



Algebra/Geometry Institute Summer 2003

Equations in Motion: Design and construct a mobile

Lesson Plan Three

Faculty Name: Candace Jackson Gray

Grade Level: 6-9

Class time: ~ 90 minutes

The mathematician's best work is art, a high perfect art, as daring as the most secret dreams of imagination, clear and limpid. Mathematical genius and artistic genius touch one another. – Gusta Mittag-Leffler

In the week prior to the activity, students should collect materials for objects and support of their mobile, be familiar with the vocabulary: prototype, model, representation, fulcrum, pivot, support, projection and conjecture. Teacher will provide a bulletin board of kinetic art as well as library books on various artists and *objets d'art* that show hanging as well as mounted configurations.

In addition, students should be able to:

- Simplify variable expressions and solve equations

- Use and transform formulas

- Write and solve inequalities

- Solve and represent variable expressions using Algebra tiles specifically the Zero principle

1 Teaching objective(s) :

- Create and apply algebraic expressions, equations and inequalities.

- Translate between simple algebraic expressions and verbal phrases.

- Recognize and demonstrate the difference in evaluate, simplify and solve.

- Model and solve linear equations and inequalities using the properties of equality.

- Use and explore the concepts of measurement.

2 Instructional Activities:

Formula to be displayed: $d_1 w_1 = d_2 w_2$. Where d is the distance from the center pivot (fulcrum) and w is the weight of the shape or shapes suspended.

Strategies: Teacher models the formula using various objects brought in by the students, as well as use inequalities in order to design a balanced construction.

Then, using the overhead Algebra Tiles, review the Zero Principle and model the example for the class.

Distribute the journal guide, prototype record and activity table and rubric to be used during the exploration and investigation.

Establish “check partners”: a classmate that will use the rubric to review the project for balance and generally overview the completeness of the exploration and design.

Explain procedures: Experiment with the objects by weighing using the scales for balance on and off the supports detached from support line. Weighing is necessary for the formula solutions as well. Measure the distances of the pivots and length of the rods. Remind students to use the journal throughout the process for their prototype and calculate as well to make the balance easier. In addition, the Kinetic Art worksheet , will aid in a successful design.

(Hint: begin from the bottom up) For clarity it may help to label the support and objects using lower and uppercase letters. This process may help with the Algebra Tile rendition.

When constructing the mobile you are seeking balance. For balance the object weight and support distances are part of the investigation. ***In order for the shapes to balance the equation must balance. You must use at least two different shapes for each support, two different lengths of support, and two different weights.***

The check for the ‘working mobile’ is that it will spin, float and turn **freely**.

3 Materials and Resources:

Mobile hardware suggestions: fishing line, string, yarn, wire, bamboo skewers, dowels, straws, natural rods: sticks, branches, shapes: rounded glass, buttons, coins, paper shapes, various recycled materials, natural materials: feathers, leaves, objects found in yards and streets, or from collection adventures in stores, neighborhoods, parks...etc.

Journal page, prototype table, rubric and design record.

Various pencils, markers, paper for calculations, pencils, calculators, tape or markers for labels and artistic representation.

4 Assessment: Rubric (attached).

Extensions: Art, writing and physics.

Physics: When constructing the mobile, you were seeking balance. At the park, what object represents a similar form? The balance between the weight and distance of kids upon a fulcrum called a seesaw. Draw and write about this phenomenon.

Art: Albert Einstein spent 40 minutes studying Calder’s A Universe in the 1930’s. Investigate Calder’s work and make a poster, scrapbook, power point, flash show, picture mobile or artistic representation that proves what President Ford said when he learned of Calder’s death: “Art has lost a genius.”

Writing: Alexander Calder biography. Although Calder is known as an ‘artist’, research this American and develop the idea that he was a mathematician or engineer that showed the engineering concept: “oscillate in different directions and different amplitudes” – Calder.

Prototype table

[illegible]

Name:

Rubric

- 4 Outstanding design that shows free motion
An appealing mobile that balances unequal number of objects
Or hung at different distances from main support
Algebra tile representation is correct and balanced
Equations incorporated for construction are correct
All work reports complete.
- 3 Design is slightly out of balance
Average effort in originality and appeal
Algebra tile representation is incomplete or with errors
Equations are incomplete or wrong
Most work reports complete
- 2 Construction is poor, out of balance
Algebra tile representation missing
Or Equations missing
One work report complete
- 1 Construction is incomplete
Little effort made with algebra tile representation
And Equations
No work reports completed.

Name:

Check partner assessment:

Self assessment:

Teacher assessment:

Comments:

Journal guide

Title of work of art:

Conjecture: What do you think your balancing work of art will look like? You can draw it.

Prototype: What did your prototype look like? Did it balance right away? What 'techniques' did you use? What worked and did not work?

Formula: did the $d_1 w_1 = d_2 w_2$ expression work for you?

Algebraic tile representation: Below draw (trace) and color your Zero Principle from one of your formula examples used in the prototype table.

Partner feedback: did your 'check partner' help?

Product knowledge: What did you learn?

Materials list:

Did you select an extension? Which one and what do you propose to do?

Name: