**LESSON PLAN TEMPLATE**

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| **Lesson Title** | Mastering Quadratic Roots and Equation Modeling |
| **Learning Area/s** | Mathematics |
| **Name of Teacher/s** | DEPED TAMBAYAN PH (www.depedtambayanph.net) |
| **Grade Level and Section** | Grade 10 |
| **No. of Sessions** | 4 Sessions |
| **References** | None specified |
| **Declaration of AI use** | This lesson plan was co-created using Gemini AI to assist with unpacking competencies into a 4-session learning design, structuring activities, and assessment formulation. |

**Intentions.**

**Meaningful learning experiences are anchored in how we frame them. Start by deciding what you want learners to master by the end of the lesson – keep it clear and simple.**

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| **Learning Competency and Curriculum Standards:** | **Learning Competency:**<br>Determine the nature of roots of a quadratic equation using the discriminant. Determine the equation of a quadratic function given: a. a table of values b. its graph c. its zeros<br><br>**Content Standards:**<br>The learners should have knowledge and understanding of... • radical expressions • the roots of a quadratic equation • quadratic functions • equations reducible to quadratic equations • equation of a circle and the graph of a circle<br><br>**Performance Standards:**<br>By the end of the term, the learners are able to... • simplify, and perform operations, involving radical expressions. • determine the nature of roots of a quadratic equation. • determine the equation of a quadratic function. • solve equations reducible to quadratic equations and radical equations. • transform the equation of a circle from center - radius form to general form, and vice versa, and determine the center and radius from a given equation. • graph a circle from a given equation of the circle. |

| | Session 1 | Session 2 | Session 3 | Session 4 |
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| **Learning Objectives:** | • Identify the coefficients (a, b, c) of a quadratic equation in standard form.<br>• Calculate the discriminant ($b^2 - 4ac$) of various quadratic equations.<br>• Determine the nature of roots (real, rational, irrational, or non-real) based on the value of the discriminant. | • State the relationship between the zeros of a function and the factors of its quadratic equation.<br>• Formulate a quadratic equation in the form $y = a(x - r_1)(x - r_2)$ given its zeros.<br>• Transform the factored form into standard form $ax^2 + bx + c = 0$. | • Identify the x-intercepts and the vertex from a given graph of a quadratic function.<br>• Substitute the coordinates of points from a graph into the vertex form or factored form to find the equation.<br>• Verify the accuracy of the derived equation by checking a third point on the graph. | • Determine if a table of values represents a quadratic function using second differences.<br>• Set up a system of linear equations using three points from a table to find a, b, and c.<br>• Formulate the quadratic equation that fits the data provided in the table. |
| **Learner Context:** | Learners demonstrate a strong preference for visual patterns and step-by-step algorithmic processes. While many can solve equations using the quadratic formula, some struggle with the conceptual meaning of 'roots'. A significant number of students perform better during collaborative board work. Potential barriers include mastery of perfect square | Learners show high engagement when tasks are framed as 'reverse-engineering'. They have recently mastered factoring, which serves as a strength for this session. A barrier for some is the distributive property (FOIL method) when dealing with fractional zeros or negative signs. | Learners are highly visual and respond well to Cartesian coordinate activities. They find it easier to identify points on a grid than to manipulate abstract symbols. A common barrier is accurately reading coordinates when the parabola does not cross exactly on grid intersections. | Learners are generally proficient in basic arithmetic but find 'systems of equations' daunting. They appreciate structured data but often get overwhelmed by large numbers. They enjoy competitive tasks and working in small groups where they can divide the workload. |

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| | identification and signed number operations. | | | |
| **Learning Experience.**<br><br>**A learning experience is like a thoughtfully designed journey. Each activity and interaction builds towards meaningful understanding and growth. Identify activities and interactions to help learners gain knowledge, skills, or understanding in a purposeful way.** | | | | |
| **Pre-Lesson:** | ● 'Sign Hunt': A quick drill on identifying a, b, and c from equations like $3x - 5 + 2x^2 = 0$.<br>● Mental Math: Recalling perfect squares from 1 to 625. | ● 'Zero-to-Factor' Warm-up: If $x = 3$, what was the factor? (Answer: $x - 3$).<br>● Review of FOIL/Box Method for binomial multiplication. | ● 'Point Finder': Identify the vertex and x-intercepts of three different parabolas displayed on the screen.<br>● Review of Vertex Form $y = a(x - h)^2 + k$. | ● 'Difference Ladder': Given a table, find the first and second differences of y-values.<br>● Recall: Identifying linear (1st difference constant) vs quadratic (2nd difference constant). |
| **Flow:** | 1. **Introduction:** Connect the discriminant to the quadratic formula, highlighting it as the 'DNA' of the roots.<br>● 2. **Scaffolding:** Categorize discriminants into four zones: Positive Square (2 Real Rational), Positive Non-Square (2 Real Irrational), | 1. **Direct Instruction:** Model the process of working backward from zeros to factors to equations.<br>● 2. **Social Learning:** 'Equation Builders'—Groups are given different sets of 'roots' (e.g., the distances of a 'Sepak Takraw' kick) and | 1. **Visual Modeling:** Project a graph of a famous Philippine arch (e.g., San Juanico Bridge segment) and identify key points.<br>● 2. **Scaffolding:** Step-by-step guide on using the vertex $(h, k)$ and another point $(x, y)$ to solve for 'a'.<br>● 3. **Active** | 1. **Real-world Context:** Present a table representing the profit of a local 'Sari-Sari' store over several months that follows a quadratic trend.<br>● 2. **Social Learning:** 'Table Teams'—Groups are assigned a table. One student finds differences, another sets up equations, |

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| | Zero (1 Real Rational/Double), and Negative (No Real Roots).<br>● 3. **Active Retrieval:** 'Discriminant Dash'—Students calculate the discriminant for equations posted around the room and classify them.<br>● 4. **Check for Understanding:** Peer-pairing to verify calculations and justify the nature of roots using a provided flowchart. | must build the corresponding quadratic equation.<br>● 3. **Scaffolding:** Use the Sum and Product of Roots shortcut ($x^2 - (sum)x + (product) = 0$) for those proficient in mental addition/multiplication.<br>● 4. **Check for Understanding:** Quick-fire rounds where students hold up 'Factor Cards' corresponding to given zeros. | **Retrieval:** 'Graph Detective'—Students move to different 'crime scenes' (graphs) to find the missing 'identity' (equation).<br>● 4. **Check for Understanding:** Pair-share to compare the 'a' values found and discuss if the parabola opens upward or downward. | the third solves for a, b, and c.<br>● 3. **Scaffolding:** Use the 'Method of Differences' to find 'a' ($2a = ext{second difference}$) to simplify the process.<br>● 4. **Check for Understanding:** Use 'Think-Ink-Share'—Students write their derived equation and test it against a value from the table. |
| **Learning Resources:** | ● PowerPoint presentation showing the quadratic formula highlighting the radicand.<br>● Printed Classification Flowcharts.<br>● Chalkboard for step-by-step modeling. | ● Laminated 'Factor Cards'.<br>● Worksheet: 'The Path Back to Zero'.<br>● Smart TV for interactive FOIL animations. | ● Projector/Smart TV for graphing software (e.g., Desmos).<br>● Printed 'Graph Detective' cards.<br>● Grid Whiteboards. | ● Table-of-Values Activity Sheets.<br>● Calculators for verifying second differences.<br>● Slide deck showing the step-by-step 'Method of Differences'. |

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| **Opportunities for integration:** | Integration with Science: Discussing the 'discriminant' in the context of stability in engineering structures (e.g., bridge arches in the local community). | Integration with Filipino Culture: Using zeros to represent the landing points of traditional games like 'Sipa' or 'Tumbang Preso' to find the trajectory equation. | Integration with Arts and Architecture: Analyzing the symmetry and quadratic nature of local church arches or modern Filipino architectural designs. | Integration with Entrepreneurship: Modeling business trends, profit maximization, and predicting future sales based on current data patterns. |
| **Assessment.**<br><br>**Assessments reveal what learners have gained and what they still need help with. These are helpful in providing you with information to guide your future instruction throughout the entire session.** | | | | |
| **Formative Assessment:** | ● 'Exit Ticket: The Decider': Students are given three equations and must identify the nature of roots without solving for the actual roots.<br>● Observe peer discussions during the classification activity. | ● 'Board Race': Representative from each group solves an equation given zeros like 1/2 and -4.<br>● Submission of the 'Equation Builders' worksheet. | ● 'Snapshot Check': Students take a picture of their solution for a specific graph and explain it to the class.<br>● Short quiz on finding 'a' given a vertex and a point. | ● 'The Table Challenge': A 3-point table is provided; students must find the equation within 10 minutes.<br>● Review of the 'Difference Ladder' output. |
| **Ways Forward.**<br><br>**Meaningful learning can also happen beyond the classroom – for both the learners and the teacher. Pause and reflect on what happened today.** | | | | |
| **Extended learning opportunities:** | For advanced learners: Investigate why a negative discriminant results | Extended Task: Create a 'Target' game where students must determine an | For advanced learners: Explore how changing the 'a' value affects the 'width' of the arch | Extended Task: Find a quadratic trend in a real-world dataset (e.g., COVID cases |

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| | in non-real roots by attempting to square a negative number. For struggling learners: Provide a 'Discriminant Placemat' with pre-filled subtraction templates. | equation that will have specific 'zeros' to hit a target on a number line. Remediation: Guided practice focusing solely on integer zeros. | in real-world construction. For struggling learners: Use color-coded vertex $(h, k)$ and point $(x, y)$ templates. | or local weather temperatures) and try to fit a quadratic model. Remediation: Focus on tables where $x$ starts at 0 to simplify the system of equations. |
| **Reflections:** | Reflect on: How many students successfully connected the discriminant value to the number of x-intercepts? Which category of roots (rational vs. irrational) caused the most confusion? | Reflect on: Did the 'reverse-engineering' concept resonate? Were students able to handle negative roots without sign errors? | Reflect on: How effective was the 'Graph Detective' activity in maintaining engagement? Did the students realize that 'a' determines the orientation of the graph? | Reflect on: Did the 'Table Teams' strategy help manage the complexity of the math? Were students able to distinguish between linear and quadratic data effectively? |