



Order of operations and grouping symbols

GRADE 5 MATH

Answer keys for the exit ticket and practice worksheet, plus notes for the lesson slides. Each answer shows the steps and the most likely wrong answer (“If wrong”), so you can tell what a mistake means, not just that it is one. Questions go from **fluency** to **application** to **reasoning**.

Exit Ticket — answer key

Use: End of the order-of-operations lesson. Item 3 is the diagnostic and it is deliberately not “evaluate this” — a child can get every calculation right and still hold the ladder belief, which will surface the first time subtraction comes before addition. What the answer must contain is the two RANKS, because that is the claim PEMDAS cannot supply from its letters. Note the shape of every wrong answer here: 35, 11 and 2 are all correct values of a BRACKETED version of the expression, so each one tells you precisely which grouping the child supplied. This is the “shortcuts that score full marks” thread — PEMDAS is its cleanest case, and it sits alongside underline-a-digit rounding in the “Rounding multi-digit numbers” sheet (Grade 4). It is also where the equal-sign thread from G1 OA-07 and G3 OA-04 lands: an expression is a structure, and it will have to be one for algebra to be possible at all.

Timing: 5–8 min · independent · no calculators.

1. $3 + 4 \times 5$ and $(3 + 4) \times 5$ **APPLICATION**

Answer: **23 and 35 — the brackets make $3 + 4$ into one number, so it gets multiplied instead of the 4 alone**

1. 4×5 is one number, 20, so the first expression is $3 + 20 = 23$.
2. With brackets, $3 + 4$ is one number, 7, so the second is $7 \times 5 = 35$.
3. The brackets changed WHICH part is a single quantity, and that is the only difference between them.

If wrong: Answered 35 for both. 35 is the right value of the bracketed expression, so the child read the unbracketed one left to right — the brackets were not misunderstood, they were unnecessary to the method being used.

2. Same rank: add and subtract FLUENCY

Answer: **17**

1. + and – are one rank, so work left to right.
2. $20 - 6 = 14$, then $14 + 3 = 17$.

If wrong: Answered 11 — the ladder reading of PEMDAS, doing A before S. 11 is the correct value of $20 - (6 + 3)$, so the child inserted brackets nobody wrote.

3. Same rank: multiply and divide FLUENCY

Answer: **8**

1. $\times$ and $\div$ are one rank, so work left to right.
2. $24 \div 6 = 4$, then $4 \times 2 = 8$.

If wrong: Answered 2 — M done before D. 2 is the correct value of $24 \div (6 \times 2)$, again brackets nobody wrote.

4. Rio's error REASONING

Answer: **$20 - 6 + 3 = 17$, because + and - are the SAME rank and are done left to right; PEMDAS lists A before S but does not mean addition outranks subtraction**

1. Left to right: $20 - 6 = 14$, then $14 + 3 = 17$.
2. Rio's 11 is the correct answer to $20 - (6 + 3)$, which is a different expression.
3. The acronym puts A before S because it has to put them in some order to be a word — not because addition wins.
4. The same is true of M and D: $24 \div 6 \times 2$ is 8, not 2. Two ranks, not four.

If wrong: Showed that 11 is wrong without saying what the rule really is. A child who only knows “11 is wrong here” will make the same error on the next one, because the mnemonic they are reasoning from is unchanged — naming the two ranks is what fixes it.

5. The nested expression REASONING

Answer: **9, doing (8 - 6) first because the bracket around it has to be a number before the one outside it can be**

1. Innermost first: $8 - 6 = 2$.
2. Then $3 \times 2 = 6$.
3. Then $12 + 6 = 18$.
4. Then $18 \div 2 = 9$.
5. Innermost had to be first because $[3 \times (8 - 6)]$ cannot be worked out while part of it is still an unfinished expression.

If wrong: Worked outside-in and got 15, adding $12 + 3$ first. The reason to go innermost-first is not a preference — the outer bracket is not yet a number, so there is nothing there to combine.

Quick answers for fast checking:

#	Level	Answer
1	application	23 and 35; the brackets change which part is one number
2	fluency	17
3	fluency	8
4	reasoning	17; + and – are one rank, left to right
5	reasoning	9; innermost first

Practice Worksheet — answer key

Use: In-class practice after the deck. Items 1–4 are paired on purpose: 1 against 2 and 3 against 4, so a child who reads left to right produces the SAME answer twice and can see it. Item 5 is the sheet's best item — the wrong answer to the first expression is the right answer to the second, printed directly beneath it. Item 7 is worth taking to the board: “because PEMDAS” is not an acceptable answer here, since PEMDAS recited as a ladder is exactly what produced the 2. Item 8 reverses the skill, which is the only item on the sheet a child cannot do by procedure alone.

Timing: 15–20 min · pairs · no calculators · items 5, 7 and 9 on the board.

1. $5 + 2 \times 8$ FLUENCY

Answer: **21**

1. 2×8 is one number, 16. Then $5 + 16 = 21$.

If wrong: Answered 56, reading left to right — which is the value of $(5 + 2) \times 8$, the very next item.

2. $(5 + 2) \times 8$ FLUENCY

Answer: **56**

1. The bracket makes $5 + 2$ one number, 7. Then $7 \times 8 = 56$.

If wrong: Answered 21, ignoring the brackets — the same value as item 1, which is the signal that the symbols were not used.

3. $30 - 12 \div 4$ FLUENCY

Answer: **27**

1. $12 \div 4$ is one number, 3. Then $30 - 3 = 27$.

If wrong: Answered 4.5, reading left to right: $30 - 12 = 18$, then $18 \div 4$. A non-whole answer on a sheet of whole numbers is itself worth noticing.

4. $40 \div (2 + 3)$ FLUENCY

Answer: **8**

1. The bracket makes $2 + 3$ one number, 5. Then $40 \div 5 = 8$.

If wrong: Answered 23, which is $40 \div 2 + 3$ — the brackets were seen and then not honoured.

5. $100 - 15 + 5$ against $100 - (15 + 5)$ APPLICATION

Answer: **90 and 80 — different because the brackets make $15 + 5$ into one number, 20, and 20 is taken away all at once**

1. $100 - 15 + 5$: same rank, left to right. $100 - 15 = 85$, then $85 + 5 = 90$.

2. $100 - (15 + 5)$: the bracket is 20, so $100 - 20 = 80$.

3. In the first, the $+ 5$ is added ON. In the second, the 5 joins the amount being taken AWAY, so it counts against you twice over — hence 10 lower.

If wrong: Gave 80 for both. 80 is the correct value of the bracketed expression, so this names the error exactly: brackets were supplied where none were written.

6. $[(6 + 4) \times 3] - 5$ APPLICATION

Answer: **25**

1. Innermost: $6 + 4 = 10$.
2. Then $10 \times 3 = 30$.
3. Then $30 - 5 = 25$.

If wrong: Answered $6 + (4 \times 3) - 5 = 13$, treating the inner bracket as though it were not there.

7. $36 / 9 \times 2$ REASONING

Answer: **8 — because $\times$ and $/$ are the same rank, so they are done left to right: $36 / 9 = 4$, then $4 \times 2 = 8$**

1. $36 \div 9 = 4$, then $4 \times 2 = 8$.
2. The child who says 2 has done 9×2 first, which is $36 \div (9 \times 2)$.
3. The rule that settles it: $\times$ and $\div$ are one rank, and same-rank operations go left to right.
4. So the M in the mnemonic does not outrank the D — they are the same step.

If wrong: Chose 8 by feel, or said “because PEMDAS”. PEMDAS is what produced the 2, so citing it settles nothing — the one-rank claim is the part that does.

8. Brackets to make 20 APPLICATION

Answer: **$(2 + 3) \times 4 = 20$; without brackets it is 14**

1. Without brackets: $3 \times 4 = 12$, then $2 + 12 = 14$.
2. To reach 20 the addition must happen first, so it needs to be one number: $(2 + 3) = 5$.
3. Then $5 \times 4 = 20$.

If wrong: Wrote $2 + (3 \times 4)$, which is 14 — brackets placed around what was going to happen first anyway, so they change nothing. Brackets only do work when they OVERRIDE the ranks.

9. Why agree an order REASONING

Answer: **because otherwise the same written expression has several values, so it does not name a number at all**

1. $3 + 4 \times 5$ gives 23 one way and 35 another; both are defensible readings of the marks on the page.
2. If both stand, the expression is ambiguous and cannot be used to record anything.
3. The convention is not a mathematical fact; it is an agreement, which is why it has to be taught rather than discovered.
4. Brackets exist so you can override the agreement and say what you mean when the default is not it.

If wrong: Said “so you get the right answer”. That assumes there is one already, which is the thing at issue — the point is that without the agreement there is no right answer to get.

Quick answers for fast checking:

#	Level	Answer
1	fluency	21
2	fluency	56
3	fluency	27
4	fluency	8
5	application	90 and 80
6	application	25
7	reasoning	8; $\times$ and $\div$ are one rank
8	application	$(2 + 3) \times 4$; 14 without
9	reasoning	otherwise the expression names no single number

Lesson slides — teaching notes & timing

Mini-lesson slides, then the practice worksheet. Slide numbers match the deck.

Slide	~Time	Note
1/8	0:00	Frame the whole lesson as structure against sequence. An expression has PARTS, and the parts are what the symbols tell you about — reading it as a list of things to do in written order is the habit being replaced.
2/8	0:45	Take 35 seriously rather than crossing it out. It is the answer to a different expression, and a child who gave it followed a rule that works everywhere else in their reading life.
3/8	1:30	The sentence that does the work: 4×5 is already ONE number. Say it as $3 + 20$ out loud — nobody argues with $3 + 20$.

4/8	2:30	THE slide. Ask the class for $20 - 6 + 3$ by show of hands before saying anything. Expect a real split. Then note that PEMDAS did not stop the 11 — the acronym lists six letters and says nothing about ranks, so a child cannot get this from the letters alone.
5/8	3:45	The two claims worth writing on the board and keeping there: $\times$ and $\div$ are one rank; $+$ and $-$ are one rank; same rank means left to right.
6/8	4:45	Brackets as a claim about what is one number. The 23 answer is worth showing: the child SAW the brackets and then evaluated as though they were absent.
7/8	5:45	Work the nested example on the board slowly and name why innermost goes first — the outer bracket is not a number yet. Do the outermost-first version too, get 15, and let the disagreement stand as the reason a convention exists.
8/8	7:00	The $100 - 15 + 5$ pair is the exit ticket's spine: the wrong answer to the first IS the right answer to the second. Then the bracket-insertion task, which reverses the whole skill. Exit ticket after.