

LESSON PLAN (DAY 4)

Key Content Standards:

- 14.0 *Students solve a quadratic equation by factoring*
23.0 *Students apply quadratic equations to physical problems, such as the motion of an object under the force of gravity.*

Common Core Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Attend to precision.
4. Model with Mathematics.

Key ELD Standards:

Part 1: Interacting in Meaningful Ways

A. Collaborative:

Expanding 1: Exchanging Information/Ideas – Contribute to class, group, and partner discussions by following turn-taking rules, asking relevant questions, affirming others, adding relevant information, and paraphrasing key ideas.

Bridging 1: Exchanging Information/Ideas – Contribute to class, group, and partner discussions by following turn-taking rules, asking relevant questions, affirming others, adding relevant information, and paraphrasing key ideas, building on responses and providing useful feedback.

B. Interpretive:

Expanding 5: Demonstrate active listening in oral presentation activities by asking and answering detailed questions with occasional prompting and moderate support.

Bridging 5: Demonstrate active listening in oral presentation activities by asking and answering detailed questions with minimal prompting and support.

Learning Objective:

A. Cognitive Task (use cognitive verbs):

1. Students will *recall* how to factor polynomials.
2. Students will be able to *recognize* and *identify* a quadratic function or equation.
3. Students will *use* the zero product property to find roots of quadratic functions.
4. Students will *draw conclusions* between the number of factors and the number of x-intercepts or solutions of a quadratic function.

5. Students will *apply concepts* to real-world applications.
6. Students will *compare and contrast* finding solutions to a quadratic equation by graphing and factoring.
7. Students will *contribute* to class and partner discussions using proper academic language and mathematical vocabulary.

B. Understanding or Skill to be Enhanced:

Procedural Fluency -

1. Factoring quadratic functions.
2. Finding the solutions to a quadratic equation by factoring.

Concept –

2. Understanding the relationship that the number of factors of the quadratic polynomial, is equal to the number of x-intercepts of the graph of the quadratic function, and is in turn equal to the number of solutions of the quadratic equation.
3. Compare and contrast different methods (graphing, factoring) for solving quadratic equations using a Venn diagram.

Mathematical Reasoning -

4. Apply Mathematics to real-world (word) problems.
5. Explain the reasonableness of the solution (e.g.: time cannot be negative).

Assessment(s):

- Warm up problems at beginning of class.
- Check homework of a few students while they are correcting their homework and working on warm-up problems at beginning of class.
- At start of class, ask the following question – “What did we learn yesterday?”
- Randomly call individual students and ask questions during the above review.
- Randomly choose students to answer questions during class. Make sure to also check IEP, GATE, and ELLs.
- Class discussions.
- Walk around and monitor students working individually, or discussing amongst themselves during *think-pair-share*.
- Walk around and check students’ notes while they are working individually, or together in *think-pair-share*.
- Monitor students’ body language and facial expressions.
- Summative assessment.

Prerequisite Skills and Knowledge:

1. Identifying quadratic functions and equations.
2. Factoring 2nd degree polynomials.

Lesson Resources/Materials:

- c. Students –
 - i. Notes book
 - ii. Textbook
 - iii. Pencil, eraser, highlighter.
 - iv. Worksheet for Lesson 9.5.
 - v. Venn Diagram with two circles overlapping
- d. Teacher –
 - i. Laptop connected to document camera and overhead projector
 - ii. Transparencies and markers
 - iii. Worksheet for Lesson 9.5.

Instructional Sequence (Day 4)

Introduction (5 - 8 minutes):

TEACHER	STUDENTS
<ul style="list-style-type: none"> ✓ Tell students to take out homework and start correcting. ✓ Project Warm-Up problems on screen. <p><i>Assess/Evaluate:</i></p> <ul style="list-style-type: none"> ✓ Check homework of some students and take attendance while students are working on warm-up problems. 	<p>Correct homework.</p> <p><i>(Recall, Reading, Writing)</i> Start on warm-up problems.</p>

Body of the Lesson (50 - 55 minutes): Describe step-by-step what the teacher **and** the students will be doing during the lesson.

TEACHER	STUDENTS
<p><i>Essential Mathematical Vocabulary for today:</i> factor, quadratic, trinomial, zero, roots, x-intercept</p> <p style="text-align: center;"><i>Connect to prior knowledge</i></p> <p><i>Assess/Evaluate:</i></p> <ul style="list-style-type: none"> ✓ Review – What did we learn yesterday? ✓ Randomly call students to check understanding. ✓ Individually check IEP and several ELLs. May need to talk slower, aid with Sentence Starters, Revoice (teacher repetition) student’s explanation using hand gestures, along with Pace and Emphasis. ✓ For GATE student: Explain (in words) how to find the solution(s) to a quadratic equation by factoring the related function? ✓ Check to make sure GATE student uses correct academic language and mathematical vocabulary. 	<p><i>(Recall, Speaking)</i> Student(s) called on answers Teacher’s questions using complete sentences with correct academic language and mathematical vocabulary such as factor, quadratic, trinomial, zero.</p> <p><i>(Listening)</i> Students not called on are listening.</p> <p><i>(Speaking)</i> GATE student explains Teacher’s questions using correct academic language and mathematical vocabulary.</p> <p><i>(Listening)</i> Students not called on are listening.</p>

**Assign 9.5 Worksheet with problems
(including word problems)**

Practice A – in class, do problems 12, 13, 14
Practice C – in class, do problems 20, 21, 26

For each problem:

- ✓ Walk around and monitor student conversations, and their work.
- ✓ **Scaffold** as necessary.
- ✓ Randomly call students (especially IEP, GATE, and ELLs) to check understanding by asking them how they solved the problem.
- ✓ Ask questions to class as a whole.
- ✓ If necessary, **model** how to solve some problems.

Connect to real-world applications

- ✓ Example: see worksheet Practice A – package dropped from helicopter
- ✓ Example: see worksheet Practice C – rock thrown from a cliff

Draw figures to understand the problem – especially to aid IEP, ELLs, and students who are more visual.

Anticipate:

Identify possible problem words/phrases in the word problems – *relief package, hit the ground, how long (refers to time, not length)* – check to make sure class understands each word/phrase.

Critical Thinking Questions

- ✓ Compare and Contrast various methods for finding the solutions of quadratic

(Recognize, Identify, Draw Conclusions, Apply Concepts) Students work in pairs to solve the problem.

(Speaking, Listening, Writing) Discuss in pairs. Ask questions.

(Speaking) Student(s) called on answers Teacher’s questions in complete sentences using correct academic language and mathematical vocabulary.

(Listening) Students not called on are listening.

(Reading, Listening, Writing) Students reading my work on the overhead, listening to me speak, and writing in their notes.

(Apply Concepts, Use Context Cues, Reading, Speaking, Listening, Writing) Work in pairs. Students write answers in complete sentences.

(Compare and Contrast, Listening, Speaking, Reading, Writing) Discuss with partner, and

<p>functions...i.e. graphing, and factoring.</p> <p>Anticipate: Possible student answers –</p> <ul style="list-style-type: none"> ✓ Factoring – get exact answers, but may be difficult to factor. ✓ Graphing – get approximate answers, but easy to visualize. <p>Anticipate: Students can't come up with any answers, then ask the following questions –</p> <ul style="list-style-type: none"> ✓ Which method is easier? Why? ✓ Which method takes more time? Why? ✓ Which method is easy to visualize? Why? <ul style="list-style-type: none"> ✓ Individually check for understanding with IEP and several ELLs. May need to repeat the question, write it down, talk slower, aid with Sentence Starters, Revoice (teacher repetition) student's explanation using hand gestures, along with Pace and Emphasis. 	<p>complete the Venn Diagram comparing and contrasting the methods of graphing and factoring. Students may refer to their notes book, and to the text book.</p> <p><i>(Speaking)</i> Student(s) called on answers Teacher's questions in complete sentences using correct academic language and mathematical vocabulary.</p> <p><i>(Listening)</i> Students not called on are listening.</p> <p>Then class discussion using correct academic language and mathematical vocabulary.</p>
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Closure (12 – 17 minutes):

TEACHER	STUDENTS
<p>Summative Assessment on learning segment</p> <p>Assign Homework</p> <p>Assign unfinished problems from worksheet for Homework. Students who finish the summative assessment early can start on homework.</p> <p>Assess/Evaluate: Walk around and monitor individual students. Ask questions to check for understanding.</p> <p>Help individual students.</p>	<p><i>(Recall, Connect, Multiple Representations, Reading, Writing)</i> Answer the questions on the Summative Assessment.</p> <p><i>(Reading, Writing)</i> Students who finish the summative assessment early can start on homework.</p> <p><i>(Speaking)</i> Ask for help if needed.</p>

<p>✓ Make sure to check on IEP and several ELLs –May need to talk slower, aid with Sentence Starters, Revoice (teacher repetition) student’s explanation using hand gestures, along with Pace and Emphasis.</p>	
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ACADEMIC LANGUAGE (DAY 4)

1. Describe the cognitive task related to the content learning objective:
 1. Students will *recall* how to factor polynomials.
 2. Students will be able to *recognize* and *identify* a quadratic function or equation.
 3. Students will *use* the zero product property to find roots of quadratic functions.
 4. Students will *draw conclusions* between the number of factors and the number of x-intercepts or solutions of a quadratic function.
 5. Students will *apply concepts* to real-world applications.
 6. Students will *compare and contrast* finding solutions to a quadratic equation by graphing and factoring.
 7. Students will *contribute* to class and partner discussions using proper academic language and mathematical vocabulary.
2. Language Demands: How will students be communicating in relation to the content in the rich task?
 - Receptive – listening, reading, and viewing:
 - ✓ Listening and reading
 - Productive – speaking and writing:
 - ✓ Speaking and writing
3. What key language skill(s), related to a single language demand above, will you help the students develop during the lesson?
 - ✓ Speaking, listening, and writing
4. Describe the genre of the chosen language demand.

Speaking

- ✓ using precise language in *explaining* or *justifying* mathematical reasoning
- ✓ *describing* procedures
- ✓ *engaging* in collaborative and oral mathematical reasoning

Listening

- ✓ *listening* to each other when working together in pairs, while solving worksheet problems, and also while completing the Venn diagram
- ✓ *listening* to me when I am modeling and thinking aloud while solving a problem

Writing

- ✓ *writing* down all steps in solving a problem
- ✓ *writing* answers in complete sentences (for e.g.: “The x-intercepts are ___ and ___.”)
- ✓ *representing* word problems mathematically
- ✓ *translating* words or sentences into symbols
- ✓ *drawing* a visual representation of the context of a word problem
- ✓ *comparing and contrasting* on a Venn diagram

5. Describe the instructional strategies you will use to support the development of academic language skills (**related to the identified language demand above**). Include strategies you will use to meet the needs of individual or groups of students with varying language abilities.

✓ I will reinforce explaining (*orally*, or *speaking*) the thought process students are following by asking them to use correct mathematical terminology in articulating their responses. The specific strategies are:

- *Discussing* with their partner and *asking* questions
- *Explaining* the reasoning behind selecting a particular procedure
- *Modeling* (specifically for ELLs and IEP)
- *Scaffolding* (specifically for ELLs and IEP)
- *Providing* sentence starters (specifically for ELLs and IEP)
- *Rephrasing* (specifically for ELLs and IEP)
- Students speak their answers in complete sentences. For example, “The x-intercepts are ___ and ___.”

✓ The instructional strategies I will use for *writing* are:

- *Venn diagram* – students compare and contrast linear and quadratic functions/equations on a Venn diagram.
- Students are to *write down all intermediate steps* in solving a problem.
- Students write answers in *complete sentences*. For example, “The x-intercepts are ___ and ___.”
- *Multiple representation* (especially for ELLs, IEP, and for those who are more visually inclined) – draw a picture/figure to understand the context of a word problem.