Algebra 1 | Unit 1, Lesson 1
Writing Algebraic Expressions from Verbal Expressions

Intellectual Preparation Cover Sheet

Directions: Complete the IPP Cover Sheet for every lesson due for submission.

Step	Action:
1) Understand the concept and/or big ideas at play in the lesson and be able to articulate them clearly and crisply.	□ Read the entire Lesson Plan and identify the key concepts/big ideas students need to understand. □ Create a **lesson summary** annotation that describes, in your own words, the purpose of the lesson (why), the key concepts students need to understand (big ideas/what), and how they will come to understand these within the lesson. □ In the lesson summary, indicate where the rigor is for this lesson. □ Identify the 1-2 places to go deep into conceptual understanding through discussion, and list additional content/procedures to move faster through.
2) Do the core tasks of the lesson to develop/refine exemplar work and clear CFS for anticipated strategies?	□ Print the classwork and complete this step directly in the student packet for the TAI and INM problems (include exemplar annotations). □ If exemplar work in provided in the DLR, select the problem in the practice that is most aligned to the aim and exit ticket to complete exemplar work for. Alternative paths to the correct answer should be indicated for this step. □ Complete the answer key for the remaining practice problems (exemplar work not required but suggested).
3) Anticipate misconceptions and/or gaps in scholar responses and create questions/supports to address these misconceptions.	□ For each core task, annotate to describe expected errors on the tasks and back pocket questions to respond to these errors □ Identify the key phases or sentences in the TAI and INM exemplar scholar responses that should be listened for during discourse. For each key phrase/sentence, plan 2-3 funneled BPQ's that will elicit these responses. □ Using the SMP's, identify the mathematical thinking required by scholars to be successful with the TAI and prepare an exemplar answer.
4) Optional/As needed: Adjust the plan for any individualized AOTY or intellectual preparation goals.	□ As determined with coach, you might: ○ Script MVP directions into lesson plans ○ Script in additional planned investment moves ○ Create rapid & batched feedback forms to capture data ○ Determine additional points for differentiation (especially for very high and very low performance during the lesson) □ If you will meet in person to scrimmage this lesson, your coach may also ask you to submit a proposed practice objective and identify the lesson segment to practice.
Submit annotated plans and any additional work as per IPP expectations in soft copy of LPs to your coach weekly (and at least 48 hours in advance of the IPP meeting). Implement any feedback from coach prior to the phase 2 meeting.	
5) Rehearse, Refine, and Reflect: a. Meet with coach to further internalize and practice executing the plan. Refine plan as needed. b. Refine plan as needed based on practice and/or student exit ticket data. c. Discuss any realizations about this lesson with your coach. Synthesize your learning and determine a transferable takeaway you have about teaching math.	

Commented [1]: Exemplar Sample Teacher IP 2019

Commented [2]: ***Teacher IP Note:*** This is the deep conceptual prep that should take priority in preparation for teaching. This cover sheet protocol should take 30-60 min depending on familiarity with the content and should be completed using the mindset of "Where can I push my students? Where might they struggle? How can I make this lesson work for them based on their previous mastery?"

Commented [3]: ***Teacher IP Note:*** These samples should be completed on a separate sheet of paper and scanned into PDF or made a copy of and provided to your coach per your school's IP expectations.

Commented [4]: ***Teacher IP Note:*** These moves are highly encouraged at the beginning of the year in particular for first-year teachers. They are not shown in this sample for concision and to keep the focus on academic preparation vs. behavioral.

Copyright: Achievement First. Unless otherwise noted, all of the content in this resource is licensed under a Creative Commons Attribution International 4.0 (CC BY) license.

LESSON TYPE: EXERCISE BASED LESSON

AIM

- Given a numeric or basic verbal expression, SWBAT convert between numeric and verbal expressions

BIG IDEA

- Mathematicians use specific language to indicate the order that operations should be performed

KEY POINTS

- NA

STANDARD

A-SSE.1a - Interpret the structure of expressions. Interpret parts of an expression, such as terms, factors, and coefficients.
A-SSE.1b - Interpret the structure of expressions. Interpret complicated expressions by viewing one or more of their parts as a single entity

STATE TEST ALIGNMENT

No direct alignment to state test assessment items. This lesson is based in previous content to refresh students on specific language that implies grouping symbols or completing a series of operations in an order that requires grouping symbols.

SAT ALIGNMENT

Same as above, no direct alignment to released SAT problems.

ASSESSMENT

1. Match each expression below to a set of steps:
   a. $2 \cdot x - 2$ b. $3(x + 5)$ c. $2(x - 2)$ d. $3x + 5$

   i. Choose any number x → Subtract 2 $x-2$ → Multiply it by 2 $2(x-2)$ [c]

   ii. Choose any number x → Multiply it by 2 $2x$ → Subtract 2 $2x-2$ [a]

   iii. Choose any number x → Add 5 $x+5$ → Multiply it by 3 $3(x+5)$ [b]

   iv. Choose any number x → Multiply it by 3 $3x$ → Add 5 $3x+5$ [d]

2. Write an expression that represents each of the following verbal descriptions: 8 multiplied by the sum (parentheses) of a number and 12
   $8 \times (\_ + \_)$ n 12

   $8(n+12)$

3. Marcus read the verbal phrase, "The quantity of 7 less than a number, divided by 4" and wrote the expression $\frac{7-n}{4}$. Do you agree or disagree with this expression? Justify your answer.

   $(n-7) \div 4 \rightarrow \frac{n-7}{4}$

   I disagree with Marcus' expression. Even though he got the grouping correct with 7 less than a number in the numerator, he didn't switch the order to n-7. The expression he wrote was "n less than 7" for the numerator.

CONNECTION TO LEARNING AND CONCEPTUAL UNDERSTANDING

Commented [5]: Lesson Summary A1 1.01:
The first lesson of Algebra 1 serves as a bridge from work with expressions and variables in 8th grade math to more complex expressions students will be working with in A1. This lesson allows students and teachers to see where students are coming in with their comfort with translating verbal expressions to algebraic expressions (a fundamental skill for success in A1).

Big Idea/What: Specific language is used to indicate different mathematical operations which impact the overall expression.

How Developed: In the TAI students focus on just the importance of the phrasing "quantity of" and considering when an operation is used in the form p(x +/- r). In the INM students are adding more complex expressions, including division of coefficients.

Rigor: Students should be very precise with their language to explain why an expression is written a specific way based off of evidence from the text. Teachers should insist upon strong student reasoning for all expressions and showing how to check if expressions are accurate using substitution.

Go Deep: TAI debrief of importance of "sum of" and how this drastically changes the expression. Focusing students on the precision of language and the drastic differences it can have.

Go Fast: Identifying correct expression in TAI and polling class and checking expressions. Focus on the discussion of WHY expressions are correct instead.

- How does this lesson connect to previous lessons?
    - In previous grades, students have learned to write an expression in terms of an unknown quantity that is represented with a variable when given a verbal expression or description. This lesson is a refresher of this with a focus on grouping symbols which becomes a heavy focus in Algebra 1. The word "quantity" is introduced to imply these groupings along with phrases like "all divided by" where the word "all" implies an operation or series of operations occur before another operation that may or may not follow the order of operations.

- What do we want every student to take away or do as a result of this lesson? How will a teacher know if students have met this goal?
    - Understand: Students understand that expressions must be evaluated in a specific order according to the order of operations. Students understand that parentheses are used in expressions in order to perform an operation or string of operations before any other indicated operation outside the parentheses. Students understand that specific language is used to indicate when an operation is to be performed before other operations, for example using the word "quantity". Students understand that not including parentheses when indicated will often result in an incorrect evaluated value.
    - Do: Students annotate verbal expressions for operations, values, and variables. Students annotate verbal expressions for order and grouping symbols by looking for specific language such as "quantity" and "all". Students write numeric and algebraic expressions that represent the verbal expression including the order in which the operations must be completed.

HOW

- Key Strategy/ies
    - Annotate the verbal expression for operations, values, variables, and order
    - Write an expression representing the verbal expression
    - Check the expression and the verbal expression with actual values to ensure they return equivalent values

- CFS for top quality work

Student Facing	Teacher Facing
• Understanding of the problem is indicated by annotations and/or modeling • Work is organized to reflect a clear plan to solve • Appropriate mathematics is used to solve • Final answer is checked and is reasonable given a context	• Verbal expression is annotated for meaning. • Numeric or algebraic expression is written to represent the verbal expression • Expression is checked against the original verbal expression.

Commented [6]: Preparation Note: Print or write these out so they are visible for students when teaching.

ANTICIPATED MISCONCEPTIONS AND ERRORS

- Students might not correctly apply parentheses, omit parentheses, or use parentheses when they are not needed in an expression.
- Students might not take into account that the order matters for terms when subtracting and multiplying
- Students might not realize that an expression divided by a number implies a grouping symbol around the numerator

KEY VOCABULARY

- Term – a single number or variable, or the product of numbers and variables
- Variable – a placeholder for an unknown number
- Algebraic expression – a mathematical phrase that uses operations to combine numbers and variables
- Numerical expression – a mathematical phrase that uses operations to combine numbers

MATERIALS

- Handout
- Suggested Homework – Because this is a review skill, there are no practice problems in Big Ideas textbook. The suggested homework should be aligned to this skill and could be taken from the following link. The aligned questions are 1-10 on page 1, questions 20-30 on page 2.

Opening – Prompt for work time, Circulate, Debrief, Synthesis, & Frame – 12-15 min

THINK ABOUT IT!

Mr. Jackson told his students to write an expression that represents "7 multiplied by the sum of a number plus 5". Ms. Lewis told her students to write an expression that represents "7 multiplied by a number plus 5. Margo wrote the expression 7(n+5). Do you have enough information to determine who is Margo's teacher? Explain your answer.

Prompt for Work Time (<30 sec)

- *T sets timing for work and sets work expectations.*

Circulate (≤ 5 min)

- While circulating, collect data on the following:

Scholar thinking (correct and erroneous)	Scholar Initials - Work to show call
S1 - explanation indicates that Margo is in Mr. Jackson's class and cites the parentheses and order of operations as the reason	
S2 - incorrectly says that Margo is in Ms. Lewis' class	
S3 - incorrectly says that not enough information is given or that both expressions are equal	
S4 - correctly indicates that the phrase "sum of" implies that n+5 should be in parentheses	

Debrief (≤ 7 min)

- **BIG IDEA:** Mathematicians use specific language to indicate the order that operations should be performed
  - ***Suggested Approach:*** *Poll the class for if Margo is in Mr. Jackson's class, Ms. Lewis' class, or if not enough information is available to determine. Open the class into a discussion about who is correct.*
  - ***Exemplar Explanation for Discussion:*** Margo can be determined to be in Mr. Jackson's class because Mr. Jackson's verbal expression was "7 multiplied by the sum of a number plus 5" which matches Margo's expression. Mr. Jackson's verbal expression indicates that 7 should be multiplied by the sum of n and 5 so n + 5 must come first. However, because the order of operations says that you have to multiple before you add, parentheses were needed around n + 5 to indicate that this operation happens first. For those that thought the two expressions were the same, Ms. Lewis' expression would be 7n + 5 because she says 7 multiplied by a number which is 7n, then plus 5 to get 7n + 5. This is not the same as Mr. Jackson because if you were to substitute a value for n, such as 1, you would get 42 for Mr. Jackson and 12 for Ms. Lewis.
  - ***Potential BPQ's***
    - What about Mr. Jackson's verbal expression indicates the use of parentheses?
    - Why aren't the two verbal expressions the same?

Key Learning Synthesis (≤ 3 min)

- **BIG IDEA:** Mathematicians use specific language to indicate the order that operations should be performed
  - **Let's form our big idea for the day. With your partner, come up with a big idea about how mathematicians indicate grouping when describing expressions verbally.** TT. CC. SMS: Mathematicians use specific language to indicate the order that operations should be performed.
  - **What mathematical thinking did we use to arrive at our Big Idea?** *Answers will vary but should include SMP 2 and contextualizing a problem. Potentially also SMPs 3 and 4 for constructing arguments and modeling with algebraic expressions.*

Frame (≤ 30 sec)

- You all just came up with today's big idea. In previous grades you focused on writing simple expressions to represent contextual situations. Today we will translate verbal expressions in numeric and algebraic ones that are more complex and potentially require us to use grouping symbols to perform certain operations before others. A common word that we did not discuss in our Think About It is the word "quantity". Mathematician often use the word "quantity" to indicate grouping symbols. Mr. Jackson could have said "7 multiplied by the quantity of a number plus 5" and this would have been the same expression.

Commented [7]: Anticipated Misconception: Students may think that Margo is incorrect and that both teacher's work should be 7n + 5. If so, prompt student with the following:

"What is the difference between both teacher's verbal responses? Underline that difference. What is the impact?"

Commented [8]: Lap #1 - Circulate to all students to ensure 100% are writing and engaging with problem. Narrate strong progress and encourage students who may be struggling.

Lap #2 – Gather data on work to show-call.

Commented [9]: Go Slow: Prompt student thinking and discussion of WHY these two expressions need to be different.

Use BPQs as needed:
- "What is different between each verbal description? Why?"
- "How does this impact the algebraic expressions?"
- "Why do these differences matter?"
- "How can we avoid confusing these types of expressions in the future?" (TT)

Interaction with New Material – 12-15 min

Post the Big Idea in visible place for student reference: *Mathematicians use specific language to indicate the order that operations should be performed*

Let's use our key point from the TAI and apply it to solve two more problems.

Ex. 1) Given the following verbal expression, write an algebraic expression and evaluate the expression for when n = 9.
"three times a number, n, minus 4 all divided by 5"

Understand

- **Read and annotate the problem with margin notes to understand what we are being asked to find and any additional information you can provide to help us think through this problem.**
- **What is the question asking us to do?**
- **What do we know?** SMS: We know that for part a, three times a number can be represented as 3n and minus 4 as – 4. All divided by 5 means that everything before should be in parentheses. For part b, we know that half can be represented at multiplying by ½ or dividing by two and they use the word quantity which means that everything after must be in parentheses.
- **What else are we asked to do with these questions?** SMS: We are asked to evaluate the expression we write for a given variable value which means we have to substitute the value in and evaluate until it is a numeric quantity.

Plan

- **Based on your understanding of the problem, come up with a plan to solve.** TT. CC.
  - Write an expression for each situation
  - Evaluate each expression for the given value

Solve

- **We will use your plan to solve. With your partner, complete parts a and b.**
- *Teacher should allow scholars to work collaboratively until 50% of scholars are considered off-track to solve. Targeted questioning or CTE should be used to clear the misconception and release back into work.*
- **Places for Intervention:**
  - *Scholars are incorrectly using grouping symbols*
  - *Scholars are omitting grouping symbols*
  - *Scholars are writing equations instead of expressions (most likely for part b)*
  - *Scholars are not evaluating correctly utilizing order of operations*
- ***Exemplar Explanation for Discussion:***
  - *Part a:* For part a, the expression three times a number minus 4 can be written as 3n – 4. The phrase "all divided by 5" means that 3n – 4 must be in parentheses so that all of it can be divided by 5 last. You could have written $(3n - 4) \div 5$ or $\frac{3n-4}{5}$ because a fraction bar acts like grouping symbols where the numerator and denominator must be simplified before dividing. Evaluating for n=9 gives us 23/5 when we evaluate the numerator first.
  - *Part b:* In part b, half the quantity means that we are going to multiply ½ by some quantity in the parentheses. The quantity is the length increased by two or l+2. This gives us $\frac{1}{2}(l + 2)$ or $\frac{l+2}{2}$. Evaluating the width when the length is 8 gives us a width of 5 feet.

Check

- **How could we check this work?** SMS: There isn't a definite check for this work so we have to attend to precision and make sure that we have correctly contextualized this situation (teacher can give this to scholars citing SMP's 2 and 6).

Key Learning Synthesis

- **How did we apply our big idea for today to solve this example problem?** TT. CC. SMS: We contextualized each expression and ensured that we took into consideration the language that was being used to write expressions that would reflect the verbal expression making sure to follow the correct order of operations using grouping symbols.

Frame for PP/IP

- For the next 15 minutes, you'll be working with your partner applying the key point that we just stamped. While working, make sure that you are meeting our common CFS for problem solving and top-quality work.

Commented [10]: Anticipated Misconception: Students may use expression 3n/5 -4/5. If so, show-call and ask the class, "Do you agree/disagree with this expression? Why/why not?" Students should identify that the expression is equivalent to the exemplar, but that the coefficient has been distributed to all terms with in the quantity.

Commented [11]: Go SLOW: Ask, "What do we notice in each verbal expression that may impact the algebraic expression? Why?"

Commented [12]: BPQ: "What does the problem indicate we are finding? What is the difference between expressions and equations?"

Commented [13]: Go FAST: Quickly show call EXEMPLAR & Non-Exemplar (common error). Poll for which one is correct & push students to explain WHY it is correct using evidence from the verbal description.

Commented [14]: BPQs:
1) What phrases in Ex. 1 & 2 were most important for writing the correct expression? ("all divided by" and "half the quantity of the length increased by 2"
2) What do the different verbal descriptions change? (the order of operations of our expressions)
2) How could we change the verbal description to change the algebraic expression? (Instead of "all divided by" it could just have been 3n divided by 5, which would be 3n/5 – 4.

Commented [15]: Post/reveal the CFS for the work period at this time.

Exemplar Work (page 1)

Think About It:
Mr. Jackson told his students to write an expression that represents "7 multiplied by the sum of a number plus 5". Ms. Lewis told her students to write an expression that represents "7 multiplied by a number plus 5. Margo wrote the expression 7(n+5). Do you have enough information to determine who is Margo's teacher? Explain your answer.

$7 \times (n + 5)$

$7n + 5$

Mr. Jackson

$7 \times (n + 5)$

Ms. Lewis

$7n + 5$

Margo's teacher is Mr. Jackson.

Mr. Jackson told his students to multiply 7 by the sum of n+5 which means you have to find the sum first. To do this, you have to use parentheses around n+5 or else order of operations would have you multiply 7 and n first. Because Margo's expression indicates that n+5 happens first, Mr. Jackson is her teacher.

Exemplar Work (page 2)

Commented [16]: Rigor Note:
Make sure ALL students are checking their expressions using the substitution and considering the question, "Does my answer seem reasonable in the context of the problem? Why/why not?"

BPQ Ex. 2 - "Would an answer of w = 100 make sense? W = -2? Why/why not?"

Interaction with New Material:

Example) Given the two verbal situations below, write an algebraic expression and evaluate it for the given value.

a. Write an expression that represents *"three times a number, n, minus 4 all divided by 5"* and evaluate it for when *n=9*.

$(3n - 4) \div 5$

Grouping = parentheses

or

$\frac{3n-4}{5}$

If $n=9$, $\frac{3(9)-4}{5} = \frac{23}{5}$

b. Write an expression that can be used to represent the width of a rectangle if the width is half the quantity of the length, *l*, increased by 2. Evaluate the width if the length is 8 feet.

$l+2$

$\frac{1}{2} \times (\quad)$

$\frac{1}{2}(l+2)$

or

$\frac{l+2}{2}$

If $l=8$, $\frac{1}{2}(8+2) = \frac{1}{2}(10) =$ 5 feet

Name: **Date:**

U1, D1 – Writing Algebraic Expressions from Verbal Expressions

Aim: Given a numeric or basic verbal expression, SWBAT convert between numeric and verbal expressions

Think About It: Mr. Jackson told his students to write an expression that represents "7 multiplied by the sum of a number plus 5". Ms. Lewis told her students to write an expression that represents "7 multiplied by a number plus 5. Margo wrote the expression 7(n+5). Do you have enough information to determine who is Margo's teacher? Explain your answer.

Interaction with New Material: Given the two verbal situations below, write an algebraic expression and evaluate it for the given value.

a. Write an expression that represents *"three times a number, n, minus 4 all divided by 5"* and evaluate it for when *n=9*.
b. Write an expression that can be used to represent the width of a rectangle if the width is half the quantity of the length, *l*, increased by 2. Evaluate the width if the length is 8 feet.

Partner Practice:

1. Translate the following verbal expressions into an algebraic expression:
   a. Seven decreased by 3 times some number
   b. Twice the difference of *p* and 10
   c. 4 times the sum of 3 and *x*
   d. 10 less than twice a number *w*

2. A mechanic charges $45 per hour and parts cost $125. Write an expression for the total if the mechanic works h hours.

3. Write an expression to find the perimeter of a rectangle with a length of 8 mm and width of x mm.

4. Write an algebraic expression from the following:
   a. Sum of a number squared and twice the number
   b. The quotient of the three times a number and the quantity 4 plus the same number
   c. 5 less than a number all multiplied by the quantity of three times the number

5. Veronica writes the expression 3n – 5 + n given the verbal expression *"three times a number minus 5 plus the same number"*. Cory writes the expression 3n – (5 + n). Who do you agree with? Justify your answer

6. Margo said that the answer to number 5 was that they were both correct in this case. Prove Margo correct or incorrect using substitution and evaluating.

7. Look at the annotations and work shown below to find, correct, and explain the error made:

"Write an algebraic expression that represents three times a number less than the sum of twice the number and 1".

n + 1 3x n – grouping 2x

$3n - (2n + 1)$

8. A rectangle has a length of *l* and a width that is a third the length minus 1.
   a. Write an expression that could be used to find the area
   b. Write an expression that could be used to find the perimeter
   c. Write an expression that could be used to find the quotient of the perimeter divided by the area

Commented [17]: Make sure all students have time to practice this and receive feedback prior to the exit ticket.

Exemplars:
a) 7 – 3n
b) 2(p – 10)
c) r(3 + x)
d) 2w – 10

Name: **Date:**

U1, D1 EXIT TICKET

Aim: Given a numeric or basic verbal expression, SWBAT convert between numeric and verbal expressions

Self-Assessment	I mastered the learning objective today.	I am almost there.	Need more practice and feedback.
Teacher Feedback	You mastered the learning objective today.	You are almost there.	You need more practice and feedback.

1. Match each expression below to a set of steps:
   a. $2 \cdot x - 2$ b. $3(x + 5)$ c. $2(x - 2)$ d. $3x + 5$

   i. Choose any number
   Subtract 2
   Multiply it by 2

   ii. Choose any number
   Multiply it by 2
   Subtract 2

   iii. Choose any number
   Add 5
   Multiply it by 3

   iv. Choose any number
   Multiply it by 3
   Add 5

2. Write an expression that represents each of the following verbal descriptions: 8 multiplied by the sum of a number and 12

3. Marcus read the verbal phrase, "The quantity of 7 less than a number, divided by 4" and wrote the expression $\frac{7-n}{4}$. Do you agree or disagree with this expression? Justify your answer.