Writing and Solving Two-Step Stories

Teacher		**Class**	Grade 7
Subject	Math	**Topic**	Word problems with equations
Date		**Room**	
Lesson length	60 minutes	**Country**	United States

Students learn to turn stories into px+q=r and p(x+q)=r with decimals and fractions. They create, swap, and solve their own story posters.

Curriculum links

- Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers.
- Make sense of problems and persevere in solving them. [1]

Learning objectives

- Students will translate word stories into px+q=r and p(x+q)=r using rational numbers.
- Students will solve two-step equations with inverse operations in correct order.
- Students will define the unknown with units and check answers in story words.

Success criteria

- I can write px+q=r or p(x+q)=r from a story with units.
- I can solve in the right order and show each undo step.
- I can check my answer back in the story words.

What students already know

Ask: A notebook costs $2 and a $3 pen makes $11 total for 4 notebooks? Students write 4x+3=11 and solve to x=2.

Key words

variable	a letter that stands for a number you have not found yet [5]
equation	a number sentence that shows two amounts are the same [16]
total	the whole amount after all parts are put together [12]
inverse operations	opposite steps that undo each other, like add then subtract
parentheses	curved marks that show what to do first inside equal groups

Materials

- Projector with Slides 1-11
- Printed Worksheet Task B and Task C, one copy per student
- Colored paper, one large sheet per pair
- Markers
- Pencils and rulers
- Mini-whiteboards and markers for checks

Before the lesson

- Print Worksheet Tasks B-C, one copy per student
- Test Video clip 1 (0:00-5:00) on Slide 5 and Video clip 2 (0:00-2:02) on Slide 7 with sound
- Set out colored paper and markers, one set per pair
- Load Slides 1-11 and check photo on Slide 2 shows clearly

Lesson outline

0–8 min **Starter** 8 min · Whole class

Activate prior solving and hook students into authoring tricky stories.

YOU DO

1. Show Slide 1 title, then Slide 2 bike photo problem.
2. Ask students to name the unknown with units before writing anything [5].
3. Take quick ideas for the equation and solution on whiteboards.
4. Frame the lesson goal: today they will learn to tell the two story types apart and author their own.

STUDENTS DO

1. Study the photo story and think what x stands for.
2. Write Let x statement and a matching equation on boards.
3. Listen to the author challenge for the main task.

Say: Look at this bike shop story. First tell me what we do not know, with units. You are the author now — can you write a story so tricky I cannot tell which equation it is? By the end you will make posters for both types.

Ask: A shop charges a $10 fee plus $4 per hour. A customer pays $30 total. What is x with units? (Let x = number of hours for the ride [5].) · What equation matches and what is the solution? (4x + 10 = 30, so x = 5 hours. Check: 4(5)+10=30.)

Check understanding: All hold up boards with equation; if many write 10x+4, model is means = and per means multiply [12][16] and re-do.

Support: Point to the total $30 first, then underline the flat $10 and circle $4 per hour to see structure [12]. **Stretch:** What if rate is $4.50 and total is $28 with $10 fee? Write 4.5x+10=28.

Use: Slides 1-2

8–20 min **Teaching** 12 min · Whole class

Model how to translate stories into both equation forms and solve them.

YOU DO

1. Show Slide 3 chain and Slide 4 fact that the hard part is translating [12].
2. Play Video clip 1 (0:00-5:00) on Slide 5; ask students to spot how the unknown becomes x with units.
3. Model Slide 6 4-Step Solver: name x, translate to px+q=r or p(x+q)=r, solve by undoing in reverse order, check in story [1].
4. Think aloud the difference: flat fee added after multiplying versus same addition inside each equal group.

STUDENTS DO

1. Watch the clip and note the Let x line and is and per clues [12].
2. Copy the 4 steps and both worked examples with units.
3. Chorally say which undo step comes first for each form.

Say: Every solver starts with Let x = number of ___ with units. The word is means equals and per means multiply. Then we undo in reverse: for px+q we subtract then divide, for p(x+q) we divide then subtract.

Worked example: A: 4.5x + 10 = 28. Let x = number of hours. Subtract 10: 4.5x = 18. Divide by 4.5: x = 4. Check in words: 4.5(4)+10 = 18+10 = 28, so 4 hours is correct. B: 3(x + 1.5) = 21. Let x + 1.5 = dollars for one kit, x = dollars for string. Divide by 3: x + 1.5 = 7. Subtract 1.5: x = 5.5. Check: 3(5.5+1.5)=3(7)=21, so $5.50 is correct.

Ask: How do you know if a story is px+q=r or p(x+q)=r? (Flat part added once after multiplying is px+q; same added part inside each equal group is p(x+q).) · For 3(x+1.5)=21, what do you undo first and why? (Divide both sides by 3 first, then subtract 1.5, to undo in reverse order.)

Check understanding: Thumbs up for first step for 2.5x+5=20; if split, re-model with bar: 20 split into 5 plus 2.5x [5].

Support: Show a bar of 28 split into 10 plus four 4.5 parts to see subtract-then-divide [5]. **Stretch:** Preview (3/4)(x+2)=9: divide by 3/4 first, then subtract, to get x=10.

Use: Slides 3-6, Video clip 1 (0:00-5:00)

20–32 min **Guided practice** 12 min · Pairs

Practice solving both forms together and checking answers in words.

YOU DO

1. Play Video clip 2 (0:00-2:02) on Slide 7; pause to name the two undo steps in order.
2. Show Slide 10 question on order and stress that less than reverses order [12].
3. Hand out Worksheet Task B: Solve each equation and check with the story.
4. Circulate, ask pairs to explain correspondences between equation, words, and answer and ask Does this make sense? [1].

STUDENTS DO

1. Watch, track the two undo steps, and vote on Slide 10 with reasons.
2. Solve Task B problems in pairs and write the story check in words.
3. Compare answers with neighbors and fix order errors.

Say: With your partner, solve Task B. Start each with Let x = with units. Solve, then plug back into the story words, not just the equation, to prove it fits. Be ready to justify one match.

Worked example: '5 less than a number is 12' is x - 5 = 12, not 5 - x = 12, because less than reverses order [12]. Add 5: x = 17. Check in words: 5 less than 17 is 12, correct.

Ask: Is 2(x+3)=14 the same as 2x+3=14? How do you know? (No. First adds then doubles to get x=4; second doubles then adds to get x=5.5.) · After solving, how do you check so you know it makes sense? (Put the number back into the story words and units, not just the symbols [1].)

Check understanding: Scan boards for Task B checks; if checks use symbols only, model one full sentence check and have pairs add it.

Support: Provide sentence frames: Let x = number of ___ and the total is ___ dollars [5]. **Stretch:** Ask what changes if the story includes 1/2 pound extra: rewrite as 2(x+1/2)=17 and solve.

Use: Slides 7 and 10, Video clip 2 (0:00-2:02), Worksheet Task B

32–52 min **Main activity** 20 min · Pairs

Create and solve original stories for both equation types with rational numbers.

YOU DO

1. Show Slide 8 task and Slide 9 check reminder; assign the two target equations: 2.5x+5=20 and 3(x+1.5)=21.
2. Give each pair colored paper and markers; require story, Let x with units [5], equation, steps, and story check on each poster.
3. Set a 12-minute timer for drafting; prompt use of everyday ideas like craft supplies or phone data and decimals or fractions [12].
4. Organize a swap: pairs solve the other pair's stories, leave a check note, and return for corrections.

STUDENTS DO

1. Draft two stories, write Let x statements, equations, and solutions with units.
2. Make mini-posters and swap to solve another pair's stories.
3. Verify by substituting back into the story words and discuss fixes.

Say: Make two mini-posters. One where a quantity is multiplied then added for 2.5x+5=20. One where addition happens inside equal groups for 3(x+1.5)=21. Swap and solve each other's stories and prove the total matches.

Worked example: Story 1 model: A student buys 2.5 pounds of modeling clay at the same price per pound plus a $5 tool kit and pays $20 in all. Let x = price in dollars per pound. Equation: 2.5x+5=20, so x=6. Story 2 model: Three friends each buy the same notebook plus a $1.50 pen and together pay $21 in all. Let x = price in dollars of one notebook. Equation: 3(x+1.5)=21, so x=5.50.

Ask: What makes your p(x+q) story different from your px+q story? (p(x+q) has the same q inside every equal group; px+q has one flat q added at the end.) · What does x=6 mean in your first poster? (It means $6.00 per pound, not $6 total; units come from the Let x line [5].)

Check understanding: Posters must show story, Let x, equation, steps, and story check; next group verifies the check before returning [1].

Support: Give a word bank: total, each, per, plus, in all, combined, to help translate to + and multiplication [12]. **Stretch:** Require one story where the answer is not a whole number, like x = 2.4 hours, and explain why it still fits.

Use: Slides 8-9

52–60 min **Plenary** 8 min · Whole class

Confirm the two forms are distinct and assess solving and checking.

YOU DO

1. Show Slide 11 true-or-false and take votes with reasons.
2. Revisit success criteria: write each form, solve in order, check in words.
3. Hand out exit tickets with three short problems and collect them.
4. Preview homework from Worksheet Task C.

STUDENTS DO

1. Vote and justify true-or-false using order and inverse steps.
2. Complete exit ticket on their own with units and checks.
3. Self-rate against I can statements and note one question.

Say: Show me thumbs for true or false and tell why order matters. Then on your own, do the exit ticket. Start each with Let x, solve, and write one sentence check in story words.

Ask: 2x+3=11 gives x=4. True or false after subtract 3 to get 8, then divide by 2? (True: 2(4)+3=11 and steps are in reverse order.) · 2(x+3)=14 is the same as 2x+3=14. True or false? (False. First adds then doubles; second doubles then adds.)

Check understanding: Collect exit tickets; if fewer than 80% define x with units and check in words, reteach translation next lesson.

Support: Provide a check box list: units written, substituted in equation, tested in story words [1]. **Stretch:** Write what error would give x=8 for 2x+3=11 and which story detail it ignores.

Use: Slide 11

Common mistakes

Mistake	How to spot it	How to fix it
Writing 5 - x = 12 for 5 less than a number	Equation starts with the smaller number first in Task B or Slide 10 vote	Teach that less than reverses order to x - 5 = 12 and test with numbers like 10-8 [12].
Treating 2(x+3)=14 as 2x+3=14	Divides only x or subtracts before dividing in p(x+q)=r	Use bars of two equal (x+4) parts making 26 to show divide first, then subtract [5].
Giving x without units or no story check	Answer says x=4 with no hours or dollars and check only in symbols	Require Let x with units and one sentence check back in story words and ask Does this make sense? [1].

Support

- Word bank with total, each, per, plus, in all, combined for translation [12].
- Pre-drawn bars with total labeled to fill parts before writing equations [5].
- Sentence frames for Let x = number of ___ with units [5].

Stretch

- Solve with fractions like (3/4)(x+2)=9 and explain each bar step.
- Create a story with a non-whole answer like x=2.4 hours and justify fit.
- Change one number to make a fractional answer and re-solve.

For the LSE or teaching assistant

Sit with target pairs in guided and main tasks; prompt Let x with units, point to total then flat and repeated parts, and check story words together.

Check for understanding

Question	Answer

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A student buys 2.5 pounds of clay at $x per pound plus a $5 kit for $20 total. Write and solve 2.5x+5=20. What is x?	x = 6, meaning $6.00 per pound. Check: 2.5(6)+5=20.
Three packs each have a $1.50 item plus the same-price item for $21 total. Solve 3(x+1.5)=21. What is x?	x = 5.5, meaning $5.50. Check: 3(5.5+1.5)=21.
Why is 5 less than a number written as x-5, not 5-x?	Less than reverses order; 5 less than 17 is 17-5=12 [12].

Homework

Complete Worksheet Task C: write or solve each equation and show your check in story words.

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