Linear equations: transpose and verify — Teacher answers

Year 7, upper volume • text pp. 61–62 • foundation lesson 31

Ask what was done to both sides before accepting a transposition line. Accept different valid orders. Verify using the original equation, not only the last simplified line. Do not introduce bracket removal, denominator clearing or systems.

Worked example 1

Solve 5x − 7 = 2x + 8. Explain the operation behind each transposition.

$$5x - 7 = 2x + 8$$

Reference answer

x = 5.

1. Subtract 2x from both sides: 3x − 7 = 8.
2. Add 7 to both sides: 3x = 15. The short line is 5x − 2x = 8 + 7.
3. Divide both sides by 3: x = 5.
4. Check: left side 5 × 5 − 7 = 18; right side 2 × 5 + 8 = 18.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Guided attempt 2

Solve 4x + 9 = 7x − 6 by collecting the variable terms on the left. Complete each line.

$$4x + 9 = 7x - 6$$

1. Subtract 7x on both sides: _____ x + 9 = −6.
2. Subtract 9 on both sides: _____ x = _____.
3. Divide both sides by _____: x = _____.
4. Original left side = _____; original right side = _____.

Reference answer

x = 5.

1. Subtract 7x: −3x + 9 = −6.
2. Subtract 9: −3x = −15. Divide by −3: x = 5.
3. Check: 4 × 5 + 9 = 29 and 7 × 5 − 6 = 29.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Prerequisite 3

For x + 7 = 2, which operation removes +7 while keeping both sides equal? Use it to find x.

$$x + 7 = 2$$

Reference answer

Subtract 7 from both sides, giving x = 2 − 7 = −5.

1. Subtract 7 from both sides: x = 2 − 7 = −5.
2. Check: −5 + 7 = 2.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Prerequisite 4

Solve −3x = 12 and check the sign of your solution.

$$-3x = 12$$

Reference answer

x = -4.

1. Divide both sides by −3: x = −4.
2. Check: −3 × (−4) = 12.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Independent practice 5

Solve 6x − 5 = 3x + 10.

$$6x - 5 = 3x + 10$$

Reference answer

x = 5.

1. Subtract 3x and add 5 on both sides: 6x − 3x = 10 + 5.
2. 3x = 15, so x = 5.
3. Check: 6 × 5 − 5 = 25 and 3 × 5 + 10 = 25.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Independent practice 6

Solve 2x + 11 = 5x − 7.

$$2x + 11 = 5x - 7$$

Reference answer

x = 6.

1. Subtract 5x and 11 on both sides: 2x − 5x = −7 − 11.
2. −3x = −18. Divide by −3: x = 6.
3. Check: 2 × 6 + 11 = 23 and 5 × 6 − 7 = 23.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Independent practice 7

Solve −4x + 3 = x − 12.

$$-4x + 3 = x - 12$$

Reference answer

x = 3.

1. Subtract x and 3 on both sides: −4x − x = −12 − 3.
2. −5x = −15. Divide by −5: x = 3.
3. Check: −4 × 3 + 3 = −9 and 3 − 12 = −9.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Independent practice 8

Solve 7 − 2x = 3x + 22.

$$7 - 2x = 3x + 22$$

Reference answer

x = -3.

1. Subtract 3x and 7 on both sides: −2x − 3x = 22 − 7.
2. −5x = 15. Divide by −5: x = −3.
3. Check: 7 − 2 × (−3) = 13 and 3 × (−3) + 22 = 13.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Exit question 9

Solve 8x + 1 = 5x − 14 and verify in the original equation.

$$8x + 1 = 5x - 14$$

Reference answer

x = -5.

1. Subtract 5x and 1 on both sides: 3x = −15.
2. Divide by 3: x = −5.
3. Check: 8 × (−5) + 1 = −39 and 5 × (−5) − 14 = −39.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Exit question 10

A learner claims x = 7 solves 3x − 4 = x + 10. Verify by calculating both original sides. Is the claim correct?

$$3x - 4 = x + 10$$

Reference answer

Yes. At x = 7, the left side is 3 × 7 − 4 = 17 and the right side is 7 + 10 = 17.

1. Use the original equation, including both constants.
2. Left side: 3 × 7 − 4 = 17. Right side: 7 + 10 = 17.
3. The two sides are equal, so x = 7 is a solution.

- Calculate both original sides as 17.
- Conclude that the equality holds at x = 7.

Further practice 11

Solve 9x + 4 = 5x − 12.

$$9x + 4 = 5x - 12$$

Reference answer

x = -4.

1. Subtract 5x and 4 on both sides: 4x = −16.
2. Divide by 4: x = −4.
3. Check: 9 × (−4) + 4 = −32 and 5 × (−4) − 12 = −32.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Further practice 12

Solve −2x − 9 = 4x + 3.

$$-2x - 9 = 4x + 3$$

Reference answer

x = -2.

1. Subtract 4x and add 9 on both sides: −6x = 12.
2. Divide by −6: x = −2.
3. Check: −2 × (−2) − 9 = −5 and 4 × (−2) + 3 = −5.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Further practice 13

Solve 12 − 5x = 2x − 9.

$$12 - 5x = 2x - 9$$

Reference answer

x = 3.

1. Subtract 2x and 12 on both sides: −7x = −21.
2. Divide by −7: x = 3.
3. Check: 12 − 5 × 3 = −3 and 2 × 3 − 9 = −3.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Further practice 14

Solve 6x − 11 = −3x + 7.

$$6x - 11 = -3x + 7$$

Reference answer

x = 2.

1. Add 3x and 11 on both sides: 9x = 18.
2. Divide by 9: x = 2.
3. Check: 6 × 2 − 11 = 1 and −3 × 2 + 7 = 1.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Extension 15

Solve 2x + 3x − 8 = 7x − 4x + 6. Collect like terms on each side before transposing.

$$2x + 3x - 8 = 7x - 4x + 6$$

Reference answer

x = 7.

1. Collect on each side: 5x − 8 = 3x + 6.
2. Subtract 3x and add 8 on both sides: 2x = 14.
3. Divide by 2: x = 7.
4. Check: 2 × 7 + 3 × 7 − 8 = 27 and 7 × 7 − 4 × 7 + 6 = 27.

- Combine only like terms and keep both sides equal.
- Find the stated value and check it in the original equation.

Extension 16

For 6x − 7 = 2x + 9, a learner writes 6x − 2x = 9 − 7 and then 4x = 2. Explain the first error and solve correctly.

$$6x - 7 = 2x + 9$$

Reference answer

Moving −7 to the right requires +7, corresponding to adding 7 on both sides. Thus 4x = 16 and x = 4; both original sides equal 17.

1. The wrong line keeps −7 after it crosses the equality sign.
2. Subtract 2x and add 7 on both sides: 6x − 2x = 9 + 7.
3. 4x = 16, so x = 4.
4. Check: 6 × 4 − 7 = 17 and 2 × 4 + 9 = 17.

- Identify the incorrect sign of the transposed constant and explain adding 7 on both sides.
- Obtain x = 4 and check both original sides as 17.