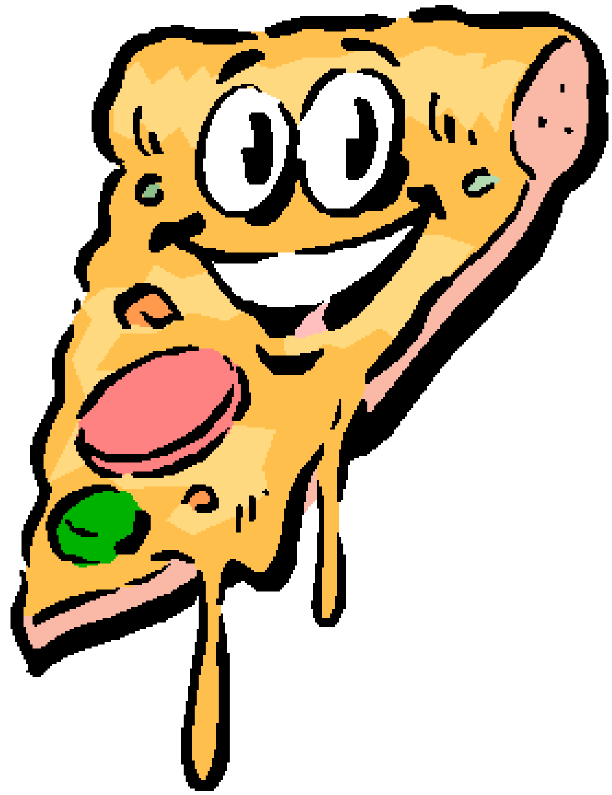
Easy, Peasy, Pizza Pie!



Primary Objectives:

Students will:

Easy Pizza Fractions

- Understand the basics of adding and subtracting fractions
- Be able to explain why the top of a fraction is a NUMBER and the bottom of a fraction is a NAME.
- Recognize the "part-whole" relationship in representations of fractions in real world situations
- Use models or pictures to show whether a fraction is less than a half, more than a half, or equal to a half or whole.
- Determine that when all parts of a model are there the fractions equal 1.

Algebraic Pizza

- Comprehend that data can guide the decision making process.
- Conclude that math and formulas can be used and are used in real-life situations.
- Know how to gather data, create a chart, and formulate a formula in order to compare different brands

Examples of Academic Standards to Incorporate:

Kindergarten:

- 6.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- 6.1.1 Model addition and subtraction (e.g., using a number chart, number line and/or concrete objects).
- 6.2.8 Compare sets of ten or fewer objects and identify which are equal to, more than, or less than others.
- 6.2.12 Model simple joining and separating situations with objects.
- 6.4.5 Use basic shapes and spatial reasoning to model objects and construct more complex shapes.
- 6.4.7 Make direct and indirect comparisons between objects (such as recognize which is bigger, smaller, shorter, longer, taller, lighter, heavier, or holds more).
- 6.5.1 Sort objects into sets and describe how the objects were sorted.

1st Grade:

- 0106.2.11 Recognize the "part-whole" relationship in representations of basic fractions such as ½ and ¼
- 6.1.10 Match the spoken, written, concrete, and pictorial representations of whole numbers, one-half, and one-fourth.
- 6.1.7 Apply spatial sense to recreate a figure from memory.
- 6.2.10 Use models (such as discrete objects, connecting cubes, and number lines) to represent "part-whole," "adding to," "taking away from," and "comparing to" situations to develop understanding of the meaning of addition and subtraction.

2nd Grade:

- 0206.1.8 Use concrete models or pictures to show whether a fraction is less than a half, more than a half, or equal to a half.
- 0206.1.9 Match the spoken, written, concrete, and pictorial representations of halves, thirds, and fourths.

3rd Grade:

- 0306.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- 0306.1.4 Match the spoken, written, concrete, and pictorial representations of fractions with denominators up to ten.
- 0306.2.5 Understand the meaning and uses of fractions.
- 0306.2.6 Use various strategies and models to compare and order fractions and identify equivalent fractions.
- GLE 0306.2.7 Add and subtract fractions with like denominators using various models.
- 0306.2.10 Understand that symbols such as ½, 1/3, and ¼ represent numbers called unit fractions.
- 0306.2.11 Identify fractions as parts of whole units, as parts of sets, as locations on number lines, and as division of two whole numbers.
- 0306.2.12 Compare fractions using drawings, concrete objects, and benchmark fractions.
- 0306.2.13 Understand that when a whole is divided into equal parts to create unit fractions, the sum of all the parts adds up to one.

4th Grade:

- 6.2.5 Generate equivalent forms of common fractions and decimals and use them to compare size.
- 6.2.8 Generate equivalent forms of whole numbers, decimals, and common fractions (e.g., 1/10, ¼, ½, ¾).
- 6.2.9 Compare equivalent forms whole numbers, fractions, and decimals to each other and to benchmark numbers
- 6.2.5 Add and subtract fractions with like and unlike denominators.
- 6.2.8 Add and subtract proper fractions with like and unlike denominators and simplify the answer.

- 6.2.6 Use the symbols < , > and = to compare common fractions and decimals in both increasing and decreasing order.
- 6.4.8 Recognize that a measure of area represents the total number of same-sized units that cover the shape without gaps or overlaps.
- 6.4.9 Recognize that area does not change when 2-dimensional figures are cut apart and rearranged.

5th Grade:

- 6.1.2 Make reasonable estimates of fraction and decimal sums or differences using models.
- 6.1.6 Communicate answers in correct verbal and numerical form; including use of mixed numbers or fractions and use of units.
- 6.1.7 Organize and consolidate verbal statements involving fractions and mixed numbers into diagrams, symbols, and numerical expressions.
- 6.1.2 Estimate fraction and decimal sums or differences.
- 6.2.3 Use visual models, benchmarks, and equivalent forms to add and subtract commonly used fractions and decimals.
- 6.2.9 Compare whole numbers, decimals and fractions using the symbols <, >, and =.

6th Grade:

- 6.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- 6.2.5 Transform numbers from one form to another (whole numbers, fractions, decimals, percents, and mixed numbers).

7th Grade:

- 6.3.2 Understand and compare various representations of relations and functions.
- 6.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- 6.1.8 Use technologies/manipulatives appropriately to develop understanding of mathematical algorithms, to facilitate problem solving, and to create accurate and reliable models of mathematical concepts.
- 6.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.
- 6.1.7 Recognize the historical development of mathematics, mathematics in context, and the connections between mathematics and the real world.
- 6.1.10 Model algebraic equations with manipulatives, technology, and pencil and paper.
- 6.3.11 Relate the features of a linear equation to a table and/or graph of the equation.

8th Grade:

- 6.1.1 Use mathematical language, symbols, and definitions while developing mathematical reasoning.
- GLE 0806.1.2 Apply and adapt a variety of appropriate strategies to problem solving, including estimation, and reasonableness of the solution.

- 6.1.3 Develop independent reasoning to communicate mathematical ideas and derive algorithms and/or formulas.
- GLE 0806.1.4 Move flexibly between concrete and abstract representations of mathematical ideas in order to solve problems, model mathematical ideas, and communicate solution strategies.
- 6.1.7 Recognize the historical development of mathematics, mathematics in context, and the connections between mathematics and the real world.
- 6.1.8 Use a variety of methods to solve real-world problems involving multi-step linear equations (e.g., manipulatives, technology, pencil and paper).
- 6.1.3 Calculate rates involving cost per unit to determine the best buy.

High School: Algebra

- 8.1.5 Recognize and use mathematical ideas and processes that arise in different settings, with an emphasis on formulating a problem in mathematical terms, interpreting the solutions, mathematical ideas, and communication of solution strategies.
- 2.1.3 Develop inductive and deductive reasoning to independently make and evaluate mathematical arguments and construct appropriate proofs; include various types of reasoning, logic, and intuition.
- 2.1.4 Move flexibly between multiple representations (contextual, physical, written, verbal, iconic/pictorial, graphical, tabular, and symbolic), to solve problems, to model mathematical ideas, and to communicate solution strategies.
- 2.1.6 Employ reading and writing to recognize the . . . connections between mathematics and the real world.
- 2.1.5 Use formulas, equations, and inequalities to solve real-world problems including time/rate/distance, percent increase/decrease, ratio/proportion, and mixture problems.
- 2.1.6 Use a variety of strategies to estimate and compute solutions, including real-world problems.
- 2.1.11 Use manipulatives to model algebraic concepts.
- 2.1.4 Translate between representations of functions that depict real-world situations.

Examples of Possible Academic Vocabulary to Incorporate:

Kindergarten

- Addition
- Classify
- Compare
- Difference
- Location
- Minus
- Number
- Order
- Pattern
- Position
- Quarter
- Shapes
- Sort
- Subtraction
- Sum
- Today
- Zero

1st Grade

- Data
- Digit
- Direction
- Equal to
- Estimate
- Even
- Graph
- Greater than/less than
- Horizontal
- Length
- Measure/measurement
- One-half
- Part
- Plus
- Ruler
- Solve
- Total
- Unit (standard, non-standard)
- Vertical
- Whole
- Whole number

2nd Grade

- Dimensions
- Distance
- Equivalent
- Fraction
- Interpret
- Likely/unlikely
- Meter/centimeter
- Multiplication
- One-fourth
- One-third
- Outcome
- Perimeter
- Reflect
- Rotate
- Set
- Symmetry

3rd Grade

- Area
- Conclusion
- Congruent
- Conjecture
- Decimal
- Denominator (like, unlike)
- Dividend
- Division
- Divisor
- Factor
- Multiples
- Numerator
- Parallel
- Perpendicular
- Product
- Reasonableness
- Unit fraction
- Population

4th Grade

- Accuracy
- Chance
- Common fraction
- Convert
- Diameter
- Equation
- Improper fraction
- Pattern rules
- Probability
- Proper fraction
- Radius (pl. radii)
- Range
- Relationship
- Right
- Taxes
- Diversity
- Expansion

5th Grade

- Data collection methods
- Edge
- Formula
- Inequality
- Irregular
- Justify
- Model
- Round

- Solution
- Substitution
- Surface area
- Undefined
- Variable
- View

6th Grade

- Circumference
- Degree (angles)
- Equilateral
- Experimental probability
- Interior/exterior angles
- Isosceles
- Negative
- Odds
- Percent
- Pi
- Poll
- Random
- Sample bias
- Sample, sample data
- Similarity
- Simulation
- Theoretical probability
- Triangle
- Ancient
- Civilizations
- Monarchy

7th Grade

- Linear equation
- Property
- Proportional relationships
- Scatter plots
- Square root
- Impact
- Capitalism
- Free enterprise

8th Grade:

- Infinite
- Sequence
- Commerce
- Consumption
- Exchange
- Interdependence
- Recession
- Innovator

Economics

- Budget
- Capitalism
- Consumerism
- Corporation
- Cost
- Incentives
- Innovation
- Monetary
- Fiscal
- Profit

Algebra

- Deductive & inductive reasoning
- Proof
- Simulations
- Quantitative and qualitative data

Easy, Peasy, Pizza Pie!

The origin of the pizza actually goes back to ancient times and the precise history of the pizza and its origin will never be known, but pizza, as we know it, began in Naples, Italy. In the late 1800's an Italian baker created a dish for when Queen Margherita Teresa Giovanni, the consort of Umberto I, visited Naples with her king. Don Raffaele Esposito, who owned Pietro Il Pizzaiolo, was asked to prepare a special dish in honour of the Queen's visit. Esposito consulted his wife, who was the real pizza expert, and together they developed a pizza featuring tomatoes, mozzarella cheese, and basil. He named it the Margherita Pizza, after the city's royal guest of honor. To show their patriotism the baker and his wife had chosen to top flat bread with food that would represent the colors of Italy; red tomato, white mozzarella cheese and green basil.
By the beginning of the 1900's pizza made it's way to the cities of the United States, especially New York City and Chicago, through Italian immigrants. Pizza wasn't really popular though until the Second World War changed American pizza eating habits forever, the serving GI's (soldiers) had got the taste for it in Italy and they could not get enough of it when they went home.

Fractions are as easy as pizza!

One way to help students to understand the basics of adding and subtracting fractions (denominators must be the same; add/subtract the numerators; DO NOT add/subtract the denominators) is to teach the students what the parts of a fraction really are: numbers and names. This also helps combat the frequently-taught but incorrect idea that a fraction and a ratio are the same. A ratio may look like a fraction, but it is not a fraction.

What is 2 pizzas plus 3 pizzas? 5 pizzas
(Write as a fraction: 2/pizzas + 3/pizzas = 5/pizzas)
Notice, we do not end up saying the answer is 5 cakes.

The top of a fraction is a NUMBER: 1, 2, 3, etc.
The bottom of a fraction is a NAME: half, third, fourth, etc.
We can add and subtract numbers. We cannot add and subtract names.

Denominate means: to name
Political parties **nominate** (name) their candidates.
Religious **denominations** are identified by their names.
The **denominations** of money are the names of the coins and bills.

Ask each student their "denominator." Don't give it away. Ask each one until one finally says their name. Continue through the room... Their name is their denominator.

When you practice adding and subtracting fractions with like denominators, actually say "pizzas" instead the fraction name. Then say, "Instead of pizzas, we are using ..." and let them answer with the appropriate denominator.

It is fun when doing subtraction to say, "If we have 5 pizzas and eat 3 pizzas, besides a stomachache, what is left?"

The transition to unlike denominators is automatic. If the names are not the same, you can't add the fractions.
2/pizzas + 3 salads is still 2/pizzas and 3/salads (unless we discover a "common denominator" -- a common name: food).

Once the students know they must have a common name (denominator) in order to add or subtract, they have a reason to learn about common denominators.

By the way, always begin common denominators without worrying about the Least Common Denominator (LCD). Once students can find **a** common denominator (multiply the denominators), add or subtract, and then reduce, they can be led to finding "easier" denominators to work with. Students who have too much difficulty with LCD can still get the correct answer; they just have more reducing to do. Those who can find a lower common denominator have less reducing.

Pizza Pursuit!

Math Concepts: Fractions

This game's goal is to assemble a whole pie out of paper pizza slices — and to learn about fractions in the process.
Materials

- Blank wooden dice or paper dice

- Marker
- 5 drawings of pizzas on card stock or printouts of pizza photographs
- Glue (optional)
- Card stock (optional)
- Scissors
- 1 paper plate for each player

Instructions

To set up the game, use the mark the sides of a blank paper or wooden die (available at craft stores) or several dies as follows: 1/2, 1/3, 1/4, 1/8, 1/12, etc, and label one side "Take a Piece." Use the Family Fun photographed pizzas:
(http://familyfun.go.com/assets/cms/pdf/playtime/FF0910MATH_pizza_pursuit.pdf)
which have already been divided into fractions as samples, and print them out (if desired, glue the printouts to card stock to make them sturdier) or have players draw five pizzas on card stock circles. Cut one pizza in half, another in quarters, and so on, corresponding to the fractions on the dies.

As you cut the pizza pies into fractions, on an index card write a line and under it put a 2. Tell students that that is because we broke that pie into 2 parts. Then cut the next pizza into quarters, make the index card with a line and a 4, and the third pie into sixths. Then put one "slice" of each pie on a plate, put the index card next to it and write the 1 on top of the line to show the children that each piece is one half, one fourth, one sixth, one eighth, one twelfth. Discuss the fractions, have a discussion on which is bigger and why. This is an important concept for students to grasp, the bigger the denominator the smaller the fraction.

Another idea to help students understand, is to write the fraction in a totally vertical orientation as:

<u>1</u> out of
2 equal parts

It helps students to understand the how and why of written fractions

Give each player a paper plate. The first player rolls the die, then chooses the correct-size slice. If a player rolls "Take a Piece," she takes a slice from someone else's plate. As the number of slices dwindles, players may substitute equivalents, taking two quarter slices to make a half slice, for example. If a player rolls a fraction that would result in her having more than a whole pie, she takes nothing. The first player to complete a pie wins.

Option:

Just like pizza, fractions are best when you can make them exactly the way you like them. Prepare a whole pie's worth of plain paper slices for a great young student fractions lesson.

This idea was adapted from a project on Lindsey Boardman's blog, Filth Wizardry. Lindsey lives in California, where she uses her science and design skills to create often-messy crafts with her two young kids. Visit her at filthwizardry.blogspot.com.

Materials

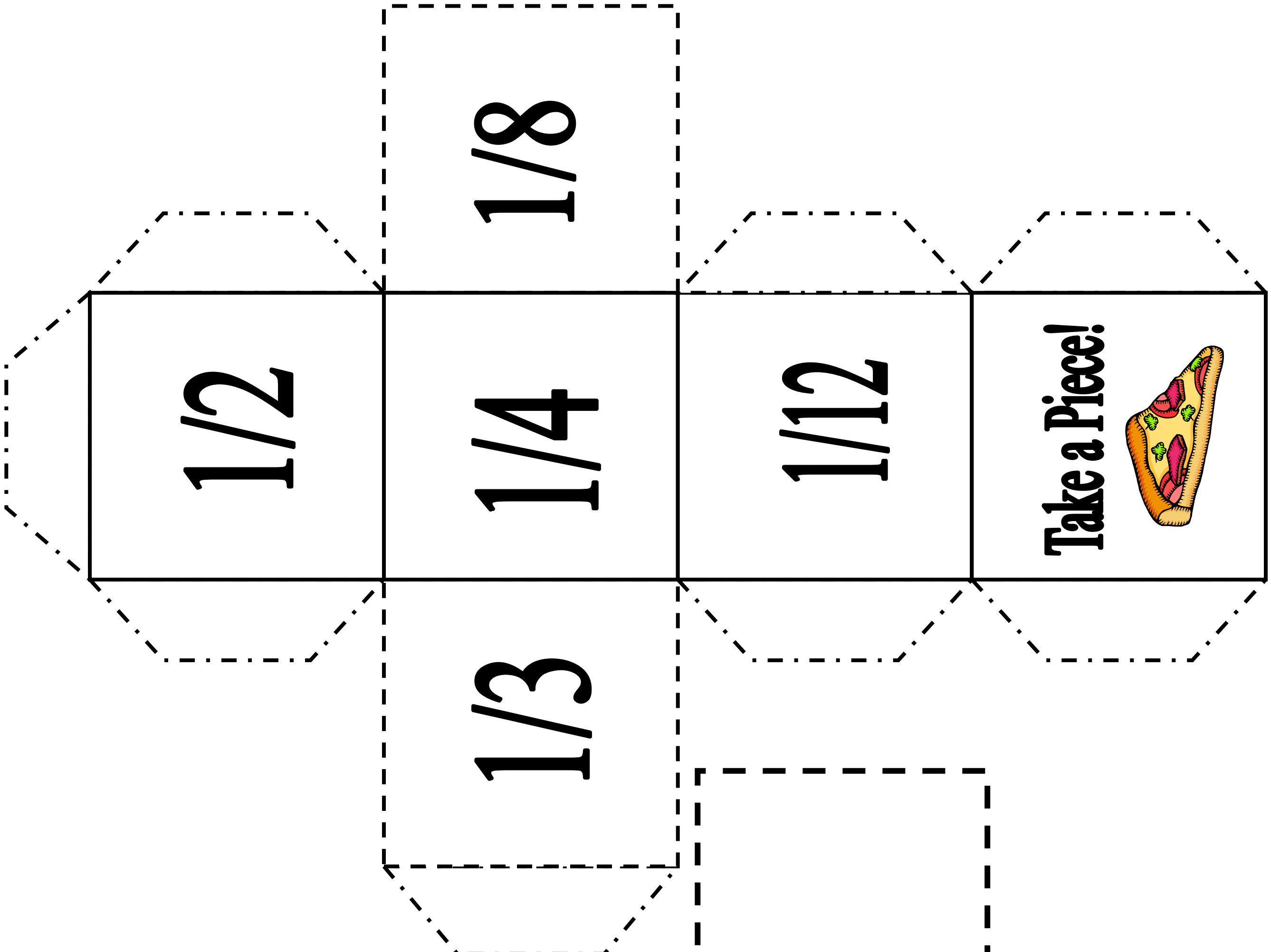
- Corrugated cardboard
- Brown paper bag or kraft paper
- Tape
- Tacky glue
- Colored paper
- Hole punch
- Glue stick

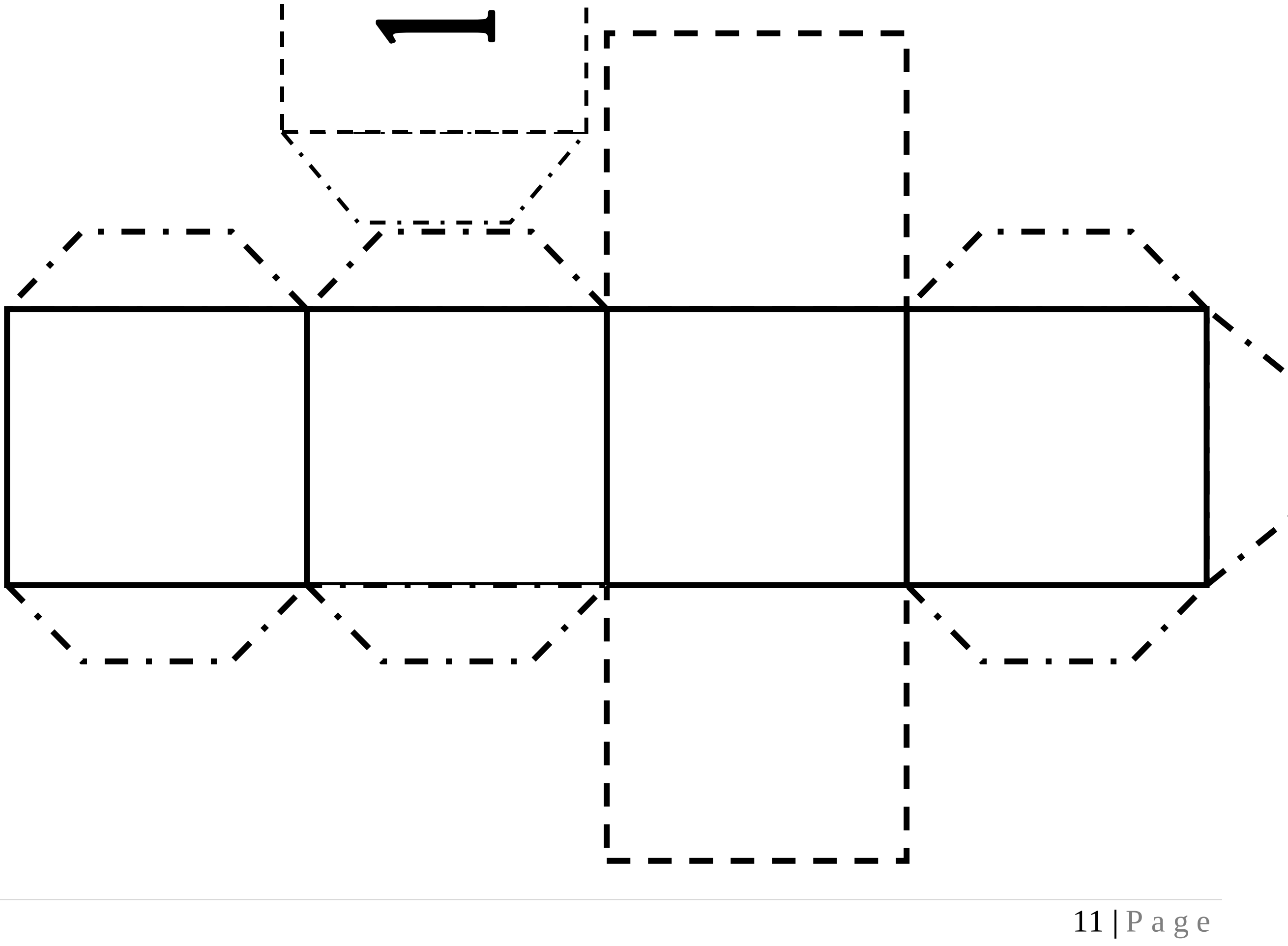
Instructions

1. Cut a large piece of corrugated cardboard into a circle, then into pie slices. Wrap each cardboard slice with a piece of brown paper bag or kraft paper as shown, securing it with tape. For the crust, roll up and crumple the excess paper along the curved edge and secure it with tacky glue.

For paper toppings, try yellow cheese shreds, black olive circles (made with a hole punch), crumpled-paper sausage meat, simple mushroom shapes, red sauce blobs, pepperoni circles, and curvy green pepper strips. Then direct them to "make" a pizza using fractions, for example have them make a pizza with l/2 mushrooms and l/2 pepperoni, etc. When you’re done let your tiny chef attach toppings to his slice with a glue stick.

Option: Have young students practice their shapes and colors by adding color and shape toppings (brown square - sausage, red circle - pepperoni, yellow or white rectangle - cheese, green triangles - veggies)


1/8
1/2
1/4
1/12
Take a Piece!
1/3



Algebraic Pizza!

Math Concepts: Algebra

The teaching of mathematics has two primary purposes. One is to give students mathematical tools that can benefit them in their lives and careers, and the other is to help students learn to think logically.

When using our hard-won money we need to make sure that we make good decisions. But we might realize that we won't truly know whether a decision was good or bad until after we make it. That is about as good as gambling, you don't come up a winner all the time, and there must be a method we can use to help make sure our decisions are the best they can be. For example, have you ever wondered whether it's a good buy to order a mass-produced pizza just because it's cheap?

There is pizza, and then there is pizza. There is the real stuff, savored at a little corner restaurant in Italy, regional American pizzeria pizza, And then there is the pizza you scarf down on a Wednesday evening when you are too tired to cook and too frazzled to remember what that thing is that is buried at the bottom of your freezer, the It's-Wednesday-and-I-Refuse-To-Cook-Pizza—will probably come from your grocer's freezer or from a franchise. Every second, Americans eat 350 slices of pizza. That's 23 pounds per person, per year. At home, the type is split almost 50-50, with frozen pizzas having a slight edge over delivery. And that raises a question. Are all of these pizzas terrible, or just the ones I bring home from the store?

When it comes to pizza, convenience counts as much as anything. Assuming it's already in your freezer, frozen is a little quicker and much cheaper. It does require some effort on your part, you have to preheat the oven, open the freezer, tear open the box, cook it, and finally, cut the pizza which is roughly the same size as a medium from your local pizza franchise.

Delivery requires a phone call, figuring out what the deals are amongst all the options, a 15- to 45-minute wait, and a brief interaction with the delivery person who brings your pizza, not to mention figuring out how much you should tip the man for driving all the way to your house.

Here's an activity that uses second-semester algebra to help your students determine which pizza gives you the most bang for your buck, helps them make the best decision they can, and shows them how data can guide the decision making process. Before making a decision a person should try to gather as much relevant information as possible and analyze that information to try and figure out which decision would be the most likely to lead to success.

Materials:

- an appetite
- Pizza brands you'd like to compare

What You Do:

1. Talk about how a pizza price can be broken down into two parts: the cost of the ingredients, and the cost of running the company or parlor (workers, electricity, rent, etc.) The ingredients' cost varies with the size of the area of the pizza. It can be represented by a times d^2, where "d" is the diameter and "a" is the constant that represents the price of the ingredients.
2. The other costs can be represented as the constant "c." The formula is then: $p = ad^2 + c$ Where p is price, d is a pizza's diameter, A is the per-pizza cost of the ingredients, and c is the per-pizza cost of operations. Each parlor will have its own values for "a" and "c."
3. Go to the pizza parlor and determine the size and prices of your favorite frozen and franchise pizzas (or have menus from several pizza places). Now, write down these things: The diameter of a large pizza. The cost of your pizza in a large size. The diameter of a medium pizza The cost of your pizza in a medium size (which is almost the only size you can get in frozen.)
4. Make a table like this, and fill in the blanks:

Pizza size	**Price**	**Diameter**	**$p=ad^2+ c$**
large			
medium			

5. For example, at a local pizza parlor, the table might look like this for pepperoni pizza:

Pizza size	**Price**	**Diameter**	**$p=ad^2+c$**
large	$17	14	$17 = a*14^2 + c$
medium	$15	12	$15 = a*12^2 + c$

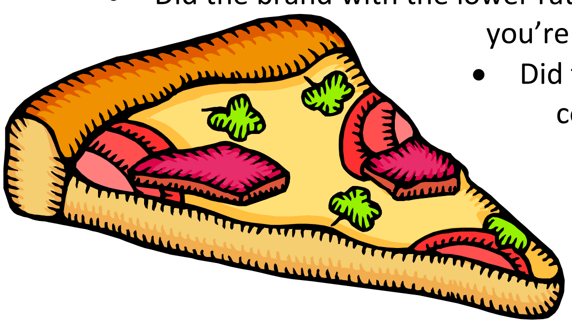
6. Use algebra to solve for the constants a and c. For example, by simplifying the "medium pizza" equation to solve for c, I get: $15 = a*12^2 + c$ $15 = 144a + c$ $15-144a = c$

I can now substitute for c in the "large pizza" equation: $17 = a*14^2 + c$ $17 = a*14^2 + 15-144a$ $17 = 196a + 15 – 144a$ $17 = 52a + 15$ $52a = 2$ $a = 2/52$, or approximately .038

By plugging "a" back into the formula for "c", we get $15 – 144 (.038) = c$ $9.528 = c$ Therefore, the final equation for my local pizza parlor is: p = .038d2 + 9.528 Now, do the same computations for yours.

7. Now, give the pizza you're testing a rating from one to ten, with one being "That stuff is garbage," and ten being "The most delicious pizza we've ever tasted."
8. Save your equation and your rating. Now, go to another pizza brand and find its equation and rating. Now, you're ready to compare. This can lead to some interesting discussions.

- Did the brand with the lower rating have higher constants? That means it's a bad buy – you're paying higher fixed costs for a poor product.



- Did the brand with the higher rating have a higher "a" constant? That means you're satisfied to pay more money for superior ingredients.
- Did the brand with the higher rating have a higher "c" constant? That means you're happy paying more for a nicer atmosphere or better location.

You can have all kinds of opinions about which pizza is the better buy, based on what your students' value about pizza. You can try another brand and compare it, too. Before long, they'll be the neighborhood pizza experts.

Extension Questions:

- Is frozen or franchise better? Create a chart and formula to compare the cost-effectiveness of buying frozen or franchise.

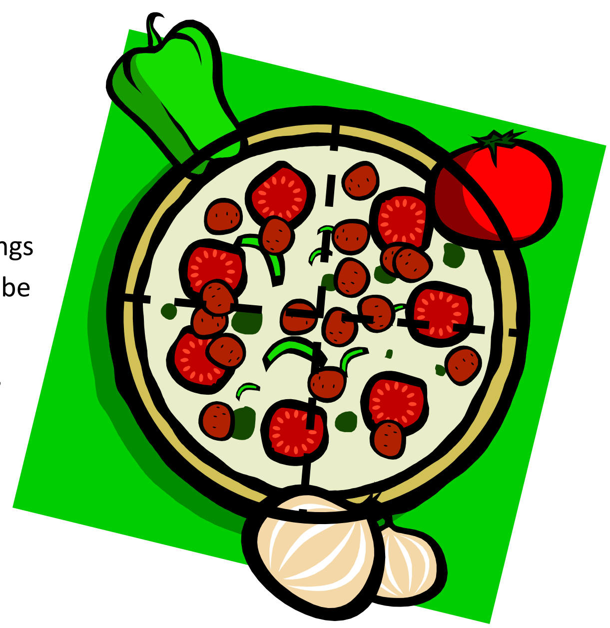
Pizza Brand	Price	Diameter	$p=ad^2+c$

- Is buying a bigger pizza really cost-effective? If you think of a large pizza as your base price, you can compare prices by knowing how the other sizes measure in comparison. If a large pizza is one unit, a medium pizza is about 3/4 of a large pizza (73%, to be exact) and an extra– large pizza is about 1 1/3 of a large pizza (131%). medium pizza = 3/4 large pizza extra large pizza = 1 1/3 large pizza. Which is really the best deal? Now, create a formula to compare the prices and see if the price is lower or higher than the percentages.

Further Extensions:

- Graphing Practice: plot each brands's points for its medium and large pizzas (price, diameter) on an x-y axis. Connect the points to make a line. Will the two brands ever sell the same pizza at the same price? Hint: look for a point of intersection.
- Brain Teaser: How can you cut a round pizza into eight equal slices with just 3 straight cuts? The answer is tricky, but it can be done. *Answer: (Cut the pizza in half, then in quarters. Now stack the quarters and make one last slice down the middle to get eight pieces.)*

Lesson Extensions:



- Use play-dough to make **pizza** and cut it into halves, thirds and quarters using plastic, dull knives.
- Create a "pie chart" graph what kinds of pizza toppings your students like. Do they like what pizza's used to be made with? In the nineteenth century the pizzas in Naples were garnished with pork fat, oil, lard, cheese, tomatoes and tiny fish, hmm, maybe not the recipe for a winning pizza!