RAFT IDEAS

Topics: Operations and Factors of Polynomials, Equivalent Polynomial Expressions

Materials List
- ✓ Cardstock or paper
- ✓ Permanent markers
- ✓ CD cases, 1 per player
- ✓ Scratch paper

This activity can be used to teach:
Common Core Math Standards:
- Structure of expressions (High School, Algebra-Seeing Structure in Expressions, 2)
- Polynomials (High School, Algebra-Arithmetic with Polynomials and Rational Expressions, 1, 2, & 3)
- Problem Solving and Reasoning (Mathematical Practices Grades 7 - 12)

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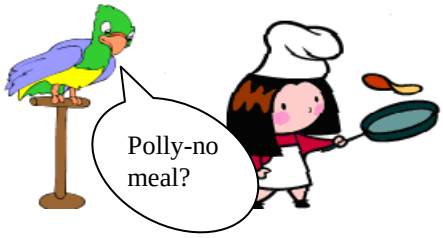
Polynomial Pancakes!

Match Equivalent Polynomial Expressions to Win!



Flip over a stack of mathematical "pancakes" made of equivalent versions of first, second, and third degree polynomials!

Assembly
1. Cut 10 or more circles, 10 cm (4") or larger works well, from cardstock or paper.
2. Draw a diameter on one side of each circle.
3. For each circle, write a polynomial above the diameter line, then write an equivalent form of the polynomial below the line.
4. Flip over each circle. Write the description of a pancake topping across the center.
5. Cut each "pancake" circle in half, along the diameter from step 2.

Playing the Game (for 2 players)
1. Each player opens a CD case, flat side open to the left, circular interior to the right.
2. Lay out pancake halves and shuffle - polynomial sides facing up.
3. Players take turns choosing a pancake half from the table, looking to match a polynomial expression on that piece to an equivalent version of that polynomial.
4. Use scratch paper to perform calculations to verify the match.
5. Once a match is found, position the corresponding equivalent polynomials side by side within the circular indentation of the CD case.
6. Close the CD case. Check calculations by "flipping" over the "pancake" CD case, to reveal the writing on the reverse side. Do one of the following:
   - If the flipped pancake message does not make sense, the pieces do not match. Return the 2nd piece to the table. Look for an appropriate piece to match.
   - When the message makes sense, take out both halves that made that "whole" pancake. Keep these pancake pieces off to the side, and continue making more pancakes with the remaining unused halves.
7. Once all pancakes have been made correctly, the player with largest stack of whole pancakes wins!

The Math Behind the Activity
This fun activity gives students excellent practice operating with 1st, 2nd & 3rd degree polynomials. A polynomial is an **algebraic** expression made of variables & constants, using only the operations of addition, subtraction, multiplication, & non-negative, whole-number exponents. For example, $x^2 - 4x + 7$ is a polynomial with three terms, x^2, -4x, and 7, but $x^2 - 4/x + 7x^{3/2}$ is not a polynomial because its 2nd term involves division by the variable x & because its 3rd term contains an exponent that is not a whole number. Polynomials contain one or more terms. A monomial has one term: 5y or $-8x^2$ or 3. A binomial has two terms: $-3x^2 + 2$. A trinomial has 3 terms: $9y - 2y^2 + y$. The product of two polynomials is also a polynomial. Many polynomials, like numbers, can be factored. A polynomial and the product of its factors are two ways to express the same value; therefore they are equivalent polynomial expressions.

Developed and written by Jeanne Lazzarini (RAFT)

Taking it Further

- Students create sets of polynomial pancakes then switch with other students and play the game.
- Match polynomials with given values for the variable(s).
  (e.g., solve for x: one edge could have $-2x = 4 - 2x^2$, and another edge has a match of $x = -1$ and $x = 2$.)
- Divide each pancake into four sections, with matching polynomials along each straight intersecting line segment. Cut into fourths, and play to match all four quarters of each pancake.
- Make Polynomial Waffles! - write polynomials on the edges of square cards. Match equivalent polynomials.

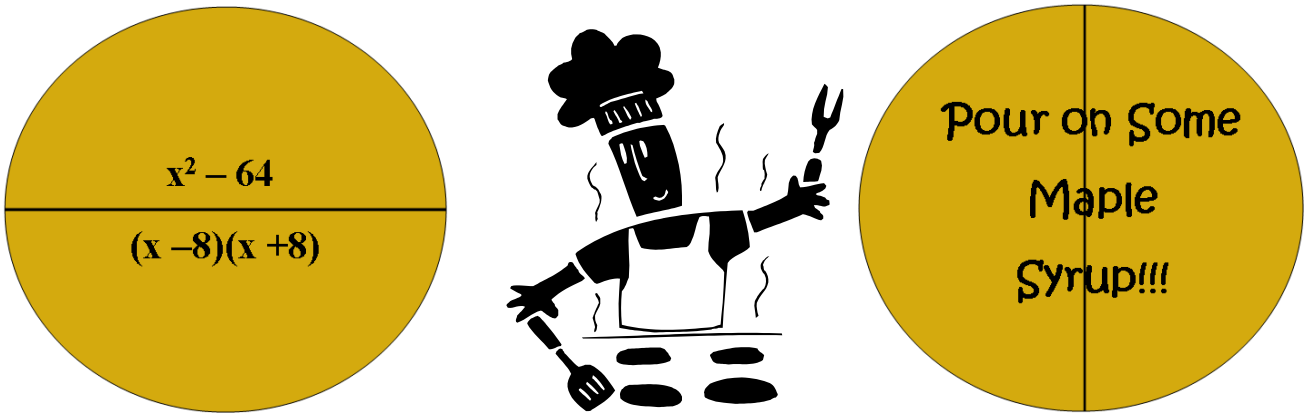
Web Resources (Visit www.raft.net/raft-idea?isid=616 for more resources!)

- Simplification of polynomials - http://www.coolmath.com/algebra/algebra-practice-polynomials.html
- Practice problems with polynomials - http://library.thinkquest.org/20991/alg2/polyf.html
- Factoring polynomials - http://www.helpalgebra.com/onlinebook/factoringpolynomials.htm

Sample Equivalent Polynomial Expressions (varying levels of difficulty)

$(x + 8)(x + 6)$	$(x^2 + 14x + 48)$
$x^2 - 64$	$(x - 8)(x + 8)$
$15x^2y - 10xy$	$5xy(3x - 2)$
$x^3 + 3x^2 - 4x$	$x(x - 1)(x + 4)$
$(7x^3 + 6x^2 - 2x) - (9x^2 - 4x + 3)$	$7x^3 - 3x^2 + 2x - 3$
$(7x^3 + 6x^2 - 2x) + (9x^2 - 4x + 3)$	$7x^3 + 15x^2 - 6x + 3$
$(2x^2 - 4x + 4)(-2x^2 - 5x + 4)$	$-4x^4 - 2x^3 + 20x^2 - 36x + 16$
$(x + 9)(x - 6)$	$x^2 + 3x - 54$
$x^2 + 6x$	$x(x + 6)$
$(x + 5)^2$	$x^2 + 10x + 25$
$(x - 5)^2$	$x^2 - 10x + 25$
$(x - 5)(x + 5)$	$x^2 - 25$
$7x^2 + 48x + 36$	$(7x + 6)(x + 6)$
$21x^2 - 2x - 8$	$(7x + 4)(3x - 2)$

$(x^2 - 81) \div (x + 9)$	$x - 9$
$(x^3 - 2x^2) \div x^2$	$x - 2$
$18x^2 + 21x + 3$	$(6x + 1)(3x + 3)$
$x^2 - 1$	$(x + 1)(x - 1)$
$(x)(x)$	x^2
$(x^2 + 9x + 20) \div (x + 4)$	$(x + 5)$
$(x + 2)(x - 9)$	$x^2 - 7x - 18$
$42x^2 - 32x + 6$	$(7x - 3)(6x - 2)$
$(5x + 7)(3x - 5)$	$15x^2 - 4x - 35$
$49x^2 + 63x + 20$	$(7x + 5)(7x + 4)$
$(x - 5x^3) - x^2 - 2x^3$	$x - x^2 - 7x^3$
$(x + 7x^3) - (x^2 + 2x^3)$	$x(5x^2 - x + 1)$
$4x^2 - 3x - 1$	$(4x + 1)(x - 1)$
$3y^3 + 2y$	$y(3y^2 + 2)$



When the polynomials match, a flip of the "pancake" will reveal a pancake topping message!

Pancake Topping Ideas→ Strawberries, Maple Syrup, Blueberries, Bananas, Raspberries, Blackberries, Cinnamon Sugar, Melted Butter, Margarine, Walnuts, Chocolate Chips