Group First, Then Solve Inside Out

Teacher		**Class**	Grade 5
Subject	Math	**Topic**	Order of operations
Date		**Room**	
Lesson length	60 minutes	**Country**	United States

Students learn to use parentheses, brackets, and braces to show what to solve first. They evaluate expressions by working from the inside out.

Curriculum links

- Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

Learning objectives

- Students will evaluate expressions with parentheses, brackets, and braces.
- Students will solve the innermost group first and work outward stepwise.
- Students will use grouping symbols to show which part to solve first.

Success criteria

- I can find and solve the innermost group first.
- I can rewrite each step until no groups are left.
- I can evaluate expressions with ( ), [ ], and { } correctly.

What students already know

Ask: What is 2 + 3 x 4? Have students show answers on fingers. Note who does 2 + 12 = 14 and who does 5 x 4 = 20.

Key words

parentheses	curved marks ( ) that keep numbers together to solve first
brackets	square marks [ ] that group a bigger part outside the curved marks
braces	curly marks { } that group the biggest part outside the square marks
innermost	the group tucked deepest inside that you solve first [2]
evaluate	to work out the steps and find the answer

Materials

- plastic nesting cups or bowls, 3 per group
- sticky notes and markers
- whiteboard and markers
- Slides 1-4, Slide 6, Slide 9, Slides 10-11
- Video clip 4 (0:00–5:00) on Slide 6
- printed Worksheet Tasks B-C, one per student
- number cards for cups
- scrap paper

Before the lesson

- Print Worksheet Tasks B-C, one per student plus spares
- Test Slides 1-4, 6, 9-11 and Video clip 4 (0:00–5:00) sound and picture
- Label sets of 3 cups with ( ), [ ], { } using sticky notes and nest them
- Make number cards for 2 x [3 + (4 - 1)] and {6 + [2 x (3 + 1)]}
- Set desks for groups of 3-4 with whiteboard space clear

Lesson outline

0–5 min **Starter** 5 min · Whole class

Hook students and recall that grouping changes the answer.

YOU DO

1. Hold up three cups stuck inside each other and wiggle the smallest one.
2. Show Slides 1-2 and read the fact about grouping symbols.
3. Ask the class to solve 2 + 3 x 4 with no groups, then (2 + 3) x 4.
4. Connect cups to math: we open the smallest container first.

STUDENTS DO

1. Look at the cups and predict how to reach the middle.
2. Solve 2 + 3 x 4 and (2 + 3) x 4 on scrap paper and hold up answers.
3. Tell a partner why the answers 14 and 20 are different.

Say: I have three containers stuck inside each other. How do we get to the tiny one in the middle? Math grouping symbols work the same way. The smallest group inside is the job we do first.

Ask: What is 2 + 3 x 4 with no groups? (14, because 3 x 4 = 12 first, then 2 + 12) · What is (2 + 3) x 4? (20, because (2 + 3) = 5 first, then 5 x 4)

Check understanding: Hands up for 14 and for 20 on each problem. If mixed, solve both on the whiteboard before moving on.

Support: Show both problems side by side and point to what to do first in each. **Stretch:** Ask what would happen if we put brackets around 3 x 4: 2 + [3 x 4].

Use: Slides 1-2

5–20 min **Teaching** 15 min · Whole class

Model solving innermost parentheses first, then brackets, then braces.

YOU DO

1. Show Slides 3-4 and model the three steps: innermost first, write the new number back, repeat.
2. Play Video clip 4 (0:00–5:00) on Slide 6. Tell students to listen for do-inside-first.
3. Model 2 x [3 + (4 - 1)] on the whiteboard using cups to cover and uncover.
4. Repeat with whole numbers to build fluency with whole number operations expected in Grade 5 [2].

STUDENTS DO

1. Watch the video and raise a hand when they hear do-inside-first.
2. Copy the three steps for the model and circle the group done first.
3. Chorally say next step with the teacher for the second model.

Say: Find the group hugging numbers with nothing inside it. Solve that tiny job, write the new number back in its place, then repeat. We go ( ) first, then [ ], then { }. Always work inside out.

Worked example: 2 x [3 + (4 - 1)]: Step 1 (4 - 1) = 3. Step 2 [3 + 3] = 6. Step 3 2 x 6 = 12. Answer 12 with steps rewritten each time.

Ask: In 2 x [3 + (4 - 1)], what do we solve first and why? ((4 - 1) because it is the innermost group with nothing inside it) · After (4 - 1) = 3, what does the problem look like? (2 x [3 + 3]) · In {6 + [2 x (3 + 1)]}, what is the order of groups? ((3 + 1) first, then [2 x 4], then {6 + 8} = 14)

Check understanding: Mini whiteboards: students write the first step only for {6 + [2 x (3 + 1)]}. Reteach innermost if many miss (3 + 1).

Support: Point to the innermost pair and ask, Which pair is hugging numbers with nothing inside it? **Stretch:** Ask students to predict what changes if the braces were removed.

Use: Slides 3-4, Slide 6, Video clip 4 (0:00–5:00)

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20–40 min **Main Activity - Nest Inside Out** 20 min · Groups

Evaluate three-level expressions by lifting groups from inside out.

YOU DO

1. Give each group 3 labeled cups, number cards, sticky notes, and scrap paper.
2. Show 2 x [3 + (4 - 1)]. Have groups build it with cups and lift to solve inside out.
3. Circulate as groups repeat with {6 + [2 x (3 + 1)]} and write three steps with answer circled.
4. Stop halfway for one group to demo rewriting the expression with the new number.

STUDENTS DO

1. Label and nest cups ( ), [ ], { } with a number card inside.
2. Lift cups in order to solve innermost first, then brackets, then braces.
3. Write the three steps in order with the answer circled.

Say: Build the problem with your cups. Cover everything except the tiniest job. Do that job, write the new number back in, then uncover the next cup. Show all three steps and circle your answer.

Worked example: {6 + [2 x (3 + 1)]}: Step 1 (3 + 1) = 4. Step 2 [2 x 4] = 8. Step 3 {6 + 8} = 14. Answer 14.

Ask: Which cup do you lift first? (The ( ) cup in the middle, the innermost group) · What do you do after you solve (4 - 1) = 3? (Write 3 back in and the problem becomes 2 x [3 + 3])

Check understanding: Collect step sheets and check circled answers 12 and 14. Have groups fix missing rewrite step on the spot.

Support: Give cards with the innermost step already highlighted in color. **Stretch:** Add a second operation inside, like [(2 + 3) x (4 - 1)].

40–52 min **Practice in Pairs** 12 min · Pairs

Apply the inside-out method to evaluate grouped expressions.

YOU DO

1. Show Slide 9 and set the task: solve innermost first, write each new step, circle first group.
2. Hand out Worksheet Tasks B-C for paired practice with whole number operations [2].
3. Circulate, asking pairs to point to the group they did first.
4. Pick two pairs to read steps aloud for checking.

STUDENTS DO

1. In pairs, evaluate four expressions and show each step below the last.
2. Circle the group done first in each problem.
3. Check answers with another pair and fix any skipped rewrite.

Say: Work with your partner. Find the smallest group first and circle it. Solve it, write the new step below, and keep going until no groups are left. Show every step.

Ask: How do you evaluate the innermost part first in Task C with brackets and braces to group larger parts? (Find the ( ) inside first, solve it, then work out to [ ] and { }) · Why must you write the new number back in? (So the next step uses the right value and nothing is skipped)

Check understanding: Scan Slide 9 work for circled first step and rewritten lines. Pull a small group for reteach if rewriting is missing.

Support: Provide a three-box frame labeled first, next, last for each expression. **Stretch:** Ask pairs to place ( ) in 20 - 6 + 2 x 2 to make the largest possible answer and prove it.

Use: Slide 9, Worksheet Tasks B-C

52–60 min **Plenary** 8 min · Whole class

Confirm students can evaluate expressions inside out.

YOU DO

1. Show Slide 10 and have class read the big idea together.
2. Show Slide 11 quiz one at a time for think-pair-share.
3. Cold-call students to explain steps for 10 - [4 - (1 + 1)].
4. Link back to objectives and give exit ticket.

STUDENTS DO

1. Read the big idea and answer quiz questions with a partner.
2. Show answers on fingers and explain first step aloud.
3. Complete exit ticket on scrap paper.

Say: Always solve the inside group first, then work outward. Tell your partner the order for {2 + [3 x (4 - 1)]}. What is the very first tiny job?

Worked example: 10 - [4 - (1 + 1)]: (1 + 1) = 2, then 4 - 2 = 2, then 10 - 2 = 8. Answer 8.

Ask: (5 + 3) x 2 = ? (16, because 8 x 2) · What to do first in {2 + [3 x (4 - 1)]}? ((4 - 1))

Check understanding: Exit tickets sorted into got it / almost. Reteach innermost finding tomorrow if many miss question 3.

Support: Let students whisper the first step to a partner before answering aloud. **Stretch:** Ask: why does 10 - [4 - (1 + 1)] = 8 and not 7?

Use: Slides 10-11

Common mistakes

Mistake	How to spot it	How to fix it
Solving left to right and ignoring groups	Student does 2 + 3 first in 2 + 3 x 4 and gets 20	Cover all but the multiplication, solve it, then uncover. Groups and then x/÷ come before +/– [2]
Solving the outer brackets or braces first	In {6 + [2 x (3 + 1)]} student tries [2 x 3] first	Ask which pair hugs numbers with nothing inside it. Only (3 + 1) qualifies, so do it first
Not rewriting the expression after each step	Steps jump from (4 - 1) to answer 12 with no middle [3 + 3]	Require write the new number back in and repeat until no groups are left

Support

- Give cards with the innermost step already highlighted in color.
- Provide a three-box frame labeled first, next, last for each expression.

Stretch

- Add a second operation inside, like [(2 + 3) x (4 - 1)].
- Ask students to place ( ) to make the largest possible answer and prove it.

For the LSE or teaching assistant

Stay with the Nest Inside Out groups. Prompt innermost finding, check rewriting after each lift, and use highlighted cards for students who need it.

Check for understanding

Question	Answer
(5 + 3) x 2 = ? Show first step.	16; first step (5 + 3) = 8
10 - [4 - (1 + 1)] = ? Show steps.	8; (1+1)=2, 4-2=2, 10-2=8
What do you solve first in {2 + [3 x (4 - 1)]}?	(4 - 1)

Homework

Evaluate {20 - [(3 + 2) x 2]}. Show each step and circle the group you did first.

Sources

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