Problem First: The Bus Challenge — Teacher plan and key

A complete introductory lesson in checking a confident answer. Grades 6–8 · 20 minutes · teacher-led · devices optional · free. No accounts; no AI model; nothing is collected.

Goal	Solve independently, detect an invalid interpretation of a calculation, and verify a revised answer against constraints.
Materials	Student pages 1–2 (printed or on a device), pencil or accessible alternative. A calculator is optional. Optional: the free mini-demo.
Preparation	Print the student pages. Keep this teacher plan and key separate.
Honesty note	The “AI-style” answer is **authored** to contain an error. It is not a captured result from any named AI product.

Sequence (20 minutes)

Phase	Minutes	What happens	Evidence
Ponder	3	Present the scenario and ask for an independent estimate before showing any prepared answer. Learners record a first attempt in writing, typing, drawing or speech.	Initial estimate, calculation, reason
Plan	3	Name the constraints: passengers, seats, whole buses, budget. The driver has a separate seat. Choose how to verify.	Constraint checklist
Partner	3	Reveal the constructed answer after first attempts. Learners mark each statement agree / question / check.	Annotated answer
Probe	7	Test 2, 3 and 4 buses with independent arithmetic (or the mini-demo). Explain seating and budget before showing the key.	Verification table; explanation of the rounding error
Prove	4	Exit explanation: how did you check the answer without asking an AI?	Final reasoning
Total	20		

Budget is an optional follow-up if arithmetic would overwhelm the introduction. For a full 45- or 60-minute version with a transfer assessment, see Classroom Studio.

> **SAY**
> You will solve this before you see any answer. Then we will check a confident answer against the rules of the problem.

Teacher key

> **TEACHER KEY**
> 127 + 11 = 138 passengers. 138 ÷ 48 = 2.875, so round UP to 3 buses. 3 × 48 = 144 seats, 6 unused. 3 × $240 = $720, which is $30 under the $750 budget. Two buses give 96 seats and leave 42 people without a seat.

Buses	Capacity	Short by	Unused seats	Cost	Budget	Seating	Overall
2	96	42	0	$480	within	insufficient	not feasible
3	144	0	6	$720	within	sufficient	feasible
4	192	0	54	$960	over	sufficient	not feasible

Statement	Note
127 + 11 = 138 people.	Correct. The addition is right: 127 + 11 = 138.
138 ÷ 48 = 2.875, which rounds down to 2 buses.	The division is right (2.875) but rounding DOWN is the error. A fractional bus cannot carry the remaining people; round up to 3.
Two buses cost $480, so the trip fits the budget.	The cost is arithmetically right ($480), but the conclusion rests on a plan that seats only 96 of 138 people, so it is infeasible.

Watch for

- Rounding to the nearest whole number gives 3 here, but that is not the rule. Any leftover people need one more whole bus, even a small remainder (97 people on 48-seat buses still need 3 buses).
- A correct calculation can still support a wrong conclusion if the interpretation is wrong.
- The driver’s seat is separate; do not subtract it from passenger seats or add the driver to passengers.
- Passing the budget check does not make a plan feasible if the seating check fails.
- The capacity checker is a verification aid, not a live AI tool.

Accessible response options

- Estimate and explain by writing, typing, drawing or speaking.
- Use a number line or manipulatives for the seat count; no task requires dragging.
- Score the thinking, not handwriting or speech fluency; offer another opportunity for missing work.

Exit explanation exemplars (labeled examples)

Level	Example	Note
Strong	Two buses seat 96, but 138 people need seats, so 42 would have no seat. Three buses seat 144 and cost $720, which is $30 under budget. The constructed answer rounded down, which breaks the seating rule. I checked by multiplying 3 × 48.	Independent attempt, applies the capacity calculation, names the error and states what was verified.
Developing	It should be 3 because 2 isn’t enough.	Correct revision, but the reason is incomplete: it does not say how “not enough” was checked.
Incomplete	(Copies “3 buses” with no work shown.)	Final claim copied without explanation. Offer another opportunity.

Review status: arithmetic, source mapping and time totals are checked by ARQIV, with automated tests. The materials have not been classroom-tested. All examples are authored; none is a live AI result.