**Lesson Objective:** Students will be able to complete the quadratic square through modeling and writing a representative equation.

**Lesson Background:** Factoring, area and perimeter, polynomials, expressions, equations

### Phase 1

**Motivation and Intro:**
I – Video of Shaun White’s Olympic Snowboard Run (1 min)

II – On Promethean Board, share equation as a method for finding height of White’s snowboard trick:

\[
\begin{align*}
y &= -(x - 2)^2 + 15 \\
y &= -(x^2 - 4x) + 11 \\
\frac{-4}{2} &= 4 \\
-(x - 4x + 4) + 11 + 4
\end{align*}
\]

Share graph of quadratic equation above making connections between graph, equation, height.

**III Objective of 2 day lesson:** Students will be able to demonstrate how to complete the square involving height of Shaun White’s snowboard Performance

**IV Today’s objective:** students will be able to demonstrate (picture, model) completing a square and writing an equation that represents the picture/model.

**Vocabulary:** teacher reviews prior knowledge vocabulary with students – quadratic, roots, a, b, c

### Phase 2

**Guided Practice:**
T: Let’s explore foundational steps of completing the square with Algebra Tiles

Teacher will model how to use Algebra Tiles to represent the expression:

\[
x^2 + 2x + 1
\]

1. \(x^2 + 2x + 1\)

S sit in pairs, but each have set of Algebra Tiles to use for modeling.

S observe T modeling and respond to T questions.

S draw and label model on worksheet.
We will ask: How can we determine what is needed to complete this square?

T will have students individually build models completing the squares, draw the models on worksheet, label dimensions and area for the following problems:

2. \( x^2 + 4x \)
3. \( x^2 + 6x \)

T monitors and checks for understanding.

After students have modeled, drawn, labeled quadratic square, T asks: How did you know you needed 4 units to complete square? 9 units?

Check for understanding before having students complete the following problems:

4. \( x^2 + 8x \)
5. \( x^2 + 10x \)
6. \( x^2 + 12x \)

T monitors and checks for understanding asking probing questions.

T questions:
- What do you notice?
- How are you determining what you need to complete the square?
- How does it connect to the expression/equation?
- Draw out connection/relationship between \( b \) and \( c \), etc.
- What color are the tiles that represent \( c \)?


T asks: Could you model and complete the square for:

7. \( x^2 - 6x \)?

T monitors, repeats inquiry as above.

Students model, draw, label problems #2 and 3 on worksheet.

Students must model, draw and label individually but may discuss with partner.

Anticipated outcomes: students will build rectangles instead of squares. Discuss misconception – student model or teacher Compare and contrast square vs. rectangle

S explain thinking.

S complete problems #4, 5, 6 on worksheet, modeling and discussing with partner.

S explain to T how they are determining what they need to complete square.

S write an equation to represent model of square.

Students model, draw and complete square for #7.

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Phase 3

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Student</th>
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<td>Close:</td>
<td>S use activate to participate in independent practice.</td>
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Independent Practice: assessment (5 problems)
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Materials: paper, Algebra tiles, pens, Promethean Board

Evaluation of the Lesson:
Completing the Square

Instructions:
On left side of paper, draw model.
Label each tile and dimensions of square.

On right side of paper, complete the equation that best represents your model.

1. \( x^2 + 2x \)

\[ x^2 + 2x + ______ = ( ) ( ) \]
\[ = ( ) \]

2. \( x^2 + 4x \)

\[ x^2 + 4x + ______ = ( ) ( ) \]
\[ = ( ) \]

3. \( x^2 + 6x \)

\[ x^2 + 6x + ______ = ( ) ( ) \]
\[ = ( ) \]

4. \( x^2 + 10x \)

\[ x^2 + 10x + ______ = ( ) ( ) \]
\[ = ( ) \]
5. \( x^2 + 12x \)

\[ x^2 + 12x + \square = ( ) ( ) \]
\[ = ( ) \]

6. \( x^2 - 6x \)

\[ x^2 - 6x + \square = ( ) ( ) \]
\[ = ( ) \]

7. \( x^2 - 10x \)

\[ x^2 - 10x + \square = ( ) ( ) \]
\[ = ( ) \]

8. \[ \square = ( ) ( ) \]
\[ = ( ) \]

9. \[ \square = ( ) ( ) \]
\[ = ( ) \]