# Unit 6 Polynomials and Factoring

Content Area: **Math**
Course(s): **Algebra 1**
Time Period:
Length: **20 days**
Status: **Published**

**Algebra 1**

## Department of Curriculum and Instruction

**Belleville Public Schools**

**Curriculum Guide**

# Algebra 1, Grade 8

# Unit 6 Polynomial and Factoring

**Belleville Board of Education**

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## Unit Overview

- This unit is about operations with polynomials, factoring polynomials and solving quadratic equations by factoring.
- The students should expect to learn how to add and subtract polynomials, multiply a polynomial by a monomial, factor polynomials, solve quadratic equations by factoring.

## Enduring Understanding

Understand that polynomials form a system analogous to integers, namely, they are closed under the operations of addition, subtraction and multiplication

Use the structure of an expression to identify ways to rewrite it

Make sense of problems and persevere in solving them.

Reason abstractly and quantitatively.

Model with mathematics.

Use appropriate tools strategically.

Attend to precision.

Look for and make use of structure.

Look for and express regularity in repeated reasoning.

## Essential Questions

How can you use the distributive property to multiply binomials?

How can two algebraic expressions that appear to be different be equivalent?

How are the properties of real numbers related to polynomials?

How can you use factoring to solve quadratic equations in standard form when a=1?

How can you use factoring to solve quadratic equations in standard form when a is not =1?

What patterns and characteristics can you observe in expressions when multiplying/factoring?

## Exit Skills

By the end of Unit 6 Students Should be able to:

- Classify, add and subtract polynomials.
- Multiply a polynomial by a monomial.
- Multiply two binomials or a binomial by a trinomial.
- Find the degree of a polynomial.
- Write polynomials in ascending and descending order.
- Find special products.
- Factor using the Distributive Property.
- Factor polynomials by grouping.
- Factor trinomials of the form x2 + bx + c and ax2 + bx + c.
- Factor perfect square trinomials & differences of squares.
- Use the zero product property.

## New Jersey Student Learning Standards (NJSLS)

| | |
|---|---|
| MA.K-12.1 | Make sense of problems and persevere in solving them. |
| MA.A-SSE.A.1a | Interpret parts of an expression, such as terms, factors, and coefficients. |
| MA.K-12.3 | Construct viable arguments and critique the reasoning of others. |
| MA.K-12.4 | Model with mathematics. |

| | |
|---|---|
| MA.A-SSE.A.2 | Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$. |
| MA.K-12.5 | Use appropriate tools strategically. |
| MA.A-SSE.B.3a | Factor a quadratic expression to reveal the zeros of the function it defines. |
| MA.K-12.6 | Attend to precision. |
| MA.K-12.7 | Look for and make use of structure. |
| MA.K-12.8 | Look for and express regularity in repeated reasoning. |
| MA.A-APR.A.1 | Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. |
| MA.A-REI.A.1 | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. |
| MA.A-REI.B.4b | Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers $a$ and $b$. |

## Interdisciplinary Connections

Economics, Business, Financing, Science, Literacy

| | |
|---|---|
| LA.SL.8.1 | Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. |
| LA.SL.8.1.B | Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed. |
| LA.SL.8.1.C | Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas. |
| LA.SL.8.1.D | Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented. |

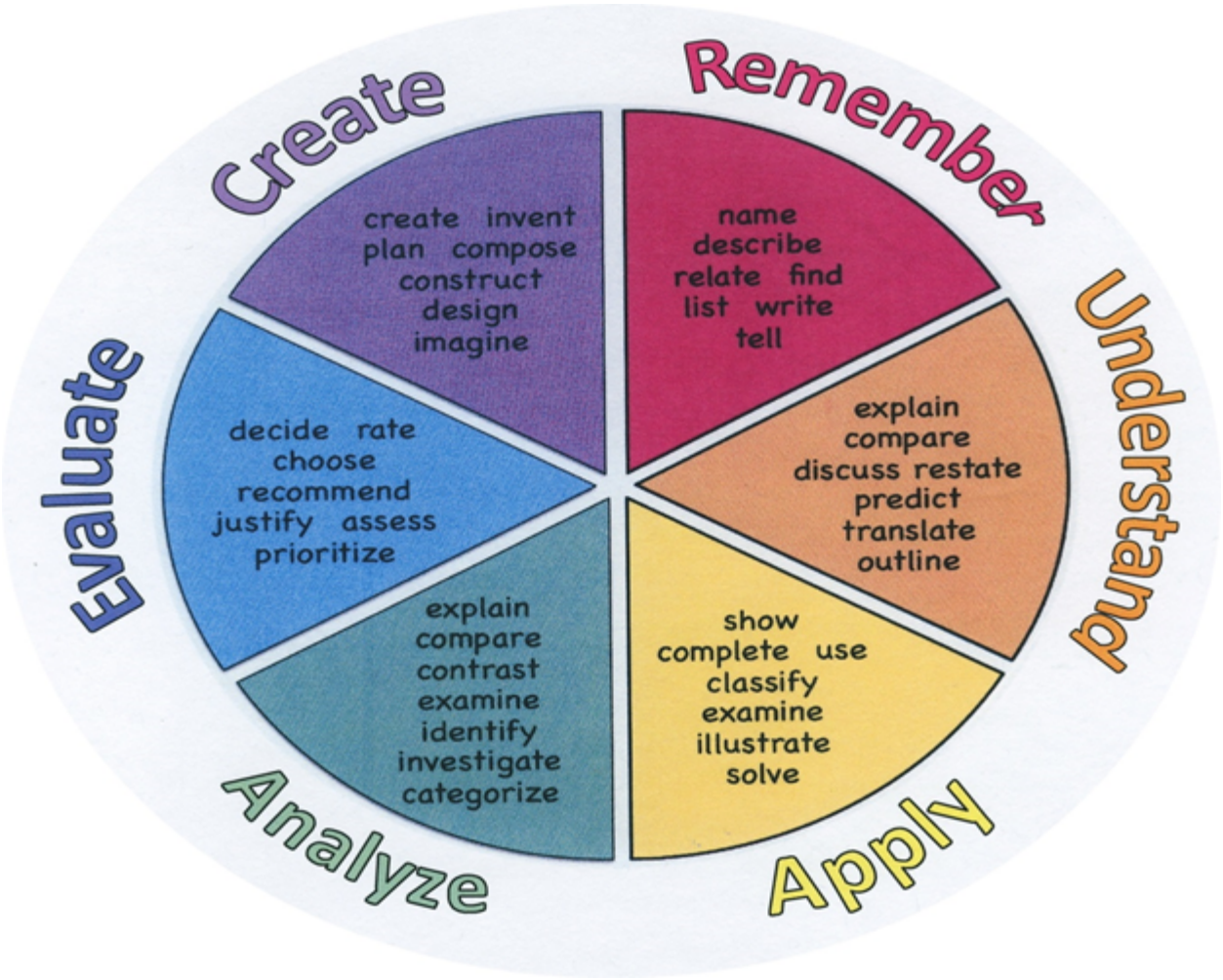
## Learning Objectives

Students will be able to:

- Classify, add, subtract and simplify polynomials by using like terms.
- Multiply a polynomial by a monomial by the distributive property.
- Multiply two binomials or a binomial by a trinomial by the distributive property or FOIL method.

- Find the degree of a polynomial.
- Write polynomials in ascending and descending order.
- Find special products using the formulas.
- Factor polynomials by using the Distributive Property.
- Factor polynomials by grouping method.
- Factor trinomials of the form x2 + bx + c and ax2 + bx + c.
- Factor perfect square trinomials & differences of squares.
- Solve quadratic equations by using the zero product property.
- Organize different methods of factoring by creating graphic organizer.

| Remember | Understand | Apply | Analyze | Evaluate | Create |
|---|---|---|---|---|---|
| Choose | Classify | Choose | Categorize | Appraise | Combine |
| Describe | Defend | Dramatize | Classify | Judge | Compose |
| Define | Demonstrate | Explain | Compare | Criticize | Construct |
| Label | Distinguish | Generalize | Differentiate | Defend | Design |
| List | Explain | Judge | Distinguish | Compare | Develop |
| Locate | Express | Organize | Identify | Assess | Formulate |
| Match | Extend | Paint | Infer | Conclude | Hypothesize |
| Memorize | Give Examples | Prepare | Point out | Contrast | Invent |
| Name | Illustrate | Produce | Select | Critique | Make |
| Omit | Indicate | Select | Subdivide | Determine | Originate |
| Recite | Interrelate | Show | Survey | Grade | Organize |
| Select | Interpret | Sketch | Arrange | Justify | Plan |
| State | Infer | Solve | Breakdown | Measure | Produce |
| Count | Match | Use | Combine | Rank | Role Play |
| Draw | Paraphrase | Add | Detect | Rate | Drive |
| Outline | Represent | Calculate | Diagram | Support | Devise |
| Point | Restate | Change | Discriminate | Test | Generate |
| Quote | Rewrite | Classify | Illustrate | | Integrate |
| Recall | Select | Complete | Outline | | Prescribe |
| Recognize | Show | Compute | Point out | | Propose |
| Repeat | Summarize | Discover | Separate | | Reconstruct |
| Reproduce | Tell | Divide | | | Revise |
| | Translate | Examine | | | Rewrite |
| | Associate | Graph | | | Transform |
| | Compute | Interpolate | | | |
| | Convert | Manipulate | | | |
| | Discuss | Modify | | | |
| | Estimate | Operate | | | |
| | Extrapolate | Subtract | | | |
| | Generalize | | | | |
| | Predict | | | | |




## Suggested Activities & Best Practices

Polynomials:

https://mathslinks.net/links/algebra-marcus-du-sautoy

Real- world applications/Quadratic Equations:

https://www.illustrativemathematics.org/content-standards/HSA/REI/B/4/tasks/586

Graphic Organizer:

https://www.teacherspayteachers.com/Product/Factoring-Polynomials-Graphic-Organizer-366550

Textbook, eAssessment, supplemental materials:

https://my.mheducation.com/login

AI Assessment and Learning System:

https://www.aleks.com/

Mindset:

https://www.youtube.com/watch?v=3icoSeGqQtY

http://www.youcubed.org/wp-content/uploads/Positive-Classroom-Norms2.pdf

Teaching Strategies for Improving Algebra Knowledge in Middle and High School Students:

https://ies.ed.gov/ncee/wwc/PracticeGuide/20

Coaching Corner:

https://sites.google.com/belleville.k12.nj.us/thecoachingcorner/home

Algebra Tools - Functions:

https://www.state.nj.us/education/aps/cccs/math/NJISTFunctions.pdf

Algebra Tools - Algebra:

https://www.state.nj.us/education/aps/cccs/math/NJISTAlgebra.pdf

Misc Mathematics materials:

http://www.mathnstuff.com/

Algebra Kahoots:

https://kahoot.com/explore/collections/math-kahoot-algebra/

## Assessment Evidence - Checking for Understanding (CFU)

- Exit Ticket Find each sum and difference a. $(4x^2 + 6x - 9) + (5 - 6x^2 + 3x)$ b. $(7 - 3x + 5x^2) - (5x - 3 + 2x^2)$ --- (formative assessment)

- Do Nows (formative assessments)
- Problems solved for homework (formative assessments)
- Score and re-teach a peer (alternative assessment)
- Create a study guide (alternative assessment)
- Benchmark #4 (summative assessment)

- Admit Tickets
- Common Benchmarks
- Compare & Contrast
- Define
- Describe
- Evaluate
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- KWL Chart
- Learning Center Activities
- Quizzes
- Red Light, Green Light
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Unit review/Test prep
- Unit tests

## Primary Resources & Materials

Glencoe McGraw-Hill Algebra1 2014

Glencoe McGraw-Hill Algebra1 2010

Practice Glencoe Algebra1

Study Guide Glencoe Algebra1

## Ancillary Resources

Glencoe Algebra 1  Tutor: Personal Tutor and Spanish Tutor

Glencore Algebra 1  Geometer's Sketchpad

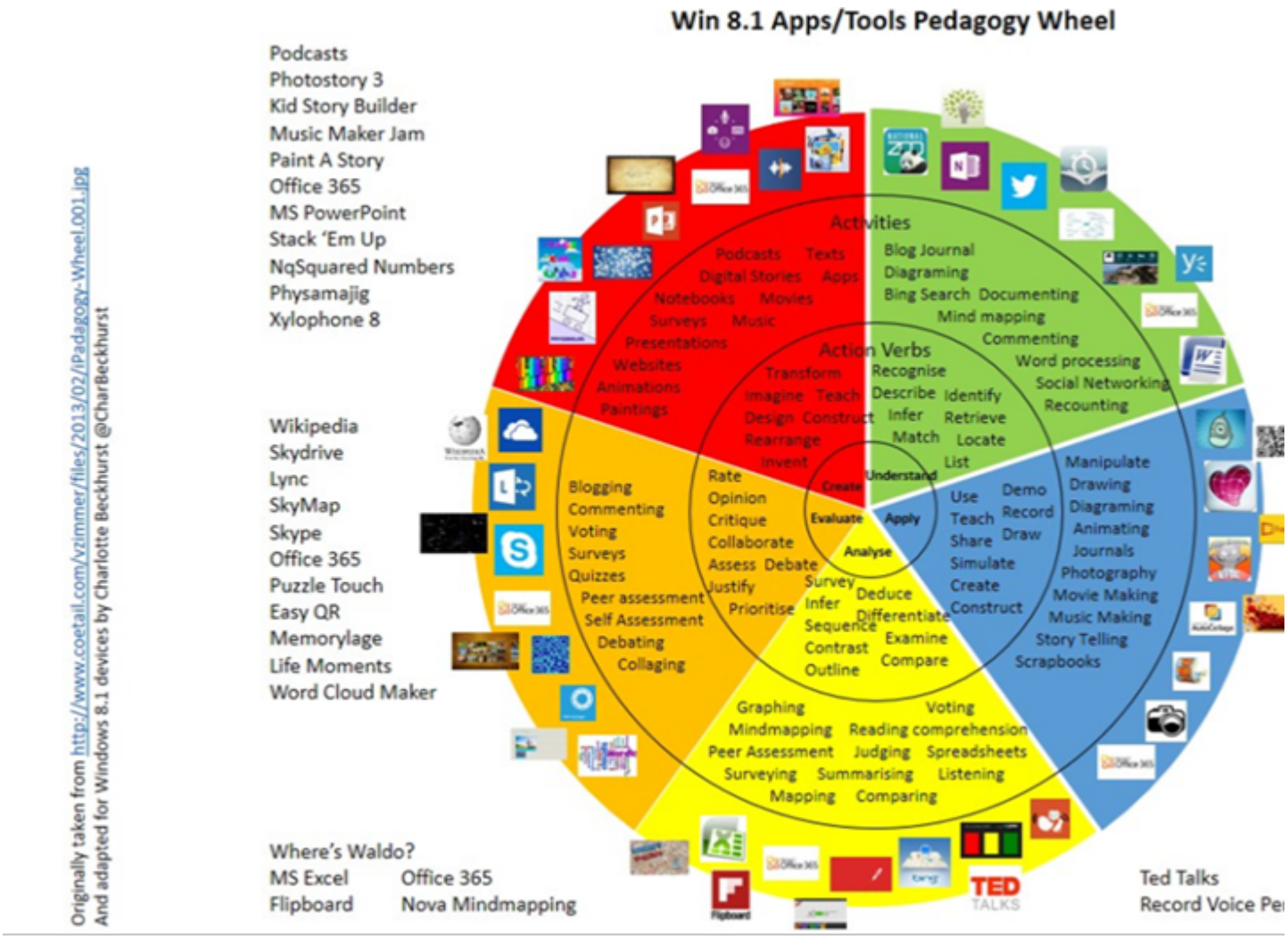
Glencoe Algebra 1  Glencoe Mathematics Secondary Series

ALEKS

## Technology Infusion

- betterlesson.com  https://betterlesson.com/lesson/447849/factoring-quadratic-expressions?from=search
- Youtube
- Khan academy
- Edulastic
- Google Docs
- Office 365
- Google Slides
- PodCasts
- Google Sheets

- Google Classroom
- Wikipedia
- Skype
- Twitter
- Ted Talks
- QR Barcode Generator
- Calculator/Graphic calculator
- desmos.com
- geogebra.org



## Alignment to 21st Century Skills & Technology

- English Language Arts;
- Science and Scientific Inquiry
- Social Studies
- Economics;
- World languages
- Technology

| | |
|---|---|
| CRP.K-12.CRP2 | Apply appropriate academic and technical skills. |
| CRP.K-12.CRP4 | Communicate clearly and effectively and with reason. |
| CRP.K-12.CRP7 | Employ valid and reliable research strategies. |
| CRP.K-12.CRP8 | Utilize critical thinking to make sense of problems and persevere in solving them. |
| CRP.K-12.CRP11 | Use technology to enhance productivity. |
| CAEP.9.2.12.C.2 | Modify Personalized Student Learning Plans to support declared career goals. |
| TECH.8.1.12.A.3 | Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue. |
| TECH.8.1.12.F.1 | Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs. |
| TECH.8.2.12.D.CS2 | Use and maintain technological products and systems. |

## 21st Century Skills/Interdisciplinary Themes

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy

## 21st Century Skills

- Civic Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Health Literacy

## Differentiation

- Use of Algebra tiles to model adding and subtracting polynomials(Mcgraw Hill Algebra 1 textbook page 463)
- Use of Algebra tiles to model multiplying polynomials(McGraw Hill Algebra 1 textbook page 478)
- Use of Algebra tiles and a product mat to model factoring using the distributive property(McGraw Hill Algebra 1 textbook page 493)
- Use of Algebra tiles to model factoring trinomials (McGraw Hill Algebra 1 textbook page 501)
- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Study guides
- Scheduled breaks
- Rephrase written directions
- Additional time
- Preview content & concepts
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Large print edition
- Small group settin

- Alternative formative and summative assessments
- Choice board
- Leveled rubrics
- Multiple intelligence options
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

- Goal setting with students
- Jigsaw
- Think-Pair-Share
- Varied supplemental materials

## Special Education Learning (IEP's & 504's)

- Use of Algebra tiles to model adding and subtracting polynomials(McGraw Hill Algebra 1 textbook page 463)
- Use of Algebra tiles to model multiplying polynomials(McGraw Hill Algebra 1 textbook page 478)
- Use of Algebra tiles and a product mat to model factoring using the distributive property(McGraw Hill Algebra 1 textbook page 493)
- Use of Algebra tiles to model factoring trinomials (McGraw Hill Algebra 1 textbook page 501)

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- modified assignment format
- modified test content
- modified test format
- modified test length
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner

## English Language Learning (ELL)

- Use of Algebra tiles to model adding and subtracting polynomials(Mcgraw Hill Algebra 1 textbook page 463)
- Use of Algebra tiles to model multiplying polynomials(McGraw Hill Algebra 1 textbook page 478)
- Use of Algebra tiles and a product mat to model factoring using the distributive property(McGraw Hill Algebra 1 textbook page 493)
- Use of Algebra tiles to model factoring trinomials (McGraw Hill Algebra 1 textbook page 501)

- teaching key aspects of a topic.  Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers

## At Risk

- Use of Algebra tiles to model adding and subtracting polynomials(Mcgraw Hill Algebra 1 textbook page 463)
- Use of Algebra tiles to model multiplying polynomials(McGraw Hill Algebra 1 textbook page 478)
- Use of Algebra tiles and a product mat to model factoring using the distributive property(McGraw Hill Algebra 1 textbook page 493)
- Use of Algebra tiles to model factoring trinomials (McGraw Hill Algebra 1 textbook page 501)

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic.  Eliminate nonessential information
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using videos, illustrations, pictures, and drawings to explain or clarify

## Talented and Gifted Learning (T&G)

Activity: Construct and Compare Linear, Quadratic and Exponential models and solve problems https://tapintoteenminds.com/3acts-by-common-core/f-le-3/

- Advanced problem-solving
- Allow students to work at a faster pace
- Complete activities aligned with above grade level text using Benchmark results
- Create a plan to solve an issue presented in the class or in a text
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

## Sample Lesson

Using the template below, please develop a **Sample Lesson** for the first unit only.

Unit Name:

NJSLS:

Interdisciplinary Connection:

Statement of Objective:

Anticipatory Set/Do Now:

Learning Activity:

Student Assessment/CFU's:

Materials:

21st Century Themes and Skills:

Differentiation/Modifications:

Integration of Technology: