Max. 8 Pages

Grade Level	9th[th]	**Content Area**	Math
Course Title (grades 9-12 Only)	Algebra I		
Expected Prior Knowledge *The knowledge/skills mastered earlier in the year foundational to the mastery of the required Standard in the current sample.*	To master this standard, students should be familiar with identities and have practiced proving that one side of the equation must equal the other. Students must also be very confortable with common factoring and be able to identify if a polynomial can be factored by simply looking at problem.		
Alignment to Program of Instruction *Briefly outline methods of instruction found in this sequence of lessons that align to the Program of Instruction described in A.3.*	Students will use their one-to-one computers and Canvas. Canvas will provide diagnostic data and videos/modules for introduction to new material/direct instruction. At the end of the lesson, students will use Canvas again to complete a formative assessment. For the summative assessment, students will also use Canvas. Direct instruction will use multiple checks for understanding, and computer-based Kagan cooperative strategies will be implemented during guided practice.		
Standard Number and Description *List the Number* and the full description for the Required Standard or Science Performance Objective listed in section A.6.*	(A-APR) #C.4 – Prove polynomial identities and use them to describe numerical relationships. .		
Materials/Resources Needed	Computers, interactive notebooks, headphones, practice sheets in the online forum, timer.		

* ***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, Standard (e.g., 6.EE.7). For HS Math, use Conceptual Category-Domain, Standard (e.g., A-REI.6). For Science, use Grade, Strand, Concept, PO (e.g., 4.1.3.1).*

Lesson (add as needed)	Instructional Strategies TW = teacher will. SW = students will. CFU = checks for understanding.	Student Activities
1	**Objective**: SWBAT define the criteria for a polynomial identity by rewriting the meaning in their own words. **Key Points/Terms:** 1. Difference of squares: $a^2 - b^2 = (a+b)(a-b)$ 2. Sum and difference of cubes: $a^3 \pm b^3 = (a \pm b)(a^2 \mp ab + b^2)$ **Activation of Prior Knowledge**: Teacher will place a "Do Now" activity in Canvas and instruct students to begin. The "Do Now" problem will ask students to determine if a polynomial can be factored. Teacher will post check for understanding questions within Canvas and ask students to complete each question. Teacher will review mistakes and explain the objective for the lesson. **INM/Modeling**: Teacher will instruct students to complete the "identifying polynomial identities" diagnostic and continue onto the new material modules. The new material modules will provide instructional examples of polynomial identities and provide practice problems. The teacher will use their own checks for understanding located in Canvas to ensure comprehension and will monitor progress via online tracking. Teacher will provide assistance when necessary through the Acellus and Canvas and will redirect students to additional modules if needed for differentiation. **Guided Practice**: Teacher will ask students to open the discussion forum about identifying polynomial identities.	Students will write down the objective and key points in their online notebooks. Student will complete the "Do Now" activity diligently and quietly. Students will respond to all checks for understanding and will share their answers within Canvas. Students will use the Acellus modules to complete the introduction to new material. Other screens unrelated to the lesson will be prohibited. Students will complete the diagnostic before moving onto the new material modules. Students will take notes during the module via online notebook and will sit quietly and respectfully when finished.

	Inside the forum, teacher will have written instructions to help students complete the guided practice exercise. Today's guided practice activity will walk students through a read to learn about polynomial identities. Students are expected to note each step in the process and rewrite the steps it in their own, student friendly language. Students will type their answers in Canvas and once finished, provide positive feedback to their classmates. Teacher will reference the expected behavior notes available in the online forum and will use checks for understanding questions to monitor comprehension.	Students will participate in the guided practice activity by completing the read to learn and follow up questions within Canvas. Students will use correct mathematical language and will clearly express the steps to solving polynomial identities. Students will demonstrate respectful behavior and will reference the key points when necessary. Students will answer all checks for understanding and will remain quiet once finished.
	Independent Practice: Teacher will direct students to login into Canvas to take the formative assessment. Teacher will remind students that they must answer 80% polynomial identity questions correctly in order to master the standard. The formative assessment will ask students to identify if a polynomial is a difference of squares or a sum and difference of cubes.	Students will use Acellus to complete the formative assessment/independent practice. Students will do their best to achieve 80% mastery on the formative assessment. Students will remain respectful during independent practice and will check their answers once finished.
	Exit Ticket: Teacher will present two exit ticket questions at the conclusion of the identities lesson. These questions will take place in Canvas and once complete, students can leave the module. Teacher will instruct students to make any final comments or questions in the appropriate forum location before exiting the module.	Students will complete the exit ticket problems and will exit Canvas once finished. Students will ask any final questions or make any final comments in the appropriate forum location before leaving the module.
2	**Objective**: • Prove the two-square identity by using the commutative and associative laws for complex numbers. **Key Points/Terms:** • Set $(a, b) = (\cos t, \sin t)$	Students will write down the objective and key points in their online notebooks. Exemplar is a direct copy with "prove" underlined. Students will share out and describe what "prove" means. Student will complete the "Do Now" activity diligently and quietly. Students will respond to all checks for understanding and

	Activation of Prior Knowledge: Teacher will place a “Do Now” activity in Canvas, which asks students to expand two given identities, one difference of squares, one difference of cubes. Teacher will post discussion questions about the “Do Now” in the Canvas and ask students to complete each question. Teacher will post checks for understanding questions in the “Do Now” to ensure understanding.	will share their answers within Canvas. Students will expand two given identities, one difference of squares, one difference of cubes. Students will also answer discussion questions that prompt inquiry into proving polynomial identities to describe numerical relationships.
	INM/Modeling: Teacher will instruct students to watch the instructional video on executing polynomial identities. The module will include practice questions to ensure understanding. The teacher will use cold calling techniques to monitor comprehension and will monitor student progress via online tracking. Teacher will then model the correct skils and knowledge necessary to prove the two-square identity. Teacher will provide assistance when necessary through Canvas and will redirect students to additional modules if needed for differentiation.	Students will use the modules to complete the introduction to new material. Students will choose the module about proving polynomial identities. Following this, students will watch and engage with the module about prving two-square identities. Other screens unrelated to the lesson will be prohibited. Students will complete the diagnostic before moving onto the new material modules. Students will take notes during the module via online notebook and will sit quietly and respectfully when finished.
	Guided Practice: Teacher will ask students to pair up for the partner teaching exercise. Inside the forum, teacher will have written instructions to help students complete the steps to proving two-square identity during the partner teaching exercise. Students are expected to retell ways to demonstrate how to perform the procedure as if they were giving advice. Teacher will reference the expected behavior notes available in the online forum and will use checks for understanding questions to monitor comprehension.	Students will participate in the guided practice activity by partner teaching how to execute an assortment of polynomial identities, including two-square polynomial identities. Students will demonstrate respectful and responsible behavior and will circle back to the key points when cold called upon. Students will answer all checks for understanding and will remain silent once finished.
	Independent Practice: Teacher will direct students to login to the computers to complete the formative assessment. Teacher will remind students that they must answer 80% of the questions correctly in order to master executing polynomial identities. The formative assessment will ask students to prove three two-square identity polynomials, each in different	

	formats. **Exit Ticket**: Teacher will present one exit ticket questions that asks two write the example of the two-square identity and prove it. These questions will take place in Canvas and once complete, students can leave the module. Teacher will instruct students to make any final comments or questions in the appropriate forum location before exiting the module.	Students will use Acellus to complete the formative assessment/independent practice. Students will do their best to achieve 80% mastery on the formative assessment and will use their knowledge about proving polynomial identities to work through the problem sets. Students will remain respectful during independent practice and will check their answers once finished. Students will complete the exit ticket problems and will exit Canvas once finished. Students will ask any final questions or make any final comments in the appropriate forum location before leaving the module.
3	**Objective**: SWBAT prove that $(x+2y)^2+(2x+3y)^2+(3x+4y)^2 = 14x^2+40xy+29y^2$ is a consequence of linear dependence. **Key Points:** We use these subtle differences to prove polynomial identities and with that information, we can describe the relationship between numbers. **Activation of Prior Knowledge**: Teacher will place a "Do Now" activity in Canvas and instruct students to begin. The "Do Now" problem will ask students to write down 10 sentences that explain what they recall about the relationship between linear dependence and vectors. Teacher will check the student answers against his or her exemplar. Teacher will then ask students to write one sentence that compares the similarities between polynomial identities and polynomials characterized by linear dependence. **INM/Modeling**: Teacher will instruct students to Acellus to complete the deficiency diagnostic for illustrating polynomial	Students will write down the objective and key points in their online notebooks. Students will note that today, we will discuss how proving polynomial identities helps us understand and describe the relationship between numbers. Student will complete the "Do Now" activity diligently and quietly. Students will write down 10 sentences that explain what they recall about the relationship between linear dependence and vectors. Students will also write down one sentence that compares true polynomial identities and polynomials characterized by linear dependence. Students will reference the key points and explain that we prove polynomial identities to understand describe the relationship between numerical quantities. Students will use the Acellus modules to complete the introduction to new material. Other screens unrelated to the lesson will be prohibited. Students will complete the diagnostic

	identities. Once complete, students will continue onto the new material modules about linear dependence. Teacher will reference the key points and model proving the objective polynomial as a consequence of linear dependence.	about advanced polynomial identities before moving onto the new material modules. Students will take notes during the module via online notebook and will sit quietly and respectfully when finished.
	Guided Practice: Teacher will demonstrate the procedure for proving both polynomial identities. Students will then practice an example on their own. Teacher will instruct students to the graphing tutorial within Canvas. The graphing tutorial will ask students to prove linear dependence within the objective polynomial. Teacher will ask students to relate the current graph to prior graphs relating to vectors. Students will use the relationship between vectors and polynomials to prove why $(x+2y)^2+(2x+3y)^2+(3x+4y)^2 = 14x^2+40xy+29y^2$ is a consequence of linear dependence. Teacher will monitor progress via online tracking and will redirect students to further discussion posts if necessary.	Students will participate in the guided practice activity by using the graphing software. Students will note the title, scale, and labels within the graph. Students will demonstrate respectful behavior and will reference the key points about proving polynomial identities and describing relationships between numerical quantities when necessary. Students will answer all checks for understanding and will remain quiet once finished. Students will describe the relationship between the given quantities and explain how proving the polynomial identity described the numerical relationship.
	Independent Practice: Teacher will direct students to the formative assessment/independent practice section of Acellus. Teacher will reference the expected behavior in Canvas and monitor progress via online tracking. Teacher will remind students that they must answer 80% of the proving polynomials vs atypical linear dependence questions correctly in order to master the standard. The formative assessment will ask students to choose the correct illustration for 5 identity problems.	Students will use Acellus to complete the formative assessment/independent practice. Students will do their best to achieve 80% mastery on the formative assessment. Students will remain respectful during independent practice and will check their answers once finished.
	Exit Ticket: Teacher will direct students to the proving polynomials mastery check. Teacher will instruct students to make any final comments or questions in the appropriate forum location before exiting the module. Students must score 8/10 points correct to master the objective.	Students will complete the exit ticket problems and will exit Canvas when finished. Students will ask any final questions or make any final comments in the appropriate forum location before leaving the module.
4	**Assessment Introduction:** Teacher will welcome students and lead them though calming	Students will prepare for the summative by completing the

	warm up exercises to decrease test anxiety. Teacher will ask students to recall and share test-taking strategies. Teacher will direct students to the Acellus portal and help them find the summative assessment. Teacher will model appropriate test taking behavior and direct students to the login screen. **Assessment:** The Acellus summative will consist of 20 questions. Students much achieve 80% or better to master this standard. Teacher will monitor student progress via online tracking.	calming exercises and sharing their test taking strategies. Students will complete the summative assessment to the best of their ability. Students must score 80% or better to master the standard.

Summative Assessment Items: *Attach here.* For each summative assessment item, include an answer key or scoring rubric describing how points are to be awarded.

Complete the following summative assessment questions. ***(2 points each, 10 points total. 8/10 or better for mastery)***

1. Write the identity for the following polynomial: $(n + 2)^2 - n^2 = 4(n + 1)$
2. Prove the identity $(x2 + y2)^2 = (x2 – y2)^2 + (2xy)^2$
3. Expand the following using Polynomial Identities: $(2a + 5)^2$
4. Illustrate an example of a simple Pythagorean triple: $(a^2 + b^2 = c^2)$
5. Write an example of the square of a trinomial:

Answer Key:

1. Write the identity for the following polynomial: $(n + 2)^2 - n^2 = 4(n + 1)$

$$(n + 2)^2 - n^2 = 4(n + 1)$$

$$(n + 2)(n + 2) – n^2 = 4n + 4$$

$$n^2 + 2n + 2n + 4 – n^2 = 4n + 4$$

$$4n + 4 = 4n + 4$$

2. Prove the identity $(x2 + y2)^2 = (x2 – y2)^2 + (2xy)^2$

$$(x^2 + y^2)^2 = (x^2 + y^2)(x^2 + y^2)$$

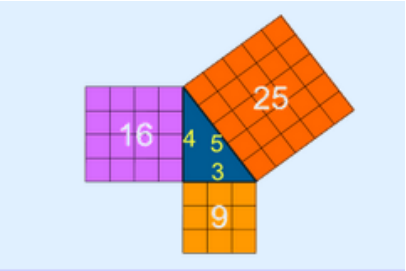
$$= x^4 + x^2y^2 + y^2x^2 + y^4$$

$= x^4 + 2x^2y^2 + y^4$
$= x^4 - 2x^2y^2 + 4x^2y^2 + y^4$
$= (x^4 - 2x^2y^2 + y^4) + 4x^2y^2$
$= (x^2 - y^2)^2 + (2xy)^2$

3. Expand the following using your understanding of Polynomial Identities: $(2a + 5)^2$

$(2x + 5)^2 = (2a)^2 + 2(2a)(5) + 5^2$

4. Use what you understand about the relationship between numerical quantities to Illustrate an example of a simple Pythagorean triple: $(a^2 + b^2 = c^2)$



5. Prove the two-square identity: $(a^2 + b^2)(x^2 + y^2) = (ax - by)^2 + (bx + ay)^2$

[(a+ib)(a−ib)] [(x +iy)(x −iy)]

[(ax −by)+i(bx +ay)] [(ax −by)−i(bx +ay)]

[(a+ib)(x +iy)] [(a−ib)(x −iy)]