

GRADE 7 · EXPRESSIONS & EQUATIONS · ANSWER KEY

FACTORING & EXPANDING LINEAR EXPRESSIONS

Today's goal: I can expand linear expressions with rational coefficients and factor linear expressions with rational coefficients.



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

8 problems + Mr DJ's worked example

Use: During the lesson after the deck. Items 2–5 isolate what a single inner sign does. Item 8 is about the language of feedback as much as the maths. **Timing:** 15–25 min · pairs or independent · circulate on 5 and 9. For factoring, require the GCF to be written down before the bracket.

1 $12x + 8$ 2 $-6x - 21$ 3 $-6x + 21$ 4 $3x + 4$ 5 $10(2x + 3)$ 6 $3(3x - 5)$

7 Only the second term's sign — from -21 to $+21$ 8 Not wrong, but not complete — the full factoring is $10(2x + 3)$

1 **MILD** $4(3x + 2)?$

$12x + 8$

1. $4 \times 3x = 12x$; $4 \times 2 = 8$.

Watch for: Answered $12x + 2$.

2 **MEDIUM** $-3(2x + 7)?$

$-6x - 21$

1. $-3 \times 2x = -6x$; $-3 \times 7 = -21$.

2. Both terms become negative because both were multiplied by a negative.

Watch for: Answered $-6x + 21$ by flipping the second sign unnecessarily.

3 **MEDIUM** $-3(2x - 7)?$

$-6x + 21$

1. $-3 \times 2x = -6x$; $-3 \times (-7) = +21$.

Watch for: Answered $-6x - 21$ by ignoring the negative inside.

4 **MEDIUM** $1/2(6x + 8)?$

$3x + 4$

1. $1/2 \times 6x = 3x$; $1/2 \times 8 = 4$.

2. Multiplying by $1/2$ halves each term.

Watch for: Answered $3x + 8$ by halving only the first term.

5 **MEDIUM** Factor $20x + 30?$

$10(2x + 3)$

1. GCF of 20 and 30 is 10.

2. $20 \div 10 = 2$; $30 \div 10 = 3$.

3. Answer $10(2x + 3)$. The bracket $2x + 3$ shares no further factor.

Watch for: Answered $5(4x + 6)$ — correct but incomplete, since $4x + 6$ still shares a 2.

6 **MEDIUM** Factor $9x - 15?$

$3(3x - 5)$

1. GCF of 9 and 15 is 3.

2. $9 \div 3 = 3$; $-15 \div 3 = -5$.

3. Answer $3(3x - 5)$.

Watch for: Answered $3(3x - 15)$ by dividing only the first term.

7 **SPICY** What changed between 3 and 4?

Only the second term's sign — from -21 to +21

1. Question 2: $-3(2x + 7) = -6x - 21$. Question 3: $-3(2x - 7) = -6x + 21$.
2. The first terms are identical, because the $2x$ did not change.
3. The second terms differ because -3×7 is negative while $-3 \times (-7)$ is positive.
4. So one sign inside the bracket flips one sign in the answer — and only that one. It is not a global flip.
5. Students who change both terms are treating the sign as belonging to the bracket rather than to a single term.

Watch for: Said both terms changed. Only the term whose sign changed is affected.

8 **SPICY** Is $2(10x + 15)$ wrong?

Not wrong, but not complete — the full factoring is $10(2x + 3)$

1. Check it: $2(10x + 15) = 20x + 30$. Correct, so it is a genuine factoring.
2. But the bracket $10x + 15$ still has a common factor of 5, so more can be pulled out.
3. Taking that 5 out too: $2 \times 5 = 10$ outside, leaving $2x + 3$ inside $\rightarrow 10(2x + 3)$.
4. The bracket $2x + 3$ shares nothing, so this is complete.
5. Precision matters here: calling the student 'wrong' misdescribes what they did. They factored correctly and stopped early, which is a different thing to fix.

Watch for: Marked it simply wrong. It expands back correctly, so the issue is completeness, not correctness — and saying so tells the student what to do next.

Homework

7 problems + Mr DJ's worked example

Use: Parallels the practice sheet. Item 7 is the same limitation as the exit ticket's item 3, restated so students meet it twice — it is the idea most likely to be skimmed. **Timing:** ~15 min at home · independent · review item 7 as the next-day warm-up.

1 $12x + 30$

2 $-12x - 4$

3 $-12x + 4$

4 $3x - 2$

5 $12(2x + 3)$

6 $7(2x - 3)$

7 $24x + 36$ — it proves correctness, not completeness

1 **MILD** $6(2x + 5)?$

$12x + 30$

1. $6 \times 2x = 12x$; $6 \times 5 = 30$.

Watch for: Answered $12x + 5$.

2 **MEDIUM** $-4(3x + 1)?$

$-12x - 4$

1. $-4 \times 3x = -12x$; $-4 \times 1 = -4$.

Watch for: Answered $-12x + 4$.

3 **MEDIUM** $-4(3x - 1)?$

$-12x + 4$

1. $-4 \times 3x = -12x$; $-4 \times (-1) = +4$.

Watch for: Answered $-12x - 4$ by ignoring the inner negative.

4 **MEDIUM** $\frac{1}{3}(9x - 6)?$

$3x - 2$

1. $\frac{1}{3} \times 9x = 3x$; $\frac{1}{3} \times (-6) = -2$.

Watch for: Answered $3x - 6$ by scaling only the first term.

5 MEDIUM Factor $24x + 36$?

$12(2x + 3)$

1. GCF of 24 and 36 is 12.
2. $24 \div 12 = 2$; $36 \div 12 = 3$.
3. Answer $12(2x + 3)$.

Watch for: Answered $6(4x + 6)$ or $4(6x + 9)$ — correct but incomplete.

6 MEDIUM Factor $14x - 21$?

$7(2x - 3)$

1. GCF of 14 and 21 is 7.
2. $14 \div 7 = 2$; $-21 \div 7 = -3$.

Watch for: Answered $7(2x - 21)$ by dividing only the first term.

7 SPICY Expand $12(2x + 3)$ — what does the check prove?

$24x + 36$ — it proves correctness, not completeness

1. $12 \times 2x = 24x$ and $12 \times 3 = 36$, so we are back to $24x + 36$. The factoring is correct.
2. What it does NOT prove: that the factoring is complete.
3. The incomplete answer $6(4x + 6)$ also expands to $24x + 36$, so it would pass this same check.
4. To test completeness, look inside the bracket and ask whether its terms still share a factor. $4x + 6$ share 2, so that version is not finished; $2x + 3$ share nothing, so $12(2x + 3)$ is.
5. Two different questions, two different checks — expanding answers the first, inspecting the bracket answers the second.

Watch for: Concluded the expand check confirms everything. It is a good check for one thing and silent on the other, which is worth knowing precisely.

Exit Ticket

4 problems

Use: End of the factor/expand lesson. 5–8 min, independent. Item 4 gives students a self-check and, importantly, its limitation. **Timing:** 5–8 min · independent. $2(6x + 9)$ on item 3 is a partial credit answer worth discussing — correct but not complete.

1 $6x + 15$

2 $-8x + 6$

3 $6(2x + 3)$

4 $12x + 18$ — back to the start; the two operations are inverses

1 **MILD** Expand $3(2x + 5)$?

$6x + 15$

- $3 \times 2x = 6x$, and $3 \times 5 = 15$.
- Answer $6x + 15$.

Watch for: Answered $6x + 5$ by multiplying only the first term. The bracket means EVERYTHING inside is multiplied.

2 **MEDIUM** Expand $-2(4x - 3)$?

$-8x + 6$

- $-2 \times 4x = -8x$.
- $-2 \times (-3) = +6$ — two negatives multiply to a positive.
- Answer $-8x + 6$.

Watch for: Answered $-8x - 6$ by carrying the minus through without applying the sign rule to the second term.

3 **MEDIUM** Factor $12x + 18$ completely?

$6(2x + 3)$

- Find the greatest common factor of 12 and 18. Factors of 12: 1, 2, 3, 4, 6, 12. Of 18: 1, 2, 3, 6, 9, 18. The greatest shared factor is 6.
- $12 \div 6 = 2$ and $18 \div 6 = 3$.
- Answer $6(2x + 3)$.

Watch for: Answered $2(6x + 9)$ or $3(4x + 6)$. Both are correct factorings but not COMPLETE — $6x + 9$ still shares a factor of 3, and $4x + 6$ still shares a 2.

4 **SPICY** Expand $6(2x + 3)$

$12x + 18$ — back to the start; the two operations are inverses

- $6 \times 2x = 12x$ and $6 \times 3 = 18$, giving $12x + 18$.
- That is exactly the expression from question 3, so expanding has undone the factoring.
- Factoring and expanding are inverse operations, like multiplying and dividing.
- This gives a free check: after factoring, expand your answer. If you do not get back to where you started, something is wrong.
- It also catches incomplete factoring only if you check the GCF separately — $2(6x + 9)$ expands correctly back to $12x + 18$ too, so the expand check confirms correctness, not completeness.

Watch for: Said the check proves the factoring is complete. It proves it is correct; completeness needs the separate question of whether the bracket still has a common factor.

Lesson slides

teaching notes & timing

Slide	Time	What to do
1	0:00	Frame it: expanding and factoring are the same relationship read in opposite directions.
2	1:00	Hook — poll $6x + 5$ vs $6x + 15$. Do NOT resolve.
3	2:30	WE1 — resolve. Draw arrows from the 3 to BOTH terms; the picture does the work.
4	5:00	Signs. Connect back to the “Multiplying & dividing rational numbers” lesson explicitly — same rule, new setting.
5	7:00	WE2 — factoring, with GREATEST emphasised. Show $2(6x + 9)$ and ask what is still shareable.
6	11:30	The inverse relationship AND the limitation of the check. Both incomplete and complete factorings pass it.
7		Show the problem and the slip. Pairs: what went wrong, and what is the right answer? Take two answers before moving on.
8		Solve it together, one step at a time. It is also the worked example at the top of the practice sheet, so students can look back at it.
9	9:30	CFU — all-student response. $10(2x + 3)$. Watch for $5(4x + 6)$, which is correct but not complete. Whiteboards: everyone tries Mild, then climbs. These are #1, #2, #8 on the practice sheet.
10		Fingers up: 3 = got it, 2 = almost, 1 = not yet. Pull the 1s for a quick reteach while everyone else starts the practice sheet.
11	13:30	Launch the in-class practice sheet. Launch the practice sheet. Exit ticket in the last 5–8 minutes.