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MN Standard 9.3.5.8

ALGEBRA 1 · UNIT 1: EXPRESSIONS · LESSON 10 · TEACHER EDITION

Teacher Edition: U1 L10 The Distributive Property

Course: Algebra 1 | **Unit:** 1 (Expressions) | **Lesson:** 10/17 **Standards:** MN 9.3.5.7, 9.3.5.8 **Objectives:** Apply the distributive property to expand and simplify algebraic expressions. Identify equivalent expressions by distributing constants across parentheses. Connect algebraic manipulation to real-world assembly and agricultural contexts. **Key Vocabulary:** Distributive Property, Equivalent Expressions, Coefficient, Like Terms, Parentheses

1 📋 MATERIALS CHECKLIST

[ ] Student Worksheet: `U1L10 DistributiveProp Worksheet` (1 per student) [ ] Bell Ringer Projector Slide or Handout [ ] Whiteboards, Markers, Erasers (for all students) [ ] Exit Ticket slips [ ] Answer Key for projection/display [ ] **Optional:** Area model templates (grid paper) for visual learners

2 ⏱️ PACING TIPS & CLASSROOM MANAGEMENT

• **Bell Ringer (4 min):** Circulate quickly. Look specifically for students who treat $a(b+c)$ as $ab+c$. Flag these for targeted intervention during independent practice. • **Direct Instruction (6 min):** Use the "Repeated Multiplication" narrative strongly. If a student struggles with signs, revert to the area model visual: negative width/height requires flipping the grid orientation or tracking sign rules explicitly. • **Guided Practice:** Model Problem 1 thinking aloud. For Problem 2 (negative coefficient), pause and ask: *"What happens when we multiply two negatives?"* before proceeding. • **Independent Work:** Encourage students to box their distributed terms before combining like terms to prevent "skipping" errors. • **Exit Ticket (3 min):** Collect as students leave. Scan for the common error $a(b-c)=ab-c$ immediately; this indicates a need for re-teaching sign distribution in Lesson 11 warm-up.

3 🔑 BELL RINGER ANSWER KEY

Gauge readiness: Arithmetic distribution and area model connection.

1. Numerical Distribution Check

$4(5+3) = ?$ **Answer:** 27 **Check:** $4(5) + 4(3) = 20 + 7 = 27$. *Teacher Note:* Confirm students recognize that multiplying the sum is equivalent to multiplying each addend and summing.

2. Area Model Translation

Rectangle dimensions: Width $= x$, Length $= (y + 4)$. Write an expression for the area using distribution. **Answer:** Area $= x(y + 4) = xy + 4x$ *Teacher Note:* Students may write $xy + 4$. Redirect to visual: The x must multiply *both* parts of the length side.

3. Pattern Recognition

Expand mentally: $-2(z - 5)$ **Answer:** $-2z + 10$ *Common Error:* $-2z - 10$. *Mitigation:* Remind students that subtracting is adding a negative: $-2(z + (-5)) \rightarrow -2z + (-2)(-5) = -2z + 10$.

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4 📝 WORKSHEET ANSWER KEY

Part A: Expand Using the Distributive Property

Instructions: Remove parentheses by distributing the coefficient to every term inside.

1. $3(m + 6)$

Answer: $3m + 18$

2. $-4(n - 2)$

Answer: $-4n + 8$ *Note:* Emphasize sign change: $(-4)(-2) = +8$.

3. $5(2x - 3y)$

Answer: $10x - 15y$

4. $-7(p + q - 1)$

Answer: $-7p - 7q + 7$ *Note:* Check distribution to the constant term: $(-7)(-1) = +7$.

Part B: Expand and Simplify

Instructions: Distribute, then combine like terms.

5. $2(3x - 4) + 5x$

Steps: $(6x - 8) + 5x \rightarrow 11x - 8$ **Answer:** $11x - 8$

6. $-3(y + 2) - (y - 5)$

Note: Treat subtraction of parenthesis as multiplying by -1. **Steps:** $(-3y - 6) + (-1)(y - 5) \rightarrow -3y - 6 - y + 5$ **Combine:** $-4y - 1$ **Answer:** $-4y - 1$

7. $0.5(8a - 12b) + 3b$

Steps: $(4a - 6b) + 3b \rightarrow 4a - 3b$ **Answer:** $4a - 3b$

Part C: Real-World Application

Context: Assembly Line Efficiency & Agricultural Planning.

8. **Assembly Context (Toro Connection):**

An assembly line produces mower decks. Each deck requires $(2s + 5n)$ fasteners, where s is screws and n is nuts. If the shift runs for d hours producing one deck per hour, write an expression for total fasteners needed. **Answer:** $d(2s + 5n) = 2ds + 5dn$ *Interpretation:* Total screws $= 2ds$, Total nuts $= 5dn$.

9. **Agricultural Context:**

A cooperative plans to plant Three Sisters mounds. Each plot contains m mounds. If each mound requires $(4c + 6b)$ seeds, where c is corn and b is beans/squash mix, write the expanded expression for total seeds per plot. **Answer:** $m(4c + 6b) = 4mc + 6mb$

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5 🎟️ EXIT TICKET ANSWER KEY

1. Expand: $-3(2x - 5)$

Correct Answer: $-6x + 15$ *Diagnostic:* If student writes $-6x - 15$, they missed the double negative product.

2. Identify and Correct the Error:

Student Work: $4(x + 3) = 4x + 3$ **Error Analysis:** The coefficient 4 was distributed to x but not to the constant term 3. **Correction:** $4(x) + 4(3) = 4x + 12$.

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6 🧠 MISCONCEPTIONS & REDIRECT QUESTIONS

Monitor for these errors; use redirects rather than immediate correction.

Partial Distribution	$5(x + 2) = 5x + 2$	*"Imagine you have 5 bags. Each bag contains a variable x and the number 2. When you empty all 5 bags, how many 2s do you see? Did every item in the bag get multiplied?"*
Sign Errors with Negatives	$-2(y - 4) = -2y - 8$	*"Rewrite the subtraction as addition of a negative: $-2(y + (-4))$. Now distribute. What is the product of -2 and -4? Does that change your sign?"*
Distribution vs. Addition	$(x + 3)(x + 2) \rightarrow x^2 + 5x + 6$ (Premature FOIL) or $a(b + c) = a + b + c$	*"We are multiplying a constant by a group, not adding groups. Check with numbers: Is $4(2 + 3)$ equal to $4 + 2 + 3$? If not, what operation connects the outside number to the inside terms?"*

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7 🌱 CULTURAL CONNECTION NOTES

Context: Ojibwe (Anishinaabe) Agricultural Traditions **Cultural Note:** The Ojibwe people have a deep, reciprocal relationship with the land, exemplified by the traditional practice of planting the **Three Sisters** (corn, beans, and squash). This agricultural system is not merely a farming technique but a cultural teaching about interdependence. Corn provides structure for beans; beans fix nitrogen for corn; squash leaves retain moisture and suppress weeds. In this lesson, we honor this wisdom by using distribution to model resource allocation in community gardens that follow these traditional planting patterns. **Math Word Problem:** The Red Lake Nation Youth Garden Club is establishing a demonstration plot following Ojibwe traditions. The plot will contain p distinct mounds. Each mound requires $(3c + 2b)$ units of nutrient mix, where c represents cups for corn support and b represents cups for bean/squash base. Write an expanded expression for the total nutrient mix needed for all p mounds. **CIRCLE→UNDERLINE→BOX→WRITE Breakdown:**

> *Use this strategy to guide students through word problem translation.*

1. 🔴 **CIRCLE** the quantities and groups:

Circle "p mounds" and "$(3c + 2b)$ units per mound".

2. 🔵 **UNDERLINE** what you are solving for:

Underline "total nutrient mix needed".

3. 🟦 **BOX** key operations/relationships:

Box "Each mound requires..." (indicates multiplication/distribution across mounds).

4. ✍️ **WRITE** the expression and expand:

Write: Total $= p(3c + 2b)$ *Expand:* $3pc + 2pb$

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8 💼 CAREER SPOTLIGHT

Company: The Toro Co. **Location:** Bloomington, Minnesota **Role:** Assembly Line Technician **Education Required:** High School Diploma / GED **Median Salary:** $ 45,870 **Connection to Algebra:** Assembly line technicians use algebraic expressions daily to calculate material requirements and efficiency rates. For example, if a technician must assemble irrigation valves where each unit requires $(2g + 3w)$ components (where g is gaskets and w is washers), the distributive property allows them to quickly determine total parts needed for a batch of orders: $n(2g + 3w) = 2ng + 3nw$. Mastery of distribution ensures accurate inventory planning and minimizes waste on the production floor.

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9 📊 DIFFERENTIATION TIER NOTES

🟢 Support (Tier 1/2)

• **Visual Scaffolding:** Provide area model grids where students shade regions corresponding to distributed terms before writing expressions. • **Color Coding:** Use two colors for coefficients and terms inside parentheses; match colors during distribution steps to ensure every term is visited. • **Sentence Frames:** "The coefficient #underline()[ ]#underline()[ ]#underline()[ ] multiplies #underline()[ ]#underline()[ ]#underline()[ ] AND #underline()[ ]#underline()[ ]#underline()[ ]. The result is #underline()[ ]#underline()[ ]#underline()[ ]."

🟡 On-Level

• Focus on fluency with negative coefficients and combining like terms post-distribution. • Encourage peer-checking using the “Show Your Distribution” protocol (arrow from outside term to each inside term).

🔴 Extension (Tier 3)

• **Reverse Distribution:** Challenge students to identify the greatest common factor in expressions like $6x + 9y$ and rewrite as $3(2x + 3y)$, previewing factoring. • **Complex Simplification:** Provide multi-step problems requiring distribution followed by combining like terms across multiple groups: $3(x + 2) - 2(2x - 1)$. • **Error Analysis:** Have students generate their own “common error” example and write a redirect question for a peer.
