Groovy Graphing

Students will:

- Read, interpret, and analyze given set(s) of data
- Collect and display data various ways
- Determine the most appropriate ways of displaying data

Classroom Cases:

1. Create a graph to display the data from the table:

<table>
<thead>
<tr>
<th>Favorite Sport</th>
<th># of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseball</td>
<td>4</td>
</tr>
<tr>
<td>Basketball</td>
<td>3</td>
</tr>
<tr>
<td>Hockey</td>
<td>8</td>
</tr>
<tr>
<td>Football</td>
<td>7</td>
</tr>
<tr>
<td>Soccer</td>
<td>3</td>
</tr>
</tbody>
</table>

2. Using the table and the graph, answer the following questions:
   a. How many students like baseball and football?
   b. Which sport is the most popular?
   c. How many more students like football than soccer?
   d. How many students participated in the survey?

Case Closed - Evidence:
   a. 11 students
   b. Football
   c. 4 students
   d. 25 students

3. Use the graph to answer the questions below:
   a. How much does Jordan budget for hobbies?
   b. What is the total amount of money budgeted for a week?
   c. What fraction of the weekly budget goes into savings?

Case Closed - Evidence:
   a. Since the savings sector is the same size as the hobbies sector, they represent the same amount. Jordan budgets $2 for hobbies.
   b. Hobbies, school supplies, and savings make up half the graph and they total $5. So the whole graph represents 2 x $5 = $10. Total amount budgeted for a week is $10.
   c. Savings accounts for 2/10 or 1/5 of the weekly budget.

4. Mr. Johnson’s class has art on the days of the month that are multiples of 3. The class goes to PE on the even dates. On which dates will Mr. Johnson’s class have art and PE?

Case Closed - Evidence:

The class has art and PE on these dates: 6, 12, 18, 24, and 30.

Clues:
Pie charts and circle graphs name the same type of graph.
Further investigations:
Try these with your child:

Play “decimal war”. You will need a deck of cards and 2 decimal points (any small circular object – bottle caps, pennies, etc.). Tens and face cards have a value of zero. Deal each player three cards. Each player uses his three cards to create the largest number less than 10. The player with the largest number wins and gets to keep all the cards. After 10 minutes, the player with the most cards is the winner!

Roll a die 5 times (or draw 5 cards from a deck of cards without the tens and face cards. Ace = 1.). Create a number less than 100. Write a number sentence to show the value of each digit. Example: 362.15 = 3(100) + 6 (10) + 2(1) + 1(0.1) + 5(0.01)

Roll a die 3 times (or draw 3 cards from a deck of cards without the tens and face cards). Create a number less than 10. Repeat. Multiply your two decimal numbers. Divide your two decimal numbers

Divine Decimals

Students will:

- Understand place value from thousandths to one million
- Model and explain multiplication and division of decimal fractions
- Apply the rules for multiplication and division of decimal fractions
- Use formulas to represent the relationship between quantities
- Use variables for unknown quantities

Classroom Cases:
1. Use the digits 5, 9, and 2 to create the largest number you can that is less than 10 and the smallest number you can that is greater than 0.01.

Case Closed - Evidence:
9.52 and 2.59

2. Gum is on sale for $0.79 a pack. How much would it cost to purchase three packs of gum?

Case Closed - Evidence:
3 x 0.79 = $2.37

3. Lisa and her brother and sister bought a gift for $18.63. They shared the cost equally. How much did each person pay?

Case Closed - Evidence:

4. Rope costs $1.75 per foot. It takes 6.2 feet to make a jumprope. How much will a new jumprope cost?

Case Closed - Evidence:
$1.75 x 6.2 = $10.85

5. Look at the tables below. Complete the missing entries. What’s the rule? Write the rule as an algebraic expression.

<table>
<thead>
<tr>
<th>Table #1</th>
<th>Table #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Output</td>
</tr>
<tr>
<td>3.4</td>
<td>4.8</td>
</tr>
<tr>
<td>2.1</td>
<td>0.9</td>
</tr>
<tr>
<td>9.8</td>
<td>8.6</td>
</tr>
</tbody>
</table>

Case Closed - Evidence:

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>4.8</td>
<td>1.2</td>
<td>5.6</td>
</tr>
<tr>
<td>3.4</td>
<td>2.2</td>
<td>4.0</td>
<td>8.4</td>
</tr>
<tr>
<td>2.1</td>
<td>0.9</td>
<td>5.9</td>
<td>10.3</td>
</tr>
<tr>
<td>8.7</td>
<td>7.5</td>
<td>0.7</td>
<td>5.1</td>
</tr>
<tr>
<td>9.8</td>
<td>8.6</td>
<td>3.3</td>
<td>7.7</td>
</tr>
</tbody>
</table>

Rule #1: n – 1.2  Rule #2: c + 4.4

Clues:
Place value uses the position of a digit in a number to indicate the value of the digit.

Book 'em:
What’s Smaller than a Pygmy Shrew?
By Robert E. Wells

Related Files:
www.ceismc.gatech.edu/csi
Fractions

**Students will:**
- Classify counting numbers into subsets
- Find factors and multiples
- Analyze and use divisibility rules
- Find equivalent fractions and compare fractions using <, >, or =
- Add and subtract fractions and mixed numbers with unlike denominators
- Use common fractions (proper and improper) and decimal fractions interchangeably
- Model multiplication and division of fractions (denominators not to exceed 12)
- Estimate products and quotients
- Use variables to represent unknown quantities
- Use formulas to represent the relationship between quantities

**Classroom Cases:**
1. Cups are sold in packs of 15 and sell for $1.50. Drinks are sold in cases of 24 and sell for $6.75. Write algebraic expressions for the total cost of the cups and the total cost of the drinks. How much will it cost to provide drinks to 36 students?

**Case Closed - Evidence:**
The total price of the cups is $1.50 c or 1.50c where c is the number of packs of cups.

The total price of the drinks is $6.75 d or 6.75d where d is the number of cases of drinks. You’ll need three packs of cups and two cases of drinks to provide drinks for 36 students.

Substituting 3 for the c and 2 for the d, you can find the total price for the drinks and cups.

\[(1.50 \times 3) + (6.75 \times 2) = 18.00\]

2. Joey and Sarah are sharing a pizza that has been cut into 10 slices. Joey eats six of the pizza slices and Sarah eats four slices. What part of the pizza did each of them eat? Write your final answer in simplest form.

**Case Closed - Evidence:**
Joey ate 6/10 of the pizza which is the same as 3/5. Sarah ate 4/10 of the pizza which is the same as 2/5.

3. For each pattern below, determine the rule. Write each rule as an algebraic expression. Find the next three numbers in the pattern.

- a. 1, 1.5, 2, 2.5, 3, 3.5, _____, _____, _____
- b. ¼, ½, ¾, 1, 5/4, _____, _____, _____

**Case Closed - Evidence:**

- a. 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5
  
  **Rule:** \[ n + 0.5 \] where \( n \) is the previous term

- b. ¼, 1/2, 3/4, 1, 5/4, 1 ⅝, 1 ⅞, 2
  
  **Rule:** \[ b + \frac{1}{4} \] where \( b \) is the previous term

**Clues:**
Writing a fraction in lowest terms or simplifying a fraction has also been called reducing a fraction. However, the term “reduce” means to make smaller but the new fraction is not smaller in value than the original fraction. Now, students encounter the terms “simplify” or “lowest terms” in order to avoid confusion about the size of the fraction.
Further investigations:
Show your child how to use a tape measure or a piece of string to measure the circumference of cans in the cupboard. Together, measure the diameter of each can. Let your child make a table that shows the measurements, and compare the circumference and diameter for each can. Ask your child, “How many times bigger is the circumference than the diameter? Is the relationship between the circumference and the diameter of each can the same?”

Suggest that your child use parallelograms, squares, rectangles, and triangles to make a picture. Let him use a ruler to measure the side lengths of each of the shapes to the nearest millimeter and then find the total area of his picture.

Terminology:
Congruence (congruent): Having the same size and shape
Polygon: A plane shape having three or more straight sides
Irregular polygon: A polygon with all sides not equal and all angles not equal
Regular polygon: A polygon with all sides equal and all angles equal
Circumference: The distance around a circle
Diameter: A line segment passing through the center of the circle with both ends touching the circle
Pi (π): The ratio of a circle’s circumference to its diameter; when used in calculations, pi is typically approximated as 3.14

Tiling A repeating pattern of closed figures that covers a surface with no gaps and no overlaps

Clues:
The area of a rectangle is typically written as $A = l \times w$ (area equals length times width) and the area of a square is typically written as $A = s^2$ (area equals side squared). However, the base-times-height formula can be generalized for all parallelograms (including squares and rectangles) and used to find the formulas for triangles, trapezoids, and circles.

Book’em:
Spaghetti and Meatballs for All by Marilyn Burns
A Light in the Attic (Shapes) by Shel Silverstein

Related Files:
www.ceismc.gatech.edu/csi

Positively Perfect Plane Figures

Students will:

- Derive the formulas for the area of a parallelogram and a triangle
- Find the areas of regular and irregular polygons
- Estimate and find the areas of circles
- Understand congruence of geometric figures and the correspondence of their parts
- Understand the relationship of a circle’s circumference, its diameter, and pi
- Use variables to represent unknown quantities
- Use formulas to represent the relationship between quantities

Classroom Cases:

1. Draw a rectangle that has an area of 4 in$^2$. Draw a triangle with the same area.
   \[ \text{Case Closed - Evidence:} \]

<table>
<thead>
<tr>
<th>Shape</th>
<th>Base</th>
<th>Height</th>
<th>Area</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectangle</td>
<td>5 in</td>
<td>3 in</td>
<td>15 in$^2$</td>
<td>$A = b \times h$</td>
</tr>
<tr>
<td>Square</td>
<td>6 cm</td>
<td>6 cm</td>
<td>36 cm$^2$</td>
<td>$A = b \times h$</td>
</tr>
<tr>
<td>Triangle</td>
<td>3.6 m</td>
<td>2.2 m</td>
<td>3.96 m$^2$</td>
<td>$A = \frac{1}{2}(b \times h)$</td>
</tr>
<tr>
<td>Parallelogram</td>
<td>2 ½ cm</td>
<td>3 ½ cm</td>
<td>8 ¾ cm$^2$</td>
<td>$A = b \times h$</td>
</tr>
</tbody>
</table>

2. Estimate circumference and area of the clock face. Then calculate the measures using appropriate formulas.
   \[ \text{Case Closed - Evidence:} \]

   Since the radius is 6 cm, the diameter would be $2 \times 6$ or 12 cm. The circumference would be about three times the diameter, or 36 cm. To estimate the area of the clock face, I put a centimeter grid over it and counted the squares. I got about 110 cm$^2$ for an estimated area of 110 cm$^2$.

   My actual calculations are:
   \[
   \begin{align*}
   C &= \pi d \approx 3.14 \times 12 = 37.68 \text{ cm} \\
   A &= \pi r^2 \approx 3.14 \times 6^2 = 113.04 \text{ cm}^2
   \end{align*}
   \]

   \[ \text{clockface} \]

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Further investigations:
Challenge your child to find objects at home that have volumes of 1 cm³, 1 m³, 1 in³, 1 ft³, and 1 yd³. See if your child can find at least two objects for each measurement.

Invite your child to the kitchen to see how many cups it takes to fill up a large container, such as a pitcher. How many ounces is this? How many pints is this? How many quarts is this? How many gallons is this? Encourage your child to create a chart to show his results.

Ask your child to explain how area and volume are alike and different.

Terminology:
Capacity: The amount a container can hold
Cube: A solid shape that has 6 square faces all equal in size, 8 vertices, and 12 equal edges
Cubic centimeter (cm³): Metric unit for measuring volume; each dimension is measured in centimeters
Cubic meter (m³): A metric unit for measuring volume; each dimension is measured in meters
Cubic foot (ft³): Customary unit for measuring volume; each dimension is measured in feet
Cubic inch (in³): Customary unit for measuring volume; each dimension is measured in inches
Cubic yard (yd³): Customary unit for measuring volume; each dimension is measured in yards
Cup (c.): Customary unit for measuring capacity (2 cups = 1 pint)
Edge: Where two surfaces of a three-dimensional shape intersect
Face: Flat surface of a three-dimensional shape
Fluid ounce (fl. oz.): Customary unit for measuring capacity = (8 fl. oz. = 1 pint)
Gallon (gal.): Customary unit for measuring capacity (4 quarts = 1 gallon)
Liter (L): Metric unit for measuring capacity (1L = 1000 mL)
Milliliter (mL): Metric unit for measuring capacity
Pint (pt.): Customary unit for measuring capacity (2 cups = 1 pint)
Quart (qt.): Customary unit for measuring capacity (2 pints = 1 quart)
Rectangular prism: A 3-dimensional object with two identical, rectangular bases
Vertex: Point where faces of a 3-dimensional shape meet; also known as a “corner”
Volume: Amount of space occupied by an object

Super Solid Figures
Students will: Fifth Grade 5 of 5
- Describe three-dimensional figures by faces, edges, and vertices
- Determine formulas for finding the volume of cubes and other rectangular prisms
- Estimate and determine the volume of rectangular prisms
- Distinguish between volume and capacity
- Convert capacity measurements within a single system of measurement (customary, metric)

Classroom Cases:
1. Complete the conversions below:
   a. 3 cups = _____ pts.  d. 3 qts. = _____ pts.
   b. 2 qts. = _____ cups  e. ½ gal. = _____ cups
   c. 3 c. = _____ fl.oz.  f. 40 fl. oz. = _____ pts.

   Case Closed - Evidence:
   a. 3 cups = 1 ½ pts.  d. 3 qts. = 6 pts.
   b. 2 qts. = 8 cups  e. ½ gal. = 8 cups
   c. 3 c. = 24 fl.oz.  f. 40 fl. oz. = 2 ½ pts.

2. Jamie plans to serve each guest 300 mL of punch. If 12 guests are coming to the party, how many liters of punch will Jamie need?

   Case Closed - Evidence:
   12 guests will need 12 x 300 mL = 3600 mL, and 3600 mL x 1 L/1000 mL = 3.6 L
   Jamie will need 3.6 L of punch. If punch is sold by the liter, she will have to buy four bottles.

3. For each of the figures below, identify the shape, state its dimensions, and determine the volume.

   Case Closed - Evidence:
   a. This is a cube. Its dimensions are 2 cm x 2 cm x 2 cm and its volume is 8 cm³.
   b. This is a rectangular prism. Its dimensions are 4 cm x 1 cm x 2 cm and its volume is 8 cm³.
   c. This is a rectangular prism. Its dimensions are 8 cm x 1 cm x 1 cm and its volume is also 8 cm³.

Clues:
- Faces are sometimes called “surfaces”.
- Vertices are sometimes called “points”.
- This graphic is a quick reference for cups, pints, quarts, and gallons.

Book ‘em:
Pigs in the Pantry, by Amy Axelrod
The Hershey’s Milk Chocolate Weights and Measures, by Jerry Pallotta

Related Files:
www.ceismc.gatech.edu/CSI