Curriculum Sample Template – 8 Pages Max. (12 pages for integrated ELA sample)

Grade Level	9th	**Content Area**	Math
Course Title (grades 9-12 Only)	Algebra 1		
Expected Prior Knowledge *List the knowledge/skills mastered earlier in the year that are foundational to the mastery of the Required Standard(s).*	Operations $(+,-,\times,\div)$ on polynomials – including FOIL. Combining like terms. Pythagorean Triples. Factoring. *Division of polynomials is limited to single term divisors.		
Alignment to Program of Instruction *Describe how the methods of instruction found in this sequence of lessons align to the Program of Instruction described in the application package.*	During this unit SDAIE strategies are being employed to engage English learners, but also for the general benefit of the entire student population. Students who are engaged in small group lessons will benefit from the type of instruction described here. Some SDAIE strategies include math journals, special attention to vocabulary; heterogeneous grouping; pair-shares to explain steps of math problems; student friendly objectives; etc. This lesson also adheres to the philosophy laid out by the Understanding by Design framework. For example, "transfer of learning" is used during objective 2 to apply polynomial identities to useful and interesting numerical expressions. Desired results are clearly stated throughout the lesson. Class, group, and individual discussions are throughout the lesson as well ensuring deeper understanding and that the teacher is not simply a "purveyor of knowledge." Finally, students are engaged in higher levels of cognitive thought in accordance with Bloom's Taxonomy.		
Standard Number* and Description *The standard number and description of the Required Standard(s) being instructed and assessed to mastery in the curriculum sample.*	A-APR.C.4 Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2+y^2)^2=(x^2-y^2)^2+(2xy)^2$ *can be used to generate Pythagorean Triples.*		
Materials/Resources Needed *List all items the teacher and students will need for the entire sequence of instruction (excluding common consumables)*	Smart Board and computer with Smart Notebook Software, Guided Notes printed out ahead of time, Student math journals, Math glossary, Polynomial Expressions Worksheet/Answer Key, Steps of Proofs Worksheet/Answer Key		

* ***Standard Number****: For English Language Arts (Reading and Writing), use Grade, Strand, Standard (e.g., 3.RI.2). For K-8 Math, use Grade, Domain, Cluster, Standard (e.g., 6.EE.B.7). For HS Math, use Conceptual Category-Domain, Cluster, Standard (e.g., A-REI.C.6).*

Lesson (add as needed)	**Instructional Strategies -** *List and describe teacher actions, lesson by lesson, which will provide students with opportunities to engage the grade-level rigor defined by the Required Standard(s). Indicate alignment of instructional strategies to specific component(s) or content/skill(s) of the Required Standard/component.*	**Student Activities -** *Describe the activities, lesson by lesson, in which students will engage to allow them to master the grade-level rigor defined by the Required Standard(s). Indicate alignment of student activities to specific component(s) or content/skill(s) of the Required Standard/component.*
1	**Objective:** Students will simplify polynomials (this is a review and extension of an objective from a previous day) **(Key/Advancing Questions)** • Why is it important to simplify complicated expressions? • Where might people make mistakes when simplifying this expression? **Activation of Prior Knowledge:** Using the Smart Board, the **teacher will** assign "warm-up" problems reviewing adding, subtracting, and multiplying polynomials. The **teacher will** check for understanding as students work on the "warm-up." Gauging the class' understanding of prior knowledge, the **teacher will** discuss the warm-up problems. **Introduction to New Material ("INM") / Modeling:** The **teacher will** pass out the guided notes that go with the day's lesson. Using the Smart Board, the **teacher will** introduce more complex problems to simplify. The **teacher will** point out steps where typical mistakes are made and how to avoid those mistakes. For example, addressing the common error $(x+a)^2 = x^2 + a^2$ when students should use FOIL to get $x^2 + 2ax + a^2$. The **teacher will** model how to think through different types of operations on polynomials – writing and speaking an explanation of each step. The **teacher will** use the different colors of the Smart Board to highlight key parts of the problem and differentiate each step. **Guided Practice.** The **teacher will** pass out small pieces of paper with various polynomial expressions and corresponding simplified versions of them. The **teacher will** assign the students into heterogeneous groups of 3 and the students will need to match equivalent expressions together. The **teacher will** check for understanding while each group is working on the matching activity **Independent Practice**: The **teacher will** show the students 4 problems of increasing difficulty on the board and the **teacher will** ask the	**Students will** write the objective in their guided notes. **Students will** write down the key/advancing questions in their journal to answer at the end of class. These questions will serve as a closure/self-reflection for students. **Students will** complete the warm-up problems. The student will review simplification of polynomials on order to understanding the polynomials as they begin proving polynomial identities **Students will** be permitted to look at their past notes, ask their peers, or ask the teacher as needed to complete the warm-up problems. The objective here is for students to activate the prior knowledge versus complete the problems completely independently. **Students will** ask questions and discuss the warm-up problems clarifying any outstanding questions. Clarification of these questions will help the students to be successful in the lesson. **Students will** follow along, writing examples from the board in their guided notes, answer all questions from the teacher, and write down significant information to simplify polynomials. **Students will** highlight key vocabulary words that they do not understand during the course of the lesson. After a class discussion about the words, looking them up in the math glossary, or during group work time students can rewrite them in their notes using student friendly language. **Students will** work together in their groups to match each expression to its equivalent. This activity will assist students in identifying simplified polynomials. This will be important when striving to use polynomial identifies to describe numerical relationships. If there is a student in the group that doesn't understand the concept they can use the rest of the group to explain it. After this peer

	students to complete the problems – students must score at least 3 out of 4 to achieve mastery. **Assessment:** The **teacher will** give each student two problems with polynomial expressions that need simplifying. The **teacher will** ask each student to simplify their two problems and write explanations of each step as they simplify.	interaction, the **students will** call the teacher over to explain it if needed. **Students will** complete the assessment and take the final moments of class to write an answer for their key/advancing questions. Students may share answers with the group/class.
2	**Objective:** Students will use polynomial identities to describe numerical relationships **(Key/Advancing Questions)** • How can polynomial identities help else with mental math? • What are some other ways polynomial identities are useful? **Activation of Prior Knowledge:** Using the Smart Board, the **teacher will** assign "warm-up" problems reviewing basic math (multiplying 2 digit numbers like 59×61 or 98^2) as well as a couple simplifying polynomial expression problems. The **teacher will** check for understanding as students work on the "warm-up." Gauging the class' understanding of prior knowledge, the **teacher will** discuss the warm-up problems as needed. **Introduction to New Material ("INM") / Modeling:** The **teacher will** pass out the guided notes that go with the day's lesson. Using the Smart Board, the **teacher will** impress the class by doing a little "math magic" asking for a few simple square of numbers near 100 or multiplying two numbers that straddle a multiple of 10 (like in the warm-up) otherwise the teacher can show a video of someone doing "math magic". The **teacher will** then reveal how they did the problems in their head and write up the corresponding polynomial identities. The **teacher will** then teach the students how to use the identities to be able to the multiplication as mental math. The **teacher will** show a simple identity used to find Pythagorean triples, as well as remind the class what Pythagorean triples are. The teacher will model how to think about the polynomial identities. **Guided Practice.** The **teacher will** pass out "Trina's Triangles" task https://www.illustrativemathematics.org/content-standards/HSA/APR/C/4/tasks/594. The **teacher will** assign the students into heterogeneous groups of 3 and the students will need to complete the task which involves a slightly more challenging polynomial identity to find Pythagorean triples. The **teacher will** check for understanding while each group is working on the task	**Students will** write the objective in their guided notes. **Students will** write down the key/advancing questions in their journal to answer at the end of class. These questions will serve as a closure/self-reflection for students. **Students will** complete the warm-up problems. The student will review simplification of polynomials on order to understanding the polynomials as they begin proving polynomial identities. S**tudents will** be permitted to look at their past notes, ask their peers, or ask the teacher as needed to complete the warm-up problems. The objective here is for students to activate the prior knowledge versus complete the problems completely independently. **Students will** ask questions and discuss the warm-up problems clarifying any outstanding questions. Clarification of these questions will help the students to be successful in describing the numerical relationships. **Students will** follow along, writing examples from the board in their guided notes, answer all questions from the teacher, and write down significant information as the teacher models how to use polynomial identities to describe numerical relationships **Students will** highlight key vocabulary words that they do not understand during the course of the lesson. After a class discussion about the words, looking them up in the math glossary, or during group work time students can rewrite them in their notes using student friendly language. **Students will** work together in their groups to work on the task provided.

	Independent Practice: The **teacher will** show the students 2 polynomial identities that get used to factor (or reverse factor). Students will be asked to explain how to use the polynomials with their own specific examples. HW will also be given. Students need to score 3 out of 4 on a rubric. Rubric example continuum: Shows complete understanding, shows substantial understanding, limited understanding, no understanding. **Assessment:** The **teacher will** pass out a summative test that will assess students on all three objectives. See page 5 and 6. The **teacher will** also have an exit ticket that addresses the key questions to assess student's knowledge on the identities learned.	**Students will** need to think deeply about the task and may require some help when writing out the polynomial identity. If there is a student in the group that doesn't understand the concept they can use the rest of the group to explain it. After this peer interaction, the **students will** call the teacher over to explain it if needed. **Students will** complete the assessment and take the final moments of class to write an answer for their key/advancing questions. Students may share answers with the group/class.
3	**Objective:** Students will prove polynomial identities **Key Points**. • What is needed to convince you that a polynomial identity is true? • Why is it important to prove polynomial identities? **Activation of Prior Knowledge:** Using the Smart Board, the **teacher will** assign "warm-up" problems reviewing simplifying polynomial expressions. The **teacher will** check for understanding as students work on the "warm-up." Gauging the class' understanding of prior knowledge, the **teacher will** discuss the warm-up problems as needed. **Introduction to New Material ("INM") / Modeling:** The **teacher will** pass out the guided notes that go with the day's lesson. Using the Smart Board, the **teacher will** take a polynomial identity used in the previous lesson and a discussion about how we know it works. The **teacher will** expect that some students may refer to specific examples of where it worked as proof. The **teacher will** then ask "how do you know it works *every* time." The **teacher will** break the students up into their groups to discuss further before bringing the discussion to a closure with the entire class. Once the discussion is done the **teacher will** model how to prove polynomial identities starting with the ones used for objective 2. The **teacher will** address typical strategies for proving identities, such as start with the more complicated looking side of the equation first. **Guided Practice.** The **teacher will** pass out to each heterogeneous group of 3 a complicated multi-step polynomial identity to prove with each step on strips of paper and mixed up. The students will have to put the steps to the proof in order. The **teacher will** check for	**Students will** write the objective in their guided notes. **Students will** write down the key/advancing questions in their journal to answer at the end of class. These questions will serve as a closure/self-reflection for students. **Students will** complete the warm-up problems. The student will review simplification of polynomials on order to understanding the polynomials as they begin proving polynomial identities **Students will** be permitted to look at their past notes, ask their peers, or ask the teacher as needed to complete the warm-up problems. The objective here is for students to activate the prior knowledge versus complete the problems completely independently. **Students will** ask questions and discuss the warm-up problems clarifying any outstanding questions. Clarification of these questions will help the students to be successful in proving the polynomial identities. **Students will** follow along, writing examples from the board in their guided notes, answer all questions from the teacher, and write down significant information. **Students will** highlight key vocabulary words that they do not understand during the course of the lesson. After a class discussion about the words, looking them up in the math glossary, or during group work time students can rewrite them in their notes using student friendly language.

	understanding while each group is working on the task **Independent Practice**: The **teacher will** give each student a different polynomial identity to prove. The **teacher will** ask each student to work on the proof and then get into pair-shares, where each student will have to explain their proof to the other. HW will also be given. Students need to submit a correct proof. **Assessment:** The **teacher will** pass out a summative test that will assess students on all three objectives. See page 5 and 6. The **teacher will** also have an exit ticket that addresses the key questions to assess student's knowledge on the identities learned.	**Students will,** in their groups, work on ordering the steps to the proof. **Students will** need to be able to explain why they picked the order they did when prompted by the teacher. If there is a student in the group that doesn't understand the concept they can use the rest of the group to explain it. After this peer interaction, the **students will** call the teacher over to explain it if needed. **Students will** complete key/advancing questions as a reflection. Students may share their answers with a friend. **Students will** complete the summative test when it is assigned.
4	The **teacher will** instruct students to complete the summative assessment.	**Students will** complete the summative test as assigned.
S.A.	*Provide an opportunity for the student to complete the summative assessment items which is clearly separate from instruction and guided or independent practice, and in which the student is assessed independently. In the Student Activities column, provide a brief description of the summative assessment (S.A.) items that will allow students to demonstrate mastery of the rigor of the Required Standard(s)/components, and the context in which the items will be administered.*	1. Simplify expressions 2. Prove and calculate answers with polynomials. 3. Prove that a polynomial is true.

Summative Assessment Items and Scoring: *Below, provide at least three Summative Assessment Items that together accurately measure student mastery of the application of the content and/or skills as defined by the grade-level rigor in the Required Standard(s). For each assessment item, provide an answer key or scoring rubric which clearly describes how assessment items are to be scored and how points will be awarded, such that mastery of the application of the content and/or skills as defined by the grade-level rigor in the Required Standard is clearly demonstrated by an acceptable score.*

Summative Assessment Item 1 (clearly identify answer key/scoring rubric, and acceptable score):

Each step is worth 1 point, partial credit may be given for simple calculation mistakes.

Objective 1

(1) Simplify each of the following expressions.

(a) 3 points $2(x^2-1)-(x^2-1)+1$

(b) 3 points $(x+a)^2-(x-a)^2$

Summative Assessment Item 2 (clearly identify answer key/scoring rubric, and acceptable score):

Each step is worth 1 point, partial credit may be given for simple calculation mistakes.

(2) 4 points Prove that $(x-1)(x+1) = x^2 - 1$

(3) 1 point Use $(x-1)(x+1) = x^2 - 1$ to calculate 79×81.
Show all you work.

Summative Assessment Item 3 (clearly identify answer key/scoring rubric, and acceptable score): (add as needed):

Each step is worth 1 point, partial credit may be given for simple calculation mistakes.

(4) 6 points

The following polynomial identity is used by "math magicians" – people who can do mental math very quickly – to calculate squares of numbers close to 100.

$$n^2 = 10000 - (200)(100 - n) + (100 - n)^2$$

Prove that this identity is true.

Answer Key:

(1a) 3 points

$$2(x^2 - 1) - (x^2 - 1) + 1$$
$$(x^2 - 1) + 1$$
$$x^2$$

(1b) 3 points

$$(x + a)^2 - (x - a)^2$$
$$x^2 + 2ax + a^2 - (x^2 - 2ax + a^2)$$
$$4ax$$

Total: _____/6 (average of two scores divided by 6); Grading Scale: 1-4.1: Incomplete; 4.2-4.7: C; 4.8-5.3: B; 5.4 - 6: A. 4.2 is considered Mastery

(2) 4 points

$$(x-1)(x+1) = x^2 - 1$$

$$x^2 + x - x - 1 = x^2 - 1$$
$$x^2 - 1 = x^2 - 1$$
$$QED$$

Total: _____/4; Grading Scale: 1-2.7: Incomplete; 2.8-3.1: C; 3.2-3.5: B; 3.6-4: A. 2.8 is considered Mastery

(3) 1 point

$$79 \times 81 = 80^2 - 1 = 6400 - 1 = 6399$$

Total: _____/1; Grading Scale: 0-.69: Incomplete; .70-.79: C; .80-.89: B; .90-1.0: A. .7 is considered Mastery.

(4) 6 points

$$n^2 = 10000 - (200)(100 - n) + (100 - n)^2$$
$$n^2 = 10000 - 20000 + 200n + (100 - n)^2$$
$$n^2 = \cancel{10000 - 20000} + 200n \cancel{+ 10000} - 200n + n^2$$
$$n^2 = \cancel{200n - 200n} + n^2$$
$$n^2 = n^2$$
$$QED$$

Total: _____/6 ; Grading Scale: 1-4.1: Incomplete; 4.2-4.7: C; 4.8-5.3: B; 5.4 - 6: A. 4.2 is considered Mastery.

Total__/17 0-11.8=Incomplete ;11.9-13.5=C; 13.6-15.2=B, 15.3-17=A; 11.9 is considered Mastery.

To achieve mastery of Standard A-APR.C.4, students must receive 11.9/17 or 70% on the summative items.