**Understanding by Design Unit Template**

| Title of Unit | Polynomial Equations and Factoring | Grade Level | 9th Grade |
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| Subject | Algebra 1 | Time Frame | Four weeks |
| Developed By | Margarita Fox | | |

| Stage 1 - Identify Desired Results |
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**Broad Areas of Learning**
How are the BAL incorporated into this unit?

Media literacy is incorporated into this unit through the inclusion of technology. Specifically, students will be using online resources such as tutorial videos and online practice problems to learn about polynomials and master methods like factoring and solving quadratic equations. The students will also work on a performance task that requires them to select a topic, gather information, choose a format of their preference (video, PowerPoint presentation, infographics) and make a presentation in front of their teammates to explain the topic they selected.
Personal and career planning are incorporated in this unit through the inclusion of real-life applications of the material and real-life problem-solving.

**Cross-curricular Competencies**
How will this unit promote the CCC?

This unit will include the elements of problem-solving, writing, cooperation, communication, and collaboration. Most of the classes in this unit provide a space for students to work on solving exercises, practice problems, and worksheets, both independently and in groups.
Students are also asked to write definitions of the vocab terms using their own words or examples and apply these concepts to the methods learned.

**Learning Outcomes**
What relevant goals will this unit address?
*(must come from the curriculum; include the designations, e.g., IN2.1)*

From Common-Core Standards

**HSA-APR.A.1**
**HSA-APR.B3**
**HSA-**
**REI.B.4b**
**HSA-SSE.A.2**

- Classify, add, and subtract polynomials
- Learn the FOIL Method and the square of a binomial pattern.
- Learn how to multiply polynomials.
- Solve polynomial equations by using the Zero-Product Property and by factoring out the GCF.

| **Enduring Understandings**<br>What understandings about the big ideas are desired? (what you want students to understand & be able to use several years from now)<br>What misunderstandings are predictable? | **Essential Questions**<br>What provocative questions will foster inquiry into the content?<br>(open-ended questions that stimulate thought and inquiry linked to the content of the enduring understanding) |
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| *Students will understand that...*<br>• The core vocabulary required to be able to understand polynomial equations, not just for Algebra 1 but also for their future secondary math classes, such as Algebra 2 and pre-calculus.<br>• Polynomial functions have real-life applications. They can be used to describe curves and solve everyday problems, such as vertical motion models, design of rollercoasters, or economics cost analysis.<br>• Learning factorization of polynomials is an important life skill because it can be useful when comparing prices, exchanging money during travel, or when trying to divide something into equal pieces.<br><br>*Related misconceptions…*<br>• The most common misconception I expect from students is their lack of motivation when learning math. Very often, students think that the concepts are not applicable to real-life or that the material in the class will not be useful in the future if they choose a career not related to math, like law or medicine. | *Content specific….*<br>• How is a monomial different than a polynomial?<br>• How can I tell if a polynomial is on standard form?<br>• What does FOIL stand for?<br>• What do we use the Zero-Product Property for?<br>• What are the steps for solving a polynomial equation?<br><br>*FNMI, multicultural, cross-curricular…*<br>• How are polynomials used in the real world?<br>• Why is it important to learn how to factor polynomials?<br>• How can learning this material effectively can help me be successful in my future math classes? |

| Knowledge: What knowledge will students acquire as a result of this unit? This content knowledge may come from the indicators, or might also address pre-requisite knowledge that students will need for this unit. | Skills What skills will students acquire as a result of this unit? List the skills and/or behaviors that students will be able to exhibit as a result of their work in this unit. These will come from the indicators. |
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| *Students will know how to...*<br><br>• Differentiate between monomials, binomials, trinomials, and polynomials.<br>• Identify the degree of a polynomial, the leading coefficient, and when a polynomial is in standard form.<br>• Add, subtract, and multiply polynomials.<br>• Simplify algebraic expressions and find the great common factor (GCF).<br>• Factor and solve polynomial equations for math exercises and real-life problems. | *Students will be able to...*<br>• Choose among different resources: flashcards (regular or on Quizlet), infographics, notebooks, or posters to create a vocabulary or glossary of all the important concepts that will be used in the unit.<br>• Use online resources such as Khan Academy™ or YouTube videos to review —as needed—, how to simplify algebraic expressions, and find the great common factor.<br>• Use manipulatives such as algebra tiles to practice factorization.<br>• Use online resources to review —as needed—, how to add, subtract, and multiply polynomials.<br>• Use posters, infographics, or any other format of their choice to illustrate the steps to factor and solve polynomial equations. |

| Stage 2 – Assessment Evidence |
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**Performance Task**
Through what authentic performance task will students demonstrate the desired understandings, knowledge, and skills? (describes the learning activity in "story" form. Typically, the P.T. describes a scenario or situation that requires students to apply knowledge and skills to demonstrate their understanding in a real-life situation. Describe your performance task scenario below)
By what criteria will performances of understanding be judged?

**GRASPS Elements of the Performance Task**

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| *G – Goal*<br>*What should students accomplish*<br>*by completing this task?* | For one of the assignments, students will be divided into small groups (four students). Each student will be able to choose the topic of the unit they understand the most:<br>The options will be: |
| *R – Role*<br>*What role (perspective) will your*<br>*students be taking?* | 1. Before we start vocab and classification of polynomials.<br>2. Addition and subtraction of polynomials<br>3. Multiplication of polynomials |
| *A – Audience*<br>*Who is the relevant audience?* | 4. Solving polynomial equations in factored form<br>Each student will be in charge of gathering the information needed to present the topic and then choose a |
| *S – Situation*<br>*The context or challenge provided*<br>*to the student.* | format of their preference (video, PowerPoint presentation, infographics) to present in front of their teammates and explain to them the topic they selected. Each presentation must include a summary of the |
| *P – Product, Performance*<br>*What product/performance will the*<br>*student*<br>*create?* | main concepts involved in the topic, the steps to solve exercises (if applicable) and explain how to solve one example. The students will anonymously review the presenter at the end of each presentation. |

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| *S – Standards & Criteria for*<br>*Success*<br>*Create the rubric for the*<br>*Performance Task* | **Grading Rubric** | Excellent<br>(4) | Proficient<br>(3) | Developing<br>(2) | Beginning<br>(1) |
| | ♦ **Before the presentation research:** Student stays on task and focused while gathering the information needed for the assignment | | | | |
| | ♦ **Content of the presentation/Video:** The information is accurate, easy to understand, well organized, and synthesized. | | | | |

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| | ♣ **Visuals:** Presentation includes pictures, videos, diagrams, or examples to support the learning of the topic. | | | | |
| | ♣ **Fluency and effort to be understood by others:** The presenter speaks clearly and without hesitation while making an effort to make sure teammates are able to understand the topic. | | | | |
| | ♣ **Listening skills:** The presenter takes time to listen to and address teammates' questions and tries their best to answer. The student is focused and engaged while another teammate is presenting. | | | | |

| **Other Evidence** Through what other evidence (work samples, observations, quizzes, tests, journals, or other means) will students demonstrate achievement of the desired results? Formative and summative assessments used throughout the unit to arrive at the outcomes. | **Student Self-Assessment** How will students reflect upon or self-assess their learning? |
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| Aside from the performance task mentioned above, students will demonstrate achievement and understanding of the material through homework completion, class participation, observations, a mid-chapter quiz, and a chapter test at the end of the unit. | At the beginning of the unit, students will complete a not-graded self-assessment to know if they have any gaps or concepts we need to review before we start the chapter. Once we cover half of the unit, students will complete a reflection handout, where they can reflect upon their learning process so far and think about strategies or things they can do to improve or maintain their engagement for the rest of the chapter to make sure they finish this unit successfully. |

| **Stage 3 – Learning Plan** |
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| What teaching and learning experiences will you use to: <br> • achieve the desired results identified in Stage 1? <br> • equip students to complete the assessment tasks identified in Stage 2? |
| **Where are your students headed?  Where have they been?  How will you make sure the students know where they are going? What experiences do the learners bring to the unit?  How have the interests of the learners been ascertained?  Have the learners been part of the pre-planning in any way?  What individual needs do you anticipate will need to be addressed?** |

| Learning environment: Where can this learning best occur? How can the physical environment be arranged to enhance learning? |
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| At the beginning of the school year, students will fill out an anonymous survey where they will share what tools or technological resources they would enjoy and would like to see included in the math lessons. This survey will give me ideas about the activities that could help keep students engaged and will also provide me with feedback regarding how they feel about math. Though my lesson plans will be already designed by then, the idea is to try my best to incorporate any of their new ideas, to this way, make students part of the pre-planning process. This will also help me create a welcoming, warm environment and will show my students that I appreciate and value their feedback. <br><br> With this unit, students will learn about polynomial equations and factoring. They will be focused on identifying patterns, recognizing similar terms, and using technology to understand and apply concepts. They will also study real-life applications for each topic of the sections, which will help them relate math to things that can happen in the real world. Students will be provided with different options for in-class activities, which will make them feel more in charge of their learning process. <br> In the previous chapter, students learned about exponential functions and sequences. This knowledge will help them understand better all of the material that will be covered in chapter seven and also the following chapters after that. <br> In the future, all of these concepts will be the base for their Algebra 2 course and will help them assimilate and apply the more complex concepts of that course. |

| How will you engage students at the beginning of the unit? (motivational set) |
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| The purpose of this curriculum research project is to design lesson plans that incorporate the use of technology as much as possible and to make this class different from the normal and monotonous math class. At the beginning of this unit, I hope to motivate my students by talking to them about the importance of learning polynomial functions and about the real-life applications. I also hope they find motivating the newly designed lesson plans, which will give them the chance to use manipulatives and also online resources, such as educational videos, flashcards, exercises, and algebra tiles into the lessons. |

**What events will help students experience and explore the enduring understandings and essential questions in the unit? How will you equip them with the needed skills and knowledge?**

| # | Lesson Title | Lesson Activities | CCCs | Resources |
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| 1 | Important vocab to understand Polynomial Functions | 1. Vocabulary Flashcards: Students will work in small groups to create vocab flashcards. They have the option to make them online or use paper flashcards. <br> 2. Let's Quiz Each other Activity [NOT GRADED]: By working in groups of 2 or 4, students will have the opportunity to recall the information learned and quiz each other using the flashcards they made. | Reading comprehension | www.Quizlet.com <br> Paper flashcards |
|  |  | 3. Do Now Assessment [NOT GRADED]: Students will have the chance to recall the information learned in the previous class. |  | www.Mathbits.com |

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| 2 | Multiplying polynomials | 4. Practice with Algebra Tiles: Students will practice multiplication of polynomials using algebra tiles. Students will get to choose the resource they would like to use.<br>5. Complete the exit ticket Activity [NOT GRADED]: Students will solve one multiplication exercise individually and will turn it in before leaving the classroom. | Reading comprehension | Paper algebra tiles |
| 3 | Special Products of Polynomials | 6. Do Now Assessment [NOT GRADED]: Do you remember what a binomial is? Write one or two examples.<br>7. Algebra Tiles Activity: Divide students in groups of two. Have students use algebra tiles to find the product and two binomials, identifying and taking notes of the patterns they find. Students will get to choose the resource they would like to use.<br>8. Complete the exit ticket Activity [NOT GRADED]: Students will solve one multiplication exercise individually and will turn it in before leaving the classroom. | Problem-solving | www.Mathbits.com<br><br>Paper algebra tiles |
| 4 | Practice Class - Solving Polynomial Equations in Factored Form | 9. Worksheet: Students complete a review worksheet to practice how to solve polynomial equations.<br>10. Time to get your questions answered: The teacher goes any questions students might have and solves the more challenging exercises on the board.  Students will be encouraged to participate.<br>11. Complete the exit ticket Activity [NOT GRADED]: Students will solve one multiplication exercise individually and will turn it in before leaving the classroom | Problem-solving Writing | Worksheet |
| 5 | Mid-Chapter Review | 12. Practice Quiz: Divide students into groups of two to complete a practice quiz. | Problem-solving | Practice quiz |
| 6 | Mid-Chapter Performance Task | 13. Time to Present! Students will be divided into small groups and will present the topic they selected in the format of their choice (video, PowerPoint presentation, infographics). Each presentation must include a summary of the main concepts involved in the topic, the steps to solve exercises (if applicable) and explain how to solve one example. | Writing Creativity Persuasion | Student computers PowerPoint or Google Slides www.canva.com |
| 7 | Factoring $X^2 + bX + C$ and $aX^2 + bX + C$ | 14. Do Now Assessment [NOT GRADED]: Have students match equations in the factored form with their correct equation in standard form.<br>15. Algebra Tiles Activity: Divide students in groups of two. Have students use algebra tiles to factor the trinomial $X^2 + bX + C$ into the product of two binomials, identifying and taking notes of the patterns they find. Students will get to choose the resource they would like to use. | | Paper algebra tiles "Mathbits.com" |

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| | | 16.Complete the exit ticket Activity [NOT GRADED]: Students will solve two exercises individually and will turn it in before leaving the classroom. | | |
| 8 | End-of-Chapter Performance Task | 17.Time to Present: Students will briefly present and explain to their classmates the poster or infographic they made about how to factor quadratic polynomials, describing each step. | Writing Creativity Persuasion | Student computers PowerPoint or Google Slides www.canva.com |
| 9 | Online Resources | Students who are struggling, prefer to work at their own pace, want to get ahead, or need more challenging material can use the following websites to watch lesson videos, get ahead, and solve practice problems and exercises.<br><br>▪ https://www.brainpop.com/search/?keyword=Polynomials<br>This video explains all the main concepts covered in lesson one in a funny and simple way.<br>▪ https://www.mathsisfun.com/algebra/polynomials.html<br>https://www.mathsisfun.com/algebra/polynomials-multiplying.html<br>This website explains all of the main concepts of lessons one and two. It has ten practice problems for each section.<br>▪ https://www.khanacademy.org/math/algebra-home/alg-polynomials<br>This website has videos explaining all of the topics covered in the unit. It has four practice problems for each lesson.<br>▪ https://www.purplemath.com/modules/factquad.htm<br>This website explains all of the main concepts covered in lessons eight and nine.<br>https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:quadratics-multiplying-factoring/x2f8bb11595b61c86:factor-quadratics-strategy/a/factoring-quadratics-in-any-form<br>Tutorial videos that explain all of the main concepts covered in lessons eight and nine.<br>▪ www.mathbits.com<br>A very fun website with online algebra tiles | None | Student computer with internet access |

| Assess and Reflect (Stage 4) | |
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| **Considerations** | **Comments** |
| **Required Areas of Study:**<br>**Is there alignment between outcomes, performance assessment, and learning experiences?** | Yes. All of the in-class activities are carefully designed to provide students with chances to consolidate information, clearly understand the vocab terms, and have as much practice as possible of all the steps of the factoring and the solving polynomial equations processes. |
| **Adaptive Dimension:**<br>**Have I made purposeful adjustments to the curriculum content (not outcomes), instructional practices, and/or the learning environment to meet the learning needs and diversities of all my students?** | For struggling students: Most of the classes in this unit are designed in a way that allows the students who are struggling with the new concepts, have doubts, or need further clarification, to have the opportunity to have one-on-one or small group instruction as needed, while the rest of the students work on in-class activities<br><br>For students who need a challenge: Students who want to get ahead or need more challenging material can use the websites provided to watch lesson videos, get ahead, and solve practice problems and exercises.<br><br>Remote Learning Option: Teachers who are providing remote instruction can apply the "Flipped classroom," a concept explored by authors Brown and Kelleher (2012) in their article "What Great Homework Looks Like." Math teachers can record the lessons, or make the instructional videos (mentioned above) available to the students and have them watch the videos at home as homework. Then, use the class time to have students solve practice exercises and apply the material learned online or through videos the day before. By doing this, the teacher has the opportunity to provide individual and immediate positive feedback, which helps to keep students engaged in the class and motivated (Brown and Kelleher, 2012). |
| **Instructional Approaches:**<br>**Do I use a variety of teacher-directed and student-centered instructional approaches?** | My lesson plans are designed to provide a variety of instructional approaches. Since students very often see the content of the Algebra 1 course as challenging and confusing, most classes have a dedicated time for the teacher-led instruction, so the teacher can give a lecture, explain the concepts, solve examples, and guide a class discussion. Students are also provided with plenty of opportunities for content review and to get |

| | their questions answered. Classes will also give students the opportunity for differentiated instruction and the chance to use the resources and format of their preference. |
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| **Resource-Based Learning:**<br> **Do the students have access to various resources on an ongoing basis?** | Yes. Students will have access to resources online such as tutorial videos, practice problems, and algebra tiles, as well as physical resources like as the textbook and flashcards, and manipulatives. |
| **FNM/I Content and Perspectives/Gender Equity/Multicultural Education:**<br>**Have I nurtured and promoted diversity while honoring each child's identity?** | Yes. I think that I am promoting diversity by valuing and taking into account the students' input I get from surveys and assessments. Also, by having different plans in place to target each student's needs and for struggling or overachieving students.<br>Giving students the options to choose between the resources of their preference to work on in-class activities and for their performance tasks is also a way for me to honor their identity, making them feel more in charge of their learning while improving their retention, engagement, and motivation. |

From:  Wiggins, Grant, and J. McTighe. (1998). *Understanding by Design*, Association for Supervision and Curriculum Development, ISBN # 0-87120-313-8 (pbk)