add.

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
Subtotal	$33.28	Before tax or tip.
One step at a time	tax, then tip	Finish one, then the next.
Percent of what	10% of $110	The whole changes each step.

> THE ONE SENTENCE TO SAY OUT LOUD
>
> One step at a time. Percent of what?

Lesson timeline (25 minutes)

0:00 to 0:07	Tile 1, One Step at a Time. Finn's hook, Abraham's dinner, the tip two ways. The sweater receipt. Let me try a few.
0:07 to 0:14	Tile 2, Stacking Changes. The used car: a dollar fee added, then two multipliers. The $200 bike table. Let me try a few.
0:14 to 0:21	Tile 3, The Surprise. Guess before calculating. $110 then $99. Elle's card: two discounts do not add. Let me try a few.
0:21 to 0:25	Exit ticket. Back on the hub. Success looks like $42.40 with the sale price found before the tax.

Misconceptions to listen for

- **Percents add.** They are percents of different wholes.
- **The second percent is of the original.** It is of the amount just before it.
- **A dollar fee is a percent.** Dollars are added; percents are multiplied.
- **Round each line.** Round money at the end.

Support and stretch

Support

Use the receipt: one line per change, and say percent of what before each line.

Stretch

Ask for the single multiplier that does up 10 then down 10 (0.99), and for 20 off then 10 off (0.72).

Where this goes next

Lesson 7: circle graphs. The whole circle is 100 percent and 360 degrees.

> THE HABIT TO BUILD
>
> Finish one change before you start the next.