

Chapter 8 — Order of Operations

Teacher Chapter-at-a-Glance

Materials

No special materials required. Display the Order Ladder where students can refer to it.

Talk Prompt

Display $30 \div 5 \times 4$. Ask which operation should happen first and require a reason before calculating.

If Ready-to-Learn Reveals a Gap

If Ready-to-Learn reveals a gap, rebuild multiplication-before-addition and division-before-addition with short examples before introducing brackets and exponents.

Mastery Decision Guide

What a missed Tripwire item actually means, and what to do about it before moving on.

Missed Tripwire #1 → Treating multiplication as more important than division (Mistake 2).

$30 \div 5 \times 4$ rewritten as $30 \div (5 \times 4)$ signals this error. Review before the next chapter.

Missed Tripwire #2 → Treating subtraction as more important than addition (Mistake 3). $8 +$

$5 - 6$ calculated as -3 signals this error. Review before the next chapter.

Ready-to-Learn Check

Quick check before starting. A wrong answer below points to a specific gap worth closing first, not just a miss to shrug off.

1. Evaluate: $17 - 8 + 3$

Correct answer: 12

Likely wrong answer: 6

Misconception: Treats subtraction as automatically more important than addition.

Next move: Calculate left to right: $17 - 8 = 9$, then $9 + 3 = 12$.

2. Evaluate: $5 + 6 \times 2$

Correct answer: 17

Likely wrong answer: 22

Misconception: Works strictly left to right even when multiplication must come first.

Next move: Identify the multiplication sign and complete 6×2 before adding 5.

3. Evaluate: $28 \div 7 + 6$

Correct answer: 10

Likely wrong answer: 2

Misconception: Adds brackets that are not present, or ignores division priority.

Next move: Circle division first: calculate $28 \div 7$, then add 6.

4. Evaluate: $5^2 - 9$

Correct answer: 16

Likely wrong answer: 4

Misconception: Treats the exponent as if it applies after subtraction.

Next move: Evaluate 5^2 first, then subtract 9.

Common Mistakes

Students often run into the same kinds of trouble with this topic. Recognizing these patterns helps avoid them.

Comparing 0.86 and 0.809 by Place Value

	Ones		Tenths	Hundredths	Thousandths
0.86	0	.	8	6	0
0.809	0	.	8	0	9

Ones tie. Tenths tie. Hundredths decide it: $6 > 0$, so $0.86 > 0.809$.

$(2 + 3) \times 4$ and $2 + (3 \times 4)$ use the same numbers but different bracket placement.

Mistake 1: Working strictly left to right

What students do: Evaluating every expression from the first symbol to the last.

Why this happens: Expressions can look like a line of instructions.

What to do instead: Check brackets, then exponents, then multiplication or division, then addition or subtraction.

Diagnostic trigger: $5 + 6 \times 2$ calculated as 22 signals this error.

Mistake 2: Treating multiplication as more important than division

What students do: Multiplying before dividing in an expression such as $30 \div 5 \times 4$.

Why this happens: The phrase "multiply before divide" is incomplete.

What to do instead: Multiplication and division share equal priority. Read left to right.

Diagnostic trigger: $30 \div 5 \times 4$ rewritten as $30 \div (5 \times 4)$ signals this error.

Mistake 3: Treating subtraction as more important than addition

What students do: Grouping later numbers as though brackets were present.

Why this happens: Students mistake BEDMAS for a strict ranking inside each operation pair.

What to do instead: Addition and subtraction share equal priority. Work left to right.

Diagnostic trigger: $8 + 5 - 6$ calculated as -3 signals this error.

Mistake 4: Ignoring brackets

What students do: Evaluating an expression as though brackets are not present.

Why this happens: Brackets can look like decoration rather than an instruction.

What to do instead: Complete all work inside brackets before looking outside them.

Diagnostic trigger: $(13 - 4) \times 2$ calculated as 5 signals this error.

Mistake 5: Ignoring an exponent until the end

What students do: Adding, subtracting, multiplying, or dividing before evaluating a power.

Why this happens: The exponent is small and easy to skip past visually.

What to do instead: After brackets, evaluate every exponent before other operations.

Diagnostic trigger: $5^2 - 9$ calculated by subtracting first signals this error.

Practice

Teacher solutions follow this practice set.

1. Evaluate: $13 + 2 \times 4$
2. Evaluate: $25 - 4 \times 5$
3. Evaluate: $(9 + 3) \times 2$
4. Evaluate: $24 \div (8 - 2)$
5. Evaluate: $5^2 - 10$
6. Evaluate: $2 + 3^2 \times 2$
7. Evaluate: $56 \div 7 \times 3$
8. Evaluate: $31 - 12 + 4$
9. Evaluate: $[12 + 6] \div 3 + 5$
10. Evaluate: $2.4 + 10 \div 5$
11. Evaluate: $-7 + 4 \times 5$
12. Evaluate: $18 \div 3 - 2^2$

Practice Solutions

Use these concise solutions to check the method as well as the final answer.

1. Evaluate: $13 + 2 \times 4$
Solution: $13 + 2 \times 4 = 13 + 8 = 21$.
2. Evaluate: $25 - 4 \times 5$
Solution: $25 - 4 \times 5 = 25 - 20 = 5$.
3. Evaluate: $(9 + 3) \times 2$
Solution: $(9 + 3) \times 2 = 12 \times 2 = 24$.
4. Evaluate: $24 \div (8 - 2)$
Solution: $24 \div (8 - 2) = 24 \div 6 = 4$.
5. Evaluate: $5^2 - 10$
Solution: $5^2 - 10 = 25 - 10 = 15$.
6. Evaluate: $2 + 3^2 \times 2$
Solution: $2 + 3^2 \times 2 = 2 + 9 \times 2 = 2 + 18 = 20$.

7. Evaluate: $56 \div 7 \times 3$

Solution: $56 \div 7 \times 3 = 8 \times 3 = 24$; division and multiplication are completed from left to right.

8. Evaluate: $31 - 12 + 4$

Solution: $31 - 12 + 4 = 19 + 4 = 23$; subtraction and addition are completed from left to right.

9. Evaluate: $[12 + 6] \div 3 + 5$

Solution: $[12 + 6] \div 3 + 5 = 18 \div 3 + 5 = 6 + 5 = 11$.

10. Evaluate: $2.4 + 10 \div 5$

Solution: $2.4 + 10 \div 5 = 2.4 + 2 = 4.4$.

11. Evaluate: $-7 + 4 \times 5$

Solution: $-7 + 4 \times 5 = -7 + 20 = 13$.

12. Evaluate: $18 \div 3 - 2^2$

Solution: $18 \div 3 - 2^2 = 6 - 4 = 2$.

Tripwire Check

These questions test whether the thinking is solid — not just whether the procedure was memorized. Each wrong answer below points to a specific misconception, not just "try again."

1. Evaluate: $42 \div 7 \times 3$. Show each step and explain why multiplication does not come first.

Correct answer: 18. Division and multiplication share equal priority; work left to right.

Likely wrong answer: 2, from multiplying 7×3 first.

Misconception: Treats multiplication as automatically more important than division.

Next move: Return to Worked Example 4. Read the operation signs left to right.

2. A student says $8 + 5 - 6 = -3$ because subtraction comes before addition. Explain the error and calculate correctly.

Correct answer: 7. Addition and subtraction share equal priority; work left to right.

Likely wrong answer: -3, from adding 5 and 6 as if subtraction had to happen first.

Misconception: Treats subtraction as more important than addition.

Next move: Use the Order Ladder. Addition and subtraction are completed left to right.

Answer Key — Worksheets (Full Diagnostic)

Worksheet A: Guided Practice

1. Evaluate: $8 + 2 \times 4$

1. 16. Likely wrong answer: 40 (adds before multiplying). Misconception: Addition is performed before multiplication instead of after.

2. Evaluate: $26 - 4 \times 5$

2. 6. Likely wrong answer: 110 (subtracts before multiplying). Misconception: Subtraction is performed before multiplication instead of after.

3. Evaluate: $(6 + 5) \times 2$

3. 22. Likely wrong answer: 16 (multiplies only the first number inside the bracket). Misconception: The multiplier outside the bracket is applied to only one of the two terms inside.

4. Evaluate: $35 \div 7 + 9$

4. 14. Likely wrong answer: $44/7$ or a miscalculated single fraction (adds before dividing). Misconception: Addition is performed before division instead of after.

5. Evaluate: $14 - 12 \div 3$

5. 10. Likely wrong answer: $2/3$ (subtracts before dividing). Misconception: Subtraction is performed before division instead of after.

6. Evaluate: $28 \div (11 - 4)$

6. 4. Likely wrong answer: $28/11 - 4$, or a value from dividing before subtracting. Misconception: The bracket is not completed before the division is applied.

7. Evaluate: $2^4 + 6$

7. 22. Likely wrong answer: 14 (multiplies the base by the exponent instead of repeated multiplication). Misconception: The exponent is read as a multiplier on the base rather than as repeated multiplication.

8. Evaluate: $45 \div 9 \times 4$

8. 20. Likely wrong answer: 1.25 (divides in the wrong order, right to left). Misconception: Left-to-right order for same-priority operations is not followed.

9. Evaluate: $3 + 5^2$

9. 28. Likely wrong answer: 64 (multiplies 3 by 5 before squaring, instead of squaring 5 first). Misconception: The order of the exponent relative to the addition is reversed.

10. Evaluate: $8 \times 5 \div 4$

10. 10. Likely wrong answer: 6.4 (divides before multiplying, right to left). Misconception: Left-to-right order for same-priority operations is not followed.

11. Evaluate: $5.6 + 12 \div 4$

11. 8.6. Likely wrong answer: 4.4 (adds before dividing). Misconception: Addition is performed before division instead of after.

12. Evaluate: $19 - 8 + 6$

12. 17. Likely wrong answer: 5 (subtracts the total instead of working left to right). Misconception: Same-priority operations are grouped incorrectly instead of applied left to right.

13. Evaluate: $4 + 13 - 9$

13. 8. Likely wrong answer: -18 (subtracts before adding, right to left). Misconception: Left-to-right order for same-priority operations is not followed.

14. Evaluate: $2.5 \times 4 - 3$

14. 7. Likely wrong answer: 3.5 (subtracts before multiplying). Misconception: Subtraction is performed before multiplication instead of after.

15. Explain why $9 + 3 \times 4$ is not equal to 48.

15. $9 + 3 \times 4 = 9 + 12 = 21$, not 48. Multiplication happens before addition. Likely wrong answer: explains only that the answer is 21, without naming which operation goes first. Misconception: The explanation gives the correct value but doesn't identify the rule (multiplication before addition) that makes it correct.

Worksheet B: Independent Practice

1. Evaluate: $14 + 6 \times 4$

1. 38. Likely wrong answer: 80 (adds before multiplying). Misconception: Addition is performed before multiplication instead of after.

2. Evaluate: $40 - 7 \times 3$

2. 19. Likely wrong answer: 99 (subtracts before multiplying). Misconception: Subtraction is performed before multiplication instead of after.

3. Evaluate: $(9 + 7) \times 3$

3. 48. Likely wrong answer: 34 (multiplies only the first number inside the bracket). Misconception: The multiplier outside the bracket is applied to only one of the two terms inside.

4. Evaluate: $63 \div 7 + 8$

4. 17. Likely wrong answer: a miscalculated value from adding before dividing. Misconception: Addition is performed before division instead of after.

5. Evaluate: $35 - 24 \div 6$

5. 31. Likely wrong answer: 1.83 or a miscalculated value from subtracting before dividing. Misconception: Subtraction is performed before division instead of after.

6. Evaluate: $45 \div (11 - 6)$

6. 9. Likely wrong answer: a value from dividing before completing the bracket. Misconception: The bracket is not completed before the division is applied.

7. Evaluate: $6^2 - 7$

7. 29. Likely wrong answer: 29 read as if 6×2 rather than 6 squared. Misconception: The exponent is read as a multiplier on the base rather than as repeated multiplication.

8. Evaluate: $54 \div 9 \times 5$

8. 30. Likely wrong answer: divides in the wrong order, right to left. Misconception: Left-to-right order for same-priority operations is not followed.

9. Evaluate: $30 - 4^2$

9. 14. Likely wrong answer: reads 4^2 as 4×2 instead of 4×4 . Misconception: The exponent is read as a multiplier on the base rather than as repeated multiplication.

10. Evaluate: $8 \times 7 \div 4$

10. 14. Likely wrong answer: divides before multiplying, right to left. Misconception: Left-to-right order for same-priority operations is not followed.

11. Evaluate: $4.8 + 15 \div 5$

11. 7.8. Likely wrong answer: adds before dividing. Misconception: Addition is performed before division instead of after.

12. Evaluate: $26 - 11 + 8$

12. 23. Likely wrong answer: subtracts the total instead of working left to right. Misconception: Same-priority operations are grouped incorrectly instead of applied left to right.

13. Evaluate: $12 + 15 - 19$

13. 8. Likely wrong answer: subtracts before adding, right to left. Misconception: Left-to-right order for same-priority operations is not followed.

14. Evaluate: $7.2 - 18 \div 6$

14. 4.2. Likely wrong answer: subtracts before dividing. Misconception: Subtraction is performed before division instead of after.

15. Evaluate: $-5 + 7 \times 4$

15. 23. Likely wrong answer: adds the negative before multiplying. Misconception: Addition is performed before multiplication instead of after, even with a negative starting value.

16. Evaluate: $16 - 3 \times 9$

16. -11. Likely wrong answer: subtracts before multiplying. Misconception: Subtraction is performed before multiplication instead of after.

17. Evaluate: $(18 - 5) \times 2^2$

17. 52. Likely wrong answer: multiplies before completing the bracket, or squares the wrong number. Misconception: The bracket is not completed first, or the exponent is applied to the wrong part of the expression.

18. Evaluate: $64 \div 2^4 + 11$

18. 15. Likely wrong answer: reads 2^4 as 2×4 instead of repeated multiplication.
Misconception: The exponent is read as a multiplier on the base rather than as repeated multiplication.

19. Evaluate: $[27 - (8 + 4)] \times 2$

19. 30. Likely wrong answer: completes only part of the inner bracket before subtracting.
Misconception: One of the two nested bracket operations is skipped before moving to the outer calculation.

20. Evaluate: $3 + 2 \times (11 - 7)$

20. 11. Likely wrong answer: adds before completing the bracket and multiplying.
Misconception: The bracket and multiplication are not completed before the addition.

Worksheet C: Mixed Application

1. A student evaluates $16 - 3 \times 4$ as 52. Explain the mistake and find the correct value.

1. $16 - 3 \times 4 = 16 - 12 = 4$. Likely wrong answer: 52. Misconception: Subtraction is performed before multiplication. Next move: Circle 3×4 before doing any calculation.

2. A phone plan charges a base fee of \$8 plus \$3 for each of 5 extra data blocks. Write and evaluate an expression for the total charge.

2. $8 + 3 \times 5 = 23$. Total: \$23. Likely wrong answer: $(8+3) \times 5 = 55$ (adds the base fee and rate before multiplying by the number of blocks). Misconception: The base fee and the per-unit rate are combined before the rate is multiplied by the quantity.

3. Evaluate: $(22 - 8) \div 2 + 9$

3. 16. Likely wrong answer: a value from dividing before completing the bracket.
Misconception: The bracket is not completed before the division is applied.

4. Evaluate: $5 + 4^2 \times 2$

4. 37. Likely wrong answer: reads 4^2 as 4×2 instead of 4×4 , or multiplies before squaring.
Misconception: The exponent is read as a multiplier on the base rather than as repeated multiplication.

5. Evaluate: $63 \div 9 \times 2 - 5$

5. 9. Likely wrong answer: divides and multiplies out of left-to-right order.
Misconception: Left-to-right order for same-priority operations is not followed.

6. Evaluate: $18.4 - 12 \div 3$

6. 14.4. Likely wrong answer: subtracts before dividing. Misconception: Subtraction is performed before division instead of after.

7. A student evaluates $28 \div 4 \times 3$ as $7/3$. Explain the error and find the correct value.

7. 21. Division and multiplication must be completed left to right: $(28 \div 4) \times 3$, not $28 \div (4 \times 3)$.

8. Evaluate: $-9 + 2^3 \times 3$

8. 15. Likely wrong answer: adds before evaluating the exponent and multiplying.
Misconception: Addition is performed before the exponent and multiplication are completed.

9. A rectangular garden has a length of 12 m and a width of 4 m. A 5 m path is added along one side. Evaluate $12 \times 4 + 5$.

9. 53. Likely wrong answer: adds before multiplying the two dimensions. Misconception: Addition is performed before multiplication instead of after.

10. Evaluate: $50 - (6 + 2) \times 4$

10. 18. Likely wrong answer: subtracts before completing the bracket and multiplying.
Misconception: The bracket and multiplication are not completed before the subtraction.

11. Evaluate: $81 \div 9 + 4^2$

11. 25. Likely wrong answer: reads 4^2 as 4×2 , or divides and adds out of order.
Misconception: The exponent is read as a multiplier on the base rather than as repeated multiplication.

12. A student begins $7 + 18 \div 3 - 2$ by adding 7 and 18. Explain why this is not allowed, then calculate correctly.

12. Division must happen before addition: $18 \div 3 = 6$, then $7 + 6 = 13$, then $13 - 2 = 11$.

13. Evaluate: $[30 - 2 \times (9 + 3)] \div 2$

13. 3. Likely wrong answer: completes only part of the nested brackets before dividing. Misconception: One of the two nested bracket operations is skipped before moving to the outer calculation.

14. Non-Routine: Use the numbers 2, 3, and 4 to create two expressions with different bracket placement and different values. Show both evaluations.

14. Answers vary. Example: $(2 + 3) \times 4 = 20$ and $2 + (3 \times 4) = 14$. Likely wrong answer: two expressions with identical bracket placement and value. Misconception: Brackets are treated as decoration. Next move: Identify the first operation in each expression.

15. Non-Routine: Place one pair of brackets in $6 + 2 \times 5 - 3$ so that the value is 37. Show your evaluation.

15. $(6 + 2) \times 5 - 3 = 37$. Brackets make $6 + 2$ happen first: $8 \times 5 = 40$, then $40 - 3 = 37$. Likely wrong answer: 13 from leaving the expression unchanged. Misconception: Brackets are treated as decoration rather than changing the first operation. Next move: Test possible bracket positions and record which one changes the first operation.

Answer Key — Exit Ticket

1. 21.
2. 16.
3. 11.