Lesson Study Group Members: Mike Rich, Michele Flynn, Jeff Freitas and Laurie Wieland
Grade Level: High School and Jr. High Algebra 1
Title Lesson:

Part I: Planning to Teach

1.) **Research Goal:** *Students are able to organize and make connections, while taking risks, by demonstrating and explaining their steps whether accurate or not.*

2.) **Lesson Intent:** connecting completing the square with the solutions of a quadratic equation.

3.) Rationale/Standards met: Alg. I Standard 14.0

4.) Prerequisite Skills needed for lesson:
   a.) Vocabulary: complete, factor, quadratic, coefficient, constant
   b.) Math concepts: Square roots & inverse operations, identifying a, b, & c of a standard form quadratic equation

5.) Plan for Differentiation-

   * Benchmark Group: (Making Progress)
     Modifications: None

   * Strategic Group: (Special needs, below grade level standards, Mid to advanced EL students)
     Modifications: Questioning, Scaffolding
     Manipulatives, think, pair, share, whiteboards, EDI strategies, partnering,
* Intensive Group: (At risk students, intensive EL students)
  Modifications: Modeling, Strategic Grouping
  Manipulatives, partnering, whiteboards

4. **Materials/Manipulative’s/Technology:** Algebra Tiles, TI-84 Calculators, TI-SmartView software, whiteboards, markers

5. **Plan for Assessment & Analysis of Student Learning:**
   - Entry Level - Starter/Warm-up Activity – Algebra Tile to solve linear equations
   - Progress Monitoring - Whiteboards
   - Summative - Ticket out of Class

6.) **References:** None

**Part II: Procedures for the Lesson**

**Total time allotted for the lesson:** 90 minutes

<table>
<thead>
<tr>
<th>T= Teacher Script</th>
<th>A: Activities</th>
<th>PS: Possible Student Responses</th>
<th>TS: Teacher Support</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time</strong></td>
<td><strong>Lesson Plan:</strong></td>
<td><strong>Possible Student</strong></td>
<td><strong>Points of Evaluation:</strong></td>
</tr>
<tr>
<td>Breakdown</td>
<td>*Teacher Dialogue/Script *Activities</td>
<td>Responses/Teacher Support</td>
<td>Entry Level, Progress Monitoring, Summative</td>
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| 7 min.    | **Goal:** To solve quadratic equations by completing the square.  
A: Starter/Warm-up Activity - Use Algebra Tiles to solve a linear equation  
T: When you solve linear equations you are comparing lengths when you solve quadratics you are comparing areas.  
THE BIG QUESTION | Whiteboards, markers & algebra tiles to be on desks before class.  
2x + 4 = 6  
3x - 5 = 4 | |
| 5 min.    | T: What do you think it might mean to complete the square? (handout)  
T: Share out | Think, pair, share.  
PS: IDK | Random name call |
| 45 min | A: Using the algebra tiles can you model the area of $x^2 = 9$? Use the whiteboards as your surface to build on. T: What are the possible solutions? *(should be 3 or -3)* T: Use the algebra tiles to model $x^2 = 5$ T: What are the possible solutions? | Students will use a table to record all of the examples in conjunction with manipulatives. TS: If the squares are equal, then the length has to be equal. TS: Length times width will give you the area. TS: Remember that a positive times a positive gives the same as a negative times a negative. | Progress Monitoring |
| **T:** Use the algebra tiles to model $x^2 + 2x = 8$ | **PS:** 2.5, 1 & 5  
**PS:** No, we are missing something. Putting all the $x$ tiles on one side would produce a rectangle not a square. | **TS:** Solve for $x$. Go back and plug them into the equation. |
| --- | --- | --- |
| **T:** Can you arrange the tiles into a perfect square? If not, what is missing? What do we need to add? Why do we split up the number of $x$'s? (cut $b$ in half) | **T:** Build a square to model $x^2 + 4x + 3 = 8$.  
**T:** What are the possible solutions? | **TS:** Isolate the $x^2$ and $bx$ term by moving the $c$ term to the other side of the equation. Now complete the square. Remember that what you do to one side of the equation you MUST do to the other side. | **Progress Monitoring** |
<table>
<thead>
<tr>
<th><strong>T:</strong> Model $x^2 - 4x - 2 = -2$</th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>T:</strong> Lets put away the tiles and walk through the steps to complete the square to solve $x^2 + 6x + 4 = -1$</td>
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</tbody>
</table>
| **PS:** Students derive steps from their table. Randomly call on students. Come up with steps as a class. | **TS:**
1. Subtract the c term from both sides.  
2. Divide the b term by two  
3. Square the result and add it to both sides of the equation.  
4. Rewrite quadratic | **List all the steps on the whiteboards. One step at a time. Everyone together.**  
**Record steps in journals.**  
Everyone do step 1.  
Everyone do step 2.  
On and on. |
<table>
<thead>
<tr>
<th>Based on the list of steps:</th>
<th>T: Solve $x^2 + 10x - 11 = 0$ by completing the square. Use the procedures you came up with, but you can draw pictures.</th>
<th>Blah, blah, yada yada.</th>
</tr>
</thead>
<tbody>
<tr>
<td>T: $x^2 + 10x - 11 = 0$</td>
<td>as the length squared. 5. Take the square root of both sides. Remember to include the $\pm$ symbol. 6. Solve! 7. Check your answer.</td>
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<tr>
<td>Do one more, Factor first, then complete the square.</td>
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### Additional Practice:
\[ x^2 - 2x - 24 = 0 \]

### 10min
**Ticket out of Class:**
Solve the quadratic equation by completing the square.
\[ x^2 - 8x - 4 = 5 \]

### Homework:
Page 646, #16, 19, 21, 30
**MUST SHOW WORK!**

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**Part III: Reflecting on Student Learning Outcomes after You Teach the Lesson**
<table>
<thead>
<tr>
<th>Equation</th>
<th>What to add to complete the square?</th>
<th>Equation as a product (Length x Width)</th>
<th>Length of Side</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $x^2 = 9$</td>
<td></td>
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<tr>
<td>2. $x^2 + 2x = 8$</td>
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<tr>
<td>3. $x^2 + 4x + 3 = 8$</td>
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<td>4. $x^2 - 4x - 2 = 1$</td>
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