

**Pennsylvania Governor's Institute
for Mathematics Educators
2004**

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Topic/Theme: Optimization via Linear Programming

Level: Algebra 2

Time Element: 2 periods or 1 block

NCTM Standards Addressed: Algebra, Data Analysis and Probability

PA Math Standards Addressed:

- 2.2 Computation and Estimation
- 2.6 Statistics and Data Analysis
- 2.8 Algebra and Functions
- 2.11 Concepts of Calculus

Math Assessment Anchors Addressed:

- M11.A.3 Compute accurately and fluently and make reasonable estimates.

- M8.C.3 Locate points and describe relationships using the coordinate plane.

- M11.D.2 Represent and/or analyze mathematical situations using numbers, symbols, words, tables and/or graphs.

- M11.D.3 Analyze change in various contexts.

- M11.D.4 Describe or use models to represent quantitative relationships.

- M11.E.1 Formulate or answer questions that can be addressed with data and/or organize, display, interpret or analyze data.

Reading Assessment Anchors Addressed:

R11.A.2 Demonstrate the ability to understand and interpret nonfiction text, including informational, e.g., textbooks, print media (magazines, brochures, etc.), editorials, public documents; autobiography; biography; and essay appropriate to grade level.

Objectives:

Students will be able to develop constraints and objective function based on a stated problem and then find conditions under which the objective function is optimized via the method of Linear Programming.

Instructional Strategies and Plan (include strategies used to help different types of learners, i.e. auditory, visual, etc.):

- 1. Arrange students into groups**
- 2. Read problem statement**
- 3. Restate problem in student's own words**
- 4. Review vocabulary as necessary**
- 5. Break activity into separate tasks**
 - a. develop constraints in words and algebraically**
 - b. develop objective function and decide on optimization process (minimize or maximize)**
 - c. decide on graphing set-up**
 - d. graph constraints, one at a time**
 - e. identify feasible region and corner points (a.k.a. extremes, vertices)**
 - f. evaluate objective function and reach conclusion on conditions to meet objective**
 - g. restate conclusion and proof in words with supporting visuals as appropriate**
- 6. Model tasks using one constraint through graphing**
- 7. Students to present results via**
 - a. chart paper**
 - b. overhead transparencies**
 - c. graphing calculator view-screen**
- 8. Generalize the results**

Materials/Resources:

- 1. Text / Problem Statement**
- 2. Graph paper**
- 3. Chart paper or overhead transparencies**
- 4. Markers, colored pencils**

- 5. Rulers
- 6. Graphing Calculators

Interdisciplinary Connections:

- **Reading:** Identification of vocabulary, main idea, and relevant details in a real world application problem.
- **Technology:** Use a TI-83+ to complete graphing of inequalities (via shading feature), identify feasible region and determine corner points using calculator intersection option.
- **Other:** Connections to real world business operating constraints and profit objectives.

Assessment Strategies:

- **Formative Evaluation (checking student understanding during the lesson):** Classroom monitoring and guiding of student progress during construction process.
- **Summative Evaluation (how will it be determined that the objectives were achieved?):** Group presentation of results and conclusions using various media.

Correctives/Remediation:

Post presentation critique of presentations and identification of common errors and efficient strategies.

Extensions/Enrichment:

Modify original problem constraints by allowing....
Assuming same profit objective and
120 pounds of dough
36 pounds of icing
16 hours of prep time per day
180 dozen cookie capacity per day

Special Accommodations (special needs students)

- **Description of the Special Needs Student Selected:**
Jimmy –
 1. diagnosed with Asperger's syndrome
 2. above grade level in decoding and fluency in reading
 3. quickly memorizes and recites facts
 4. difficulty with problem solving and inferential thinking

5. poor fine motor skills
 6. difficulty with organization of multi task sequences
- **Accommodations to Use with this Student:**
 1. Partner Jimmy via classroom grouping.
 2. Provide worksheet(s) for development and organization of constraints.
 3. Provide worksheet(s) for vocabulary and evaluation of objective functions/conclusions.
 4. Break activity into separate tasks.
 5. Graphing calculator to be used by Jimmy's group.