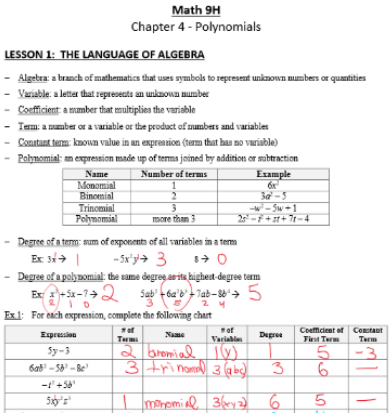
Mathematics 9: Similarities and Differences

Summary of Learning Opportunity

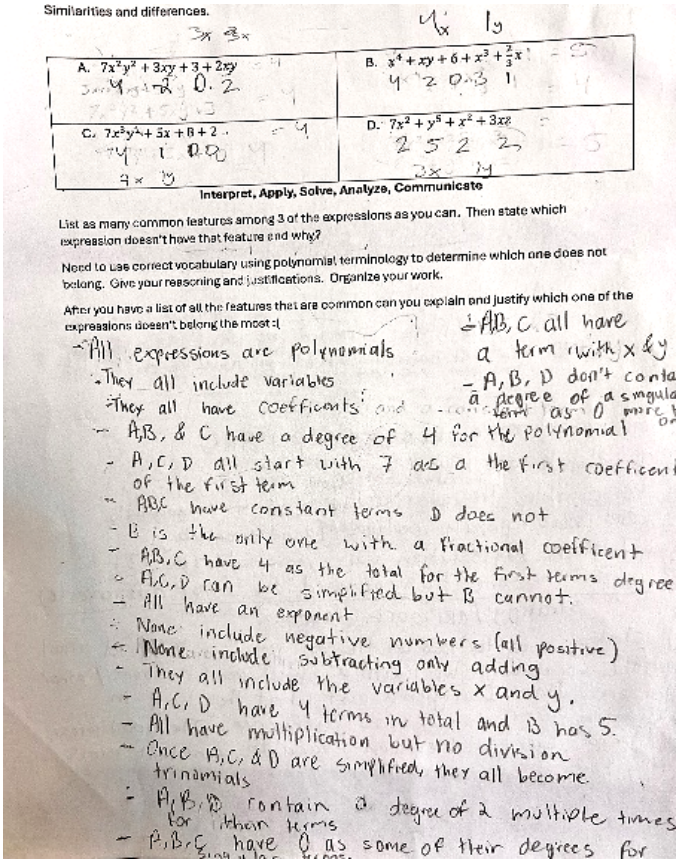
There is a lot of new mathematical vocabulary to learn in secondary math. In this short task, students applied their knowledge of previously learned vocabulary (variable, terms, degree, coefficient, constant term, polynomial, degree of a polynomial, combining like terms) to find similarities and differences between mathematical expressions. They communicated and defended their choices in small groups. This activity helped students practice Literacy competencies of applying relevant vocabulary to generate ideas and communicating their thinking with their peers. Ultimately, students developed a better understanding of math content through focusing on these thinking and communication skills.

Mathematics 9	**Learning Standards**	• Develop, demonstrate and apply mathematical understanding through play, inquiry, and problem solving • Use mathematical vocabulary and language to contribute to mathematical discussions • Explain and justify mathematical ideas and decisions • Communicate mathematical thinking in many ways • Operations with polynomials, of degree less than or equal to 2

Literacy Connections	Instruction and Assessment	Competencies Developed, Practiced, and/or Assessed
 **Math 9H** Chapter 4 - Polynomials **LESSON 1: THE LANGUAGE OF ALGEBRA** – Algebra: a branch of mathematics that uses symbols to represent unknown numbers or quantities – Variable: a letter that represents an unknown number – Coefficient: a number that multiplies the variable – Term: a number or a variable or the product of numbers and variables – Constant term: known value in an expression (term that has no variable) – Polynomial: an expression made up of terms joined by addition or subtraction Name / Number of terms / Example: Monomial 1 $6x^2$; Binomial 2 $3a^2-5$; Trinomial 3 $-w^3-5w+1$; Polynomial more than 3 $2z^5-z^4+z^2+7z-4$ – Degree of a term: sum of exponents of all variables in a term Ex: $3x^2$→ 1 $-5x^3y^2$→ 3 8→ 0 – Degree of a polynomial: the same degree as its highest-degree term Ex: x^2+5x-7→ 2 $5ab^3+6a^2b^2+7ab-8b^2$→ 5 Ex.1: For each expression, complete the following chart Expression / # of Terms / Name / # of Variables / Degree / Coefficient of First Term / Constant Term $5y-3$ / 2 / binomial / 1(y) / 1 / 5 / -3 $6ab^3-5b^3-8a^3$ / 3 / trinomial / 3(a,b) / 3 / 6 / — $-t^3+5b^3$ $5b^2z^3$ / 1 / monomial / 3(b,z) / 6 / 5 / — LITERACY: Applies Understanding—Synthesizes ideas and information	1. Prior to this activity, students learned the basics of the polynomial vocabulary through teacher-led notetaking. Students viewed a variety of expressions and identified examples of the different terms. 2. For this activity, small groups of students were given 4 polynomial expressions and prompted to find 3 similar and 1 different expression. They defended their decisions using the key vocabulary terms previously learned. Peers evaluated each similarity and difference for accuracy and relevance, promoting critical assessment within the groups.	Use mathematical vocabulary and language to contribute to mathematical discussions Develop, demonstrate, and apply mathematical understanding through play, inquiry and problem solving Use mathematical vocabulary and language to contribute to mathematical discussions Explain and justify mathematical ideas and decisions Communicate mathematical thinking in many ways

LITERACY: Communicates—Justifies and defends decisions and ideas	3. Students selected the one expression out of their group which differed the most from the others and defended their decision. As the teacher, I formatively assessed how students effectively communicated their ideas, the reasonableness of their responses and their discussion of the strategies and approaches used.	Use mathematical vocabulary and language to contribute to mathematical discussions Explain and justify mathematical ideas and decisions Communicate mathematical thinking in many ways

Demonstrations of Student Learning, Teacher Assessment, and Reflection



Similarities and differences.

A. $7x^2y^2 + 3xy + 3 + 2xy$	B. $x^4 + xy + 6 + x^3 + \frac{2}{3}x$
C. $7x^3y^4 + 5x + 8 + 2$	D. $7x^2 + y^5 + x^2 + 3xz$

Interpret, Apply, Solve, Analyze, Communicate

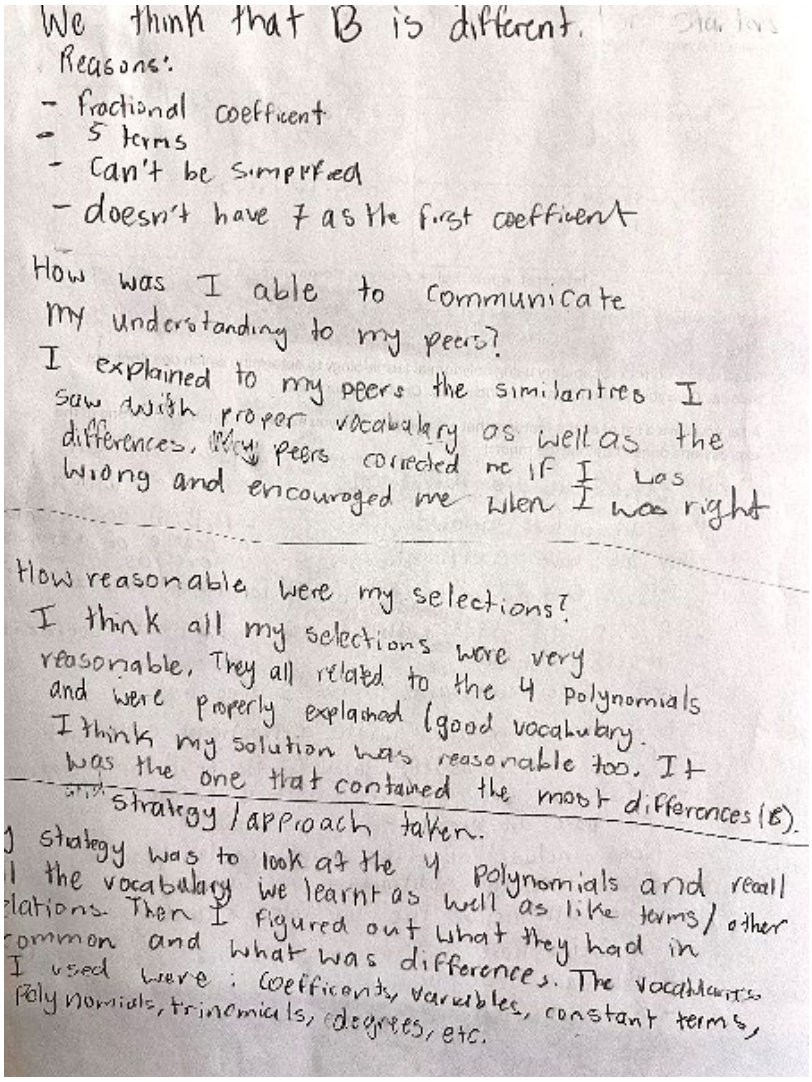
List as many common features among 3 of the expressions as you can. Then state which expression doesn't have that feature and why?

Need to use correct vocabulary using polynomial terminology to determine which one does not belong. Give your reasoning and justifications. Organize your work.

After you have a list of all the features that are common can you explain and justify which one of the expressions doesn't belong the most :)

- All expressions are polynomials
- They all include variables
- They all have coefficients
- A, B, & C have a degree of 4 for the polynomial
- A, C, D all start with 7 as a the first coefficient of the first term
- ABC have constant terms D does not
- B is the only one with a fractional coefficent
- A, B, C have 4 as the total for the first terms degree
- A, C, D can be simplified but B cannot.
- All have an exponent
- None include negative numbers (all positive)
- None include subtracting only adding
- They all include the variables x and y.
- A, C, D have 4 terms in total and B has 5.
- All have multiplication but no division
- Once A, C, & D are simplified, they all become trinomials
- A, B, D contain a degree of 2 multiple times for itthem terms
- A, B, C have 0 as some of their degrees for

- A, B, C all have a term with x & y
- A, B, D don't conta a degree of a singula



We think that B is different.

Reasons:

- fractional coefficent
- 5 terms
- can't be simplified
- doesn't have 7 as the first coefficent

How was I able to communicate my understanding to my peers?

I explained to my peers the similarities I saw with proper vocabulary as well as the differences. My peers corrected me if I was wrong and encouraged me when I was right

How reasonable were my selections?

I think all my selections were very reasonable, They all related to the 4 polynomials and were properly explained (good vocabulary. I think my solution was reasonable too, It was the one that contained the most differences (B).

Strategy / approach taken.

My strategy was to look at the 4 polynomials and recall the vocabulary we learnt as well as like terms / other relations. Then I figured out what they had in common and what was differences. The vocabularies I used were: coefficents, variables, constant terms, polynomials, trinomials, degrees, etc.

Teacher's Observations and Assessment

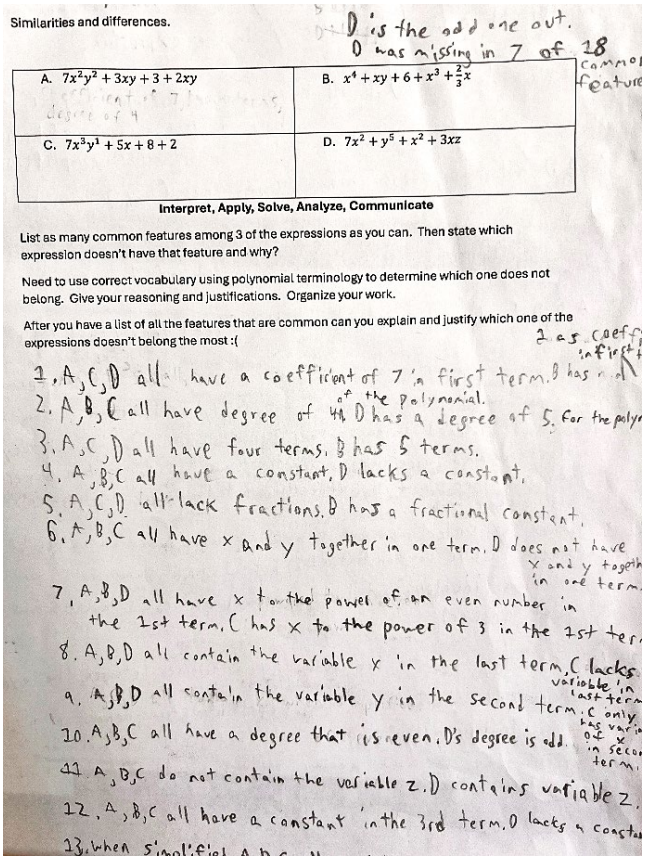
Proficient

This student, along with their group, was able to synthesize prior learning and apply appropriate vocabulary and definitions to discuss and interpret the presented expressions. The student developed sound reasoning and successfully justified their choice for the expression that differed the most out of the four provided. They analyzed the reasonableness of their selections.

Teacher's Observations and Assessment

Proficient

In their reflection, the student justified and explained the decisions made by the group. Their list of 20 similarities between the expressions demonstrated that they had synthesized the prior learning and successfully applied it to analyze the newly presented expressions.



Similarities and differences.

D is the odd one out.
D was missing in 7 of 18 common feature

A. $7x^2y^2 + 3xy + 3 + 2xy$	B. $x^4 + xy + 6 + x^3 + \frac{2}{3}x$
C. $7x^3y^1 + 5x + 8 + 2$	D. $7x^2 + y^5 + x^2 + 3xz$

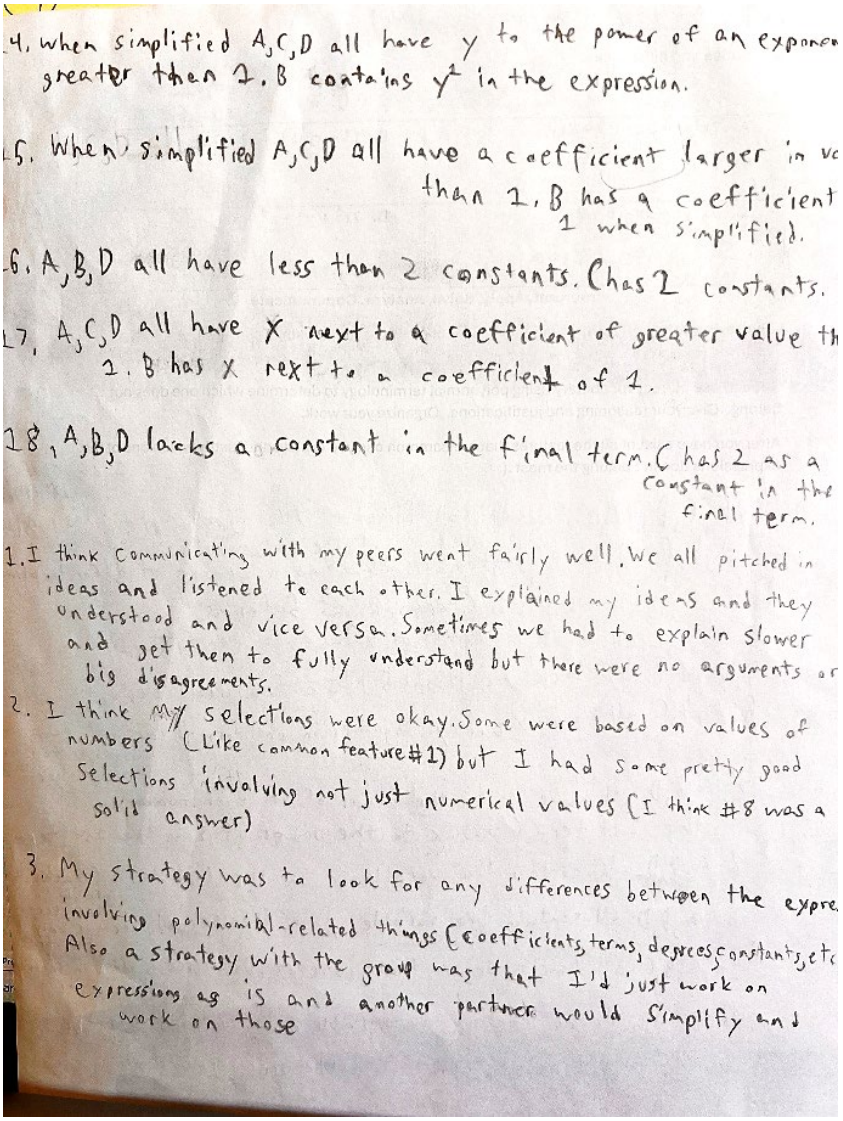
Interpret, Apply, Solve, Analyze, Communicate

List as many common features among 3 of the expressions as you can. Then state which expression doesn't have that feature and why?

Need to use correct vocabulary using polynomial terminology to determine which one does not belong. Give your reasoning and justifications. Organize your work.

After you have a list of all the features that are common can you explain and justify which one of the expressions doesn't belong the most :(

1. A, C, D all have a coefficient of 7 in first term. B has a coefficient of 1 in first term.
2. A, B, C all have degree of 4. D has a degree of 5 for the polynomial.
3. A, C, D all have four terms. B has 5 terms.
4. A, B, C all have a constant, D lacks a constant.
5. A, C, D all lack fractions. B has a fractional constant.
6. A, B, C all have x and y together in one term. D does not have x and y together in one term.
7. A, B, D all have x to the power of an even number in the 1st term. C has x to the power of 3 in the 1st term.
8. A, B, D all contain the variable x in the last term. C lacks variable in last term.
9. A, B, D all contain the variable y in the second term. C only has variable of y in second term.
10. A, B, C all have a degree that is even. D's degree is odd.
11. A, B, C do not contain the variable z. D contains variable z.
12. A, B, C all have a constant in the 3rd term. D lacks a constant.
13. When simplified A



4. When simplified A, C, D all have y to the power of an exponent greater than 2. B contains y^2 in the expression.
5. When simplified A, C, D all have a coefficient larger in value than 1. B has a coefficient 1 when simplified.
6. A, B, D all have less than 2 constants. C has 2 constants.
7. A, C, D all have X next to a coefficient of greater value than 1. B has X next to a coefficient of 1.
8. A, B, D lacks a constant in the final term. C has 2 as a constant in the final term.

1. I think communicating with my peers went fairly well. We all pitched in ideas and listened to each other. I explained my ideas and they understood and vice versa. Sometimes we had to explain slower and get them to fully understand but there were no arguments or big disagreements.
2. I think my selections were okay. Some were based on values of numbers (Like common feature #1) but I had some pretty good selections involving not just numerical values (I think #8 was a solid answer)
3. My strategy was to look for any differences between the expressions involving polynomial-related things (coefficients, terms, degrees, constants, etc. Also a strategy with the group was that I'd just work on expressions as is and another partner would simplify and work on those

Teacher's Reflection

By using the Cross-Curricular Literacy Learning Progressions, I created an activity that helped students use multiple critical thinking and communication skills. In a typical Math 9 classroom, there is limited time for students to discuss and reflect on their learning. However, this activity created an opportunity for peer interaction, allowing students to use precise mathematical vocabulary, build connections between concepts, and work through mathematical reasoning together.

There was no single "correct" answer; some students found five connections, while others, using more advanced language and concepts, identified 15 to 20 unique relationships. This approach allowed students to engage deeply and apply their knowledge independently, fostering both critical thinking and autonomy in learning.

Students could freely share their thoughts and insights, which led to rich discussions on the similarities and differences among polynomial expressions. Their contributions varied in impact—some were foundational, while others showed deeper understanding—creating a dynamic learning environment where students collaboratively explored their understanding. Students drove their own learning and developed strong communication skills within their groups. If a classmate struggled to articulate a concept, they learned from peers who could communicate it clearly. Those who were more proficient helped others by explaining what they understood, reinforcing their own knowledge in the process. My role was minimal, creating a student-centred learning environment.