UNIT 9 RATIOS

Objective:

UNDERSTANDING RATIOS IN CAKES

Prerequisite skills

Basic math
Use of calculator
Completion of Unit 1: learning problem solving techniques
Completion of Unit 2: estimating answers
Completion of Unit 3: Measuring in English and Metric Units

Vocabulary

RATIO, PERCENT

Materials list

Recipes for three different cake formulas
Ingedients for each of the cakes
Baking pans

GLES

Read and interpret ratios. 1.1, 1.2, 1.3, 1.5, 2.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 3.1, 3.2, 3.2.1, 3.3.2, 4.1.2, 5.2, 5.3, 5.3.2
Compare ratios. 1.1, 1.2, 1.3, 1.5, 2.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 3.1, 3.1.1, 5.1, 5.1.2
Recognize and write proportions from given information. 1.1, 1.1.8, 1.2, 1.2.3, 1.3.1, 1.5, 1.5.8, 2.1, 2.1.1, 2.1.2, 2.2, 2.2.2, 2.2.3, 2.2.4, 3.1, 3.2, 3.2.2, 4.1.2
Distinguish between direct and indirect relationships. 1.1, 1.1.4, 1.1.6, 1.1.8, 1.2, 1.2.3, 1.3.1, 1.5, 1.5.8, 2.1, 2.1.1, 2.1.2, 2.2.2, 2.2.3,
EALRs or GLEs (Taught & Assessed in Standards)
Math

1.1 Understand and apply concepts and procedures from number sense

1.1.4 Understand the concept of inverse proportion and apply direct and inverse proportion.
Use direct or inverse proportion to determine an unknown number of objects or an unknown value in a given situation.

1.1.6 Complete multi step computations with combinations of rational numbers using order of operations and addition, subtraction, multiplication, division, (powers, and square roots).
Apply strategies to complete multi step computations fluently.

1.1.8 Apply estimation strategies in situations involving multi step computations of rational numbers using addition, subtraction, multiplication, division, (powers, and square roots) to predict or determine reasonableness of answers
Select, explain, and justify situations involving rational numbers where estimates are sufficient and others for which an exact value is required.

1.2 Understand and apply concepts and procedures from measurement

1.2.1 Understand the relationship between change in one or two linear dimension(s) and corresponding change in perimeter, area, (surface area, and volume).
Determine and/or describe the impact of a change in two linear dimensions on perimeter, area, surface area, and/or volume.

1.2.3 Apply unit conversions within measurement systems, U.S. or metric, to maintain an appropriate level of precision.
Convert within a system while maintaining the same level of precision.

1.3 Understand and apply concepts and procedures from geometric sense

1.3.1 Understand the properties of and the relationships among 1 dimensional, 2 dimensional, (and 3 dimensional) shapes and figures.
Use the relationship between similar figures to determine the scale factor.

1.3.2 Use the properties of and relationships among 1 dimensional, 2 dimensional, and 3 dimensional shapes and figures including prisms, cylinders, cones, and pyramids.
Use properties of triangles and special right triangles in situations.

1.5 Understand and apply concepts and procedures from algebraic sense

1.5.8 Apply properties to solve multi step equations and systems of equations.
Solve, or write and solve, multi step equations.
2.1 Define problems
2.1.1 Formulate questions to be answered to solve a problem.
Define or clarify the question the problem presents.
2.1.2 Determine what information is missing or extraneous
Differentiate between necessary and extraneous information
2.1.3 Identify what is known and unknown in complex situations
Examine information to determine what is known and unknown
2.2 Construct solutions
2.2.1 Select and use relevant information to construct solutions
Determine whether a given solution shows the use of relevant information
2.2.2 Apply mathematical concepts and procedures from number sense, measurement, geometric sense, probability and statistics, and/or algebraic sense to construct solutions
Select and use appropriate concepts and procedures to construct a solution
2.2.2 Apply mathematical concepts and procedures from number sense, measurement, geometric sense, probability and statistics, and/or algebraic sense to construct solutions
Determine whether a given solution shows use of concepts and procedures that are appropriate
2.2.3 Apply a variety of strategies and approaches to construct solutions
Apply a variety of strategies and approaches
2.2.4 Determine whether a solution is viable, is mathematically correct, and answers the question(s)
Check work for mathematical accuracy
2.2.4 Determine whether a solution is viable, is mathematically correct, and answers the question(s)
Determine whether the solution is reasonable for the situation
3.1 Analyze information
3.1.1 Analyze, compare, and integrate mathematical information from multiple sources
Compare mathematical information in tables, charts, graphs, text, diagrams, figures, or pictorial representations
3.2 Conclude
3.2.1 Draw and support conclusions, using inductive or deductive reasoning
Draw a conclusion from a given situation and support the conclusion with appropriate mathematical data or facts
3.2.2 Evaluate procedures and conclusions to make needed revisions
Check the viability and appropriate use of a selected procedure in a given situation
3.3 Verify results
3.3.1 Justify results using inductive or deductive reasoning
Justify results using evidence and information from the problem situation and/or known facts, patterns, relationships, and proportional reasoning
3.3.2 Evaluate reasonableness of results
Verify that the solution to a real world problem makes sense in relation to the situation
4.1 Gather information
4.1.2 Extract mathematical information from multiple sources
Extract and use mathematical information from various sources such as pictures, symbols, text, tables, charts, graphs, diagrams, and models for a purpose
4.2 Organize, represent, and share information
4.2.3 Use mathematical language to explain or describe mathematical ideas and information in ways appropriate for audience and purpose
Use both everyday and mathematical language and notation to explain, defend, or present mathematical ideas, facts, procedures, or strategies appropriate for a given audience or purpose
5.1 Relate concepts and procedures within mathematics
5.1.2 Relate and use different mathematical models and representations of the same situation
Explain or demonstrate how two or more different models represent the same mathematical idea
5.1.2 Relate and use different mathematical models and representations of the same situation
Create two or more equivalent models or representations for a given situation
5.2 Relate mathematical concepts and procedures to other disciplines
5.2.1 Use mathematical patterns and ideas to extend mathematical thinking and modeling to other disciplines
Provide examples of using mathematical thinking, patterns, ideas, and modeling in other disciplines
5.3 Relate mathematical concepts and procedures to real world situations
5.3.1 Understand that mathematics is used extensively in daily life outside the classroom
Describe situations in which mathematics can be used to solve problems with local, national, or international implications
5.3.2 Understand that mathematics is used in many occupations or careers

Describe specific examples of mathematics associated with a given career

CAKE RATIOS

Have you ever wondered how a baker can create a cake recipe from scratch and know that it will work? Unlike a savory chef, who can often use intuition to design a successful dish, a baker must work within defined parameters to produce a cake that will rise, set, and taste the way she wants. Experienced cake bakers would never dream of trying to bake a cake without first "doing the math" to make sure that the ingredients are in balance. Having the right proportions of flour, eggs, sugar, and fat makes all the difference.

Flour and eggs for structure, fat and sugar for tenderness

In cakes, the protein ingredients, which are the flour and eggs, are the major structure-builders. They're essentially what holds the cake together. Fat and sugar do the opposite; they actually wreck or soften the cake's structure, providing tenderness and moisture.

If you have too much of the structure-building flour and eggs, the cake will be tough and dry. If you have too much of the moistening, softening fats and sugars, the cake might not set. It could be a soupy mess or so tender that it falls apart.

Bakers have formulas that balance these ingredients so their cakes have the strength to hold together but are still tender and moist. These formulas don't have to be followed dead on, **but if you stray by more than about 20 percent**, you may have problems.

There are two sets of formulas: pound-cake (or lean-cake) formulas, which have less sugar than flour; and "high-ratio" formulas, which contain more sugar. The general rule is that high-ratio cakes require shortening, whose added emulsifiers help hold the cake together. You can, however, make successful high-ratio cakes with butter if you aerate the butter by creaming it and if you add emulsifiers in the form of egg yolks. Some bakers even make cakes with olive oil, which contains natural emulsifiers (mono- and diglycerides).

Here are the three formulas for the more popular, sweeter, high-ratio cakes:

Sugar = Flour

The sugar should weigh the same as, or slightly more than, the flour. Remember that this is **weight, not volume**. A cup of sugar weighs about 7 ounces, and a cup of all-purpose flour weighs about 4-1/2 ounces. So, if we're building a recipe with 1 **cup sugar, we'll need about 1-1/2 cups flour (about 6-3/4 ounces).**

The eggs should weigh about the same as, or slightly more than, the fat. One large egg (out of its shell) weighs about 1-3/4 ounces. If our developing recipe contains 4 **ounces butter (or shortening), we could use two whole eggs (3-1/2 ounces**). This is a little under, but remember that these rules are flexible, and we're still **within 20%.**

Eggs = Butter

But eggs have two parts: **whites, which dry out baked goods**, and yolks**, which make textures smooth and velvety**. A yolk from a large egg weighs about 2/3 ounce. One way to balance the eggs with the fat and to get a smoother cake is to add extra yolks. You could use one egg plus three yolks for a total of about 3-3/4 ounces.

The liquid (including the eggs) should weigh the same as, or more than, the sugar. Our recipe now has 7 ounces sugar and 3-1/2 or 3-3/4 ounces eggs. To get the total amount of liquid to weigh more than the sugar, we could add 4 ounces (1/2 cup) of a liquid, like milk or buttermilk.

Eggs + Liquid = Sugar

Proper leavening is also critical. If a recipe is overleavened, the bubbles will get too big, float to the top, and—pop! There goes your leavening, and here comes a heavy, dense cake. **One teaspoon of baking powder for one cup of flour is the perfect amount of leavening for most cake recipes**. For baking soda (which is used if the recipe has a considerable amount of acidic ingredients), use **1/4 teaspoon soda for each cup of flour**. Finally, don't forget a little **salt, about 1/2 teaspoon for a small cake like this**. It's a major flavor enhancer.

Once you have a working recipe, you can test it and start making adjustments to taste. I like baked goods very moist, so I would have started with one egg and three yolks. If I decided I wanted a moister cake, I could bump up the sugar, or I could replace some or all of the butter with oil. Oil coats flour proteins better than other fats and will make a more tender, moister product.

Bake each cake recipe and when they are baked and cool, taste each cake and write an evaluation based on the ratios you used in each