

GRADE 7 · EXPRESSIONS & EQUATIONS · ANSWER KEY

WRITING & SOLVING EQUATIONS

Today's goal: I can use variables to represent quantities in real-world problems, use variables to represent quantities in mathematical problems and construct simple equations to solve problems.



How to use this key. Problem numbers match the student sheets. Each answer shows the steps and the slip Mr DJ sees most, so a wrong answer tells you what to reteach. Pepper levels: **Mild** warm-up, **Medium** stretch, **Spicy** challenge, **Extra Spicy** big brain.

Practice

9 problems

Use: During the lesson after the deck. Item 9 is the reading skill at the heart of the standard; items 6–8 pair a negative coefficient with the check that exposes sign slips. **Timing:** 15–25 min · pairs or independent · circulate on 7 and 9. Require the check written out, not done mentally.

1 $x = 5$ 2 $x = 5$ 3 $x = -3$ 4 $3(-3) + 11 = 2$ 5 $x = 12$ 6 $x = -3$ 7 $8 - 2(-3) = 14$

8 No — different equations can share a solution 9 $3x - 5 = 20$ gives $8\frac{1}{3}$; $5x - 3 = 20$ gives $4\frac{1}{5}$

1 **MILD** $5x + 3 = 28$

$x = 5$

1. Subtract 3: $5x = 25$. Divide by 5: $x = 5$.
2. Check: $5(5) + 3 = 28$.

Watch for: Divided by 5 first.

2 **MILD** $6x - 4 = 26$

$x = 5$

1. Add 4: $6x = 30$. Divide by 6: $x = 5$.
2. Check: $6(5) - 4 = 26$.

Watch for: Subtracted 4 instead of adding it.

3 **MEDIUM** $3x + 11 = 2$

$x = -3$

1. Subtract 11: $3x = -9$. Divide by 3: $x = -3$.

Watch for: Stopped at $3x = -9$ and answered -9 , or refused a negative answer.

4 **MEDIUM** Check $x = -3$

$3(-3) + 11 = 2$

1. $3(-3) = -9$. Then $-9 + 11 = 2$. Correct.
2. A negative solution is a perfectly good solution — nothing in the problem forbade it.

Watch for: Skipped the check because the answer looked wrong. Checking is exactly what settles that doubt.

5 **MEDIUM** $\frac{1}{2}x + 4 = 10$

$x = 12$

1. Subtract 4: $\frac{1}{2}x = 6$.
2. Divide by $\frac{1}{2}$, which means multiply by 2: $x = 12$.
3. Check: $\frac{1}{2}(12) + 4 = 6 + 4 = 10$.

Watch for: Answered 3 by dividing by 2 instead of multiplying. Undoing ‘half of’ means doubling.

6 **MEDIUM** $8 - 2x = 14$

$x = -3$

1. Subtract 8 from both sides: $-2x = 6$.
2. Divide by -2 : $x = -3$.

Watch for: Answered 3 by dividing 6 by 2 and losing the negative, or by treating $-2x$ as $2x$.

7 **MEDIUM** Check $x = -3$ in $8 - 2x = 14$

$8 - 2(-3) = 14$

1. $2(-3) = -6$.
2. $8 - (-6) = 8 + 6 = 14$. Correct.
3. The subtracting-a-negative step is where this check usually goes wrong, so write it out.

Watch for: Computed $8 - 6 = 2$ and concluded the answer was wrong. The double negative was dropped.

8 **SPICY** Same answer — same equation?

No — different equations can share a solution

1. Both give $x = 5$, but $5x + 3 = 28$ and $6x - 4 = 26$ are different statements.
2. They happen to be true at the same value of x , and only there.
3. Test another value: at $x = 1$, the first gives $8 = 28$ (false) and the second gives $2 = 26$ (false) — both false, but for different reasons.
4. Two equations are the same only if they are true for exactly the same values AND say the same thing. Sharing one solution is a coincidence you can arrange deliberately.

Watch for: Said yes because the answers match. A shared solution is one point of agreement, not equivalence.

9 **SPICY** Two sentences, two equations

$3x - 5 = 20$ gives $8\frac{1}{3}$; $5x - 3 = 20$ gives $4\frac{1}{5}$

1. '5 less than 3 times a number': $3x - 5 = 20 \rightarrow 3x = 25 \rightarrow x = \frac{25}{3} = 8\frac{1}{3}$.
2. '3 less than 5 times a number': $5x - 3 = 20 \rightarrow 5x = 23 \rightarrow x = \frac{23}{5} = 4\frac{3}{5}$.
3. Same three numbers, different roles, different answers.
4. Word order matters because it decides WHICH number multiplies and WHICH is subtracted. Swapping them changes the equation entirely.
5. Neither equation starts with the number that appears first in the sentence — 'less than' always reverses the order you read.

Watch for: Wrote the same equation twice, or read both as $5 - 3x$. Reading 'less than' carefully is the whole item.

Homework

7 problems + Mr DJ's worked example

Use: Parallels the practice sheet. Item 7 states the 'A less than B means $B - A$ ' rule explicitly, having had students meet the error twice already. **Timing:** ~15 min at home · independent · review item 7 as the next-day warm-up before starting inequalities.

1 $x = 5$

2 $x = -3$

3 $x = 18$

4 $x = 3$

5 $6 + 4v = 26$, so $v = 5$ visits

6 $x = 5$ — collect like terms first

7 $2x - 7 = 9$, so $x = 8$

1 **MILD** $7x + 2 = 37$

$x = 5$

1. Subtract 2: $7x = 35$. Divide by 7: $x = 5$.

Watch for: Divided first.

2 **MEDIUM** $4x + 15 = 3$

$x = -3$

1. Subtract 15: $4x = -12$. Divide by 4: $x = -3$.

2. Check: $4(-3) + 15 = -12 + 15 = 3$.

Watch for: Refused the negative, or answered $4\frac{1}{2}$ by dividing 18 by 4.

3 **MEDIUM** $\frac{1}{3}x - 2 = 4$

$x = 18$

1. Add 2: $\frac{1}{3}x = 6$.

2. Multiply by 3: $x = 18$.

3. Check: $\frac{1}{3}(18) - 2 = 6 - 2 = 4$.

Watch for: Answered 2 by dividing by 3. Undoing 'a third of' means tripling.

4 **MEDIUM** $20 - 4x = 8$

$x = 3$

1. Subtract 20: $-4x = -12$. Divide by -4 : $x = 3$.

2. Check: $20 - 4(3) = 20 - 12 = 8$.

Watch for: Answered -3 by mishandling the two negatives in the division.

5 **SPICY** Gym: \$6 to join plus \$4 per visit, paid \$26

$6 + 4v = 26$, so $v = 5$ visits

1. Let v be the number of visits.

2. $6 + 4v = 26$. Subtract 6: $4v = 20$. Divide by 4: $v = 5$.

3. Check: $6 + 4(5) = 26$.

4. In words: the member visited 5 times. The \$6 is paid once; the \$4 repeats, so it attaches to v .

Watch for: Wrote $6v + 4 = 26$. The joining fee is not charged per visit.

6 **SPICY** $2x + 2x + 6 = 26$

$x = 5$ — collect like terms first

1. Before undoing anything, simplify the left side: $2x + 2x = 4x$.

2. The equation becomes $4x + 6 = 26$.

3. Subtract 6: $4x = 20$. Divide by 4: $x = 5$.

4. Check in the ORIGINAL: $2(5) + 2(5) + 6 = 10 + 10 + 6 = 26$.

5. Collecting first is not optional bookkeeping — trying to undo two separate x terms at once is where students lose track.

Watch for: Subtracted 6 and then divided by 2, forgetting there were two x terms. Simplify before you solve.

7 **EXTRA SPICY** "7 less than twice a number is 9"

$2x - 7 = 9$, so $x = 8$

1. 'Twice a number' is $2x$. '7 less than' it means $2x - 7$.

2. Equation: $2x - 7 = 9$. Add 7: $2x = 16$. Divide by 2: $x = 8$.

3. Check: $2(8) - 7 = 16 - 7 = 9$.

4. Why not $7 - 2x = 9$: that says '2x less than 7', which is a different sentence. It would give $7 - 2x = 9 \rightarrow -2x = 2 \rightarrow x = -1$.

5. 'A less than B' always means $B - A$. The phrase reverses the reading order, which is why it catches so many people.

Watch for: Wrote $7 - 2x = 9$ by following the order of the words. The phrase 'less than' is the trap and it is worth memorising as $B - A$.

Exit Ticket

4 problems

Use: End of the equations lesson. 5–8 min, independent. Item 4's fixed-versus-per-unit distinction returns in the “Writing & solving inequalities” lesson. **Timing:** 5–8 min · independent. 5 – 3x on item 1 is the literal-translation error; it is about reading, not algebra.

1 $3x - 5 = 20$, giving $x = 25/3$

2 $x = 6$

3 $2x - 9 = 13$, so $x = 11$

4 $12 + 5m = 47$, so $m = 7$ miles

1 **MEDIUM** “5 less than 3 times a number is 20”

$3x - 5 = 20$, giving $x = 25/3$

1. ‘3 times a number’ is $3x$. ‘5 less than’ that means subtract 5 FROM it: $3x - 5$.
2. Equation: $3x - 5 = 20$.
3. Add 5: $3x = 25$. Divide by 3: $x = 25/3$, or $8\frac{1}{3}$.
4. Check: $3 \times 25/3 = 25$, and $25 - 5 = 20$.

Watch for: Wrote $5 - 3x = 20$ because 5 appears first in the sentence. ‘5 less than something’ always means that something minus 5.

2 **MEDIUM** Solve $4x + 7 = 31$

$x = 6$

1. Subtract 7 from both sides: $4x = 24$.
2. Divide both sides by 4: $x = 6$.
3. Check: $4(6) + 7 = 24 + 7 = 31$.

Watch for: Divided by 4 first, giving $x + 7 = 7.75$. Undo addition before multiplication — the reverse of how the expression was built.

3 **MEDIUM** Doubled, then 9 subtracted, gives 13

$2x - 9 = 13$, so $x = 11$

1. Doubled: $2x$. Then 9 subtracted: $2x - 9$.
2. Equation: $2x - 9 = 13$.
3. Add 9: $2x = 22$. Divide by 2: $x = 11$.
4. Check: $2(11) - 9 = 22 - 9 = 13$.

Watch for: Wrote $9 - 2x = 13$, reversing the subtraction.

4 **SPICY** Taxi: \$12 plus \$5 per mile, ride cost \$47

$12 + 5m = 47$, so $m = 7$ miles

1. Let m be the number of miles.
2. Fixed charge \$12, plus \$5 for each mile: $12 + 5m$.
3. Equation: $12 + 5m = 47$.
4. Subtract 12: $5m = 35$. Divide by 5: $m = 7$.
5. Check: $12 + 5(7) = 12 + 35 = 47$.
6. In words: the ride was 7 miles. Note the answer is a number of MILES, not dollars — say what the variable stands for.

Watch for: Wrote $12m + 5 = 47$, swapping the fixed charge and the rate. The \$12 is charged once; the \$5 repeats per mile, so it is the one attached to m .

Lesson slides

teaching notes & timing

Slide	Time	What to do
1	0:00	Frame it: the algebra is easy. Turning English into algebra is the hard part.
2	1:00	Hook — poll the two equations. Do NOT resolve. 5 – 3x wins on word order alone.
3	3:00	WE1 — resolve. Give them the rule as $B - A$ and have them say it back.
4	5:00	Solving, undoing in reverse. Connect to getting dressed and undressed if the class likes an analogy.
5	7:00	The check. Model it every single time; students mirror what you do, not what you say.
6	11:00	Fixed versus per-unit. Ask which number would change if the ride were twice as long.

8	8:30	CFU — all-student response. $12 + 5m = 47$, $m = 7$ miles. Watch for $12m + 5$. Whiteboards: everyone tries Mild, then climbs. These are #1, #3, #9 on the practice sheet.
9		Fingers up: 3 = got it, 2 = almost, 1 = not yet. Pull the 1s for a quick reteach while everyone else starts the practice sheet.
10	13:00	Launch the in-class practice sheet. Launch the practice sheet. Exit ticket in the last 5–8 minutes.