Just In Time Quick Check
Standard of Learning (SOL) A.2b

Strand: Expressions and Operations

Standard of Learning (SOL) A.2b
The student will perform operations on polynomials, including adding, subtracting, multiplying and dividing polynomials.

Grade Level Skills:
- Model sums, differences, products, and quotients of polynomials with concrete objects and their related pictorial and symbolic representations.
- Determine sums and differences of polynomials.
- Determine products of polynomials. The factors should be limited to five or fewer terms (i.e., $(4x + 2)(3x + 5)$ represents four terms and $(x + 1)(2x^2 + x + 3)$ represents five terms).
- Determine the quotient of polynomials, using a monomial or binomial divisor, or a completely factored divisor.

Just in Time Quick Check Student Version

Just in Time Quick Check Teacher Notes

Supporting Resources:
- VDOE Mathematics Instructional Plans (MIPS)
    - A.2b - Dividing Polynomials Using Algebra Tiles (Word) / PDF Version
    - A.2b - Multiplying Polynomials Using Algebra Tiles (Word) / PDF Version
    - A.2b - Adding and Subtracting Polynomials Using Algebra Tiles (Word) / PDF Version
- VDOE Co-Teaching Mathematics Instruction Plans (MIPS)
    - A.2b - Multiplying Polynomials (Word) / PDF Version
- VDOE Algebra Readiness Formative Assessments
    - A.2 a,b,c (Word) / PDF
- VDOE Word Wall Cards: Algebra I   (Word) | (PDF)
    - Degree of Polynomial
    - Leading Coefficient
    - Add Polynomials (group and like terms)
    - Subtract Polynomials (group and like terms)
    - Multiply Binomials
    - Multiply Polynomials
    - Multiply Binomials (model, graphic organizer, squaring a binomial and sum and difference)
    - Divide Polynomials (monomial divisor)
    - Divide Polynomials (binomial divisor)

Supporting and Prerequisite SOL: A.2a, 8.14b

SOL A.2b - Just in Time Quick Check

1. James simplified $(16x + 8x^2y - 7xy^2 + 9y) + (5xy^2 + 10x^2y + x - 7y)$

   His work is shown below. Find and correct his mistake.

   $$16x + 8x^2y - 7xy^2 + 9y + 5xy^2 + 10x^2y + x - 7y$$
   $$(16x + x) + (8x^2y - 7xy^2 + 5xy^2 + 10x^2y) + (9y - 7y)$$
   $$17x + 16x^2y^2 + 2y$$

2. Multiply the following. Show your work/thinking.
   $$(4x - 2)(2x - 4)$$

3. What is the product of the expression shown? Write your answer in simplest form. Show your work/thinking.
   $$(x + 2)(x^2 + x + 3)$$

4. Simplify the expression below. Show your work/thinking.
   $$(x + 2)^2$$

5. Simplify: $(3x^3 - 4x^2 - 4) - (2x^3 - 3x^2 + 3)$

6. Simplify the following expression. Write your answers using only positive exponents. Show your work/thinking.

   $$\frac{8x^2 - 10x - 3}{2x - 3}$$

1. James simplified $(16x + 8x^2y - 7xy^2 + 9y) + (5xy^2 + 10x^2y + x - 7y)$

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   A common misconception when adding and subtracting polynomials with multiple variables, is that students will add terms that are not like. This may indicate the student cannot identify similar terms. The student may need more practice with algebra tiles to build a conceptual understanding between the terms as well as a review of algebraic vocabulary. Students would benefit from extra practice in identifying like terms – such as a card sort. It may also benefit students to use colored pencils or highlighters to distinguish like terms.

2. Multiply the following. Show your work/thinking.
$$(4x - 2)(2x - 4)$$

   A common error when multiplying binomials involving subtraction is that students may make errors with the signs. This may indicate that a student needs to revisit multiplication of integers. One strategy is to have students rewrite the problem using "add the opposite" or (4x + (-2))(2x + (-4)) so that distribution of terms would be 4x(2x) + 4x(-4) + -2(2x) + -2(-4). This may help students keep track of the signs. Teachers may find it helps students to use a box method for multiplication so that they can organize terms and signs.

   Example setting up the box method:

	$2x$	-4
$4x$	$8x^2$	$-16x$
-2	$-4x$	8

3. What is the product of the expression shown? Write your answer in simplest form. Show your work/thinking.
$$(x + 2)(x^2 + x + 3)$$

   A common error when multiplying binomials is that students may leave out one or more terms when multiplying. This may indicate that a student needs to revisit the distributive property. Teachers may find it helps students to use a box method for multiplication so that they can organize terms and signs or rewriting the problem as two separate monomial by trinomial multiplication problems and then combining terms as the final step.

4. Simplify the expression below. Show your work/thinking.
$$(x + 2)^2$$

   A common misconception made by students is to only square each term: $x^2 + 4$. This may indicate they are confused about the meaning of squaring a binomial. The teacher may need to provide a visual of this problem using algebra tiles and have students rewrite the problem as (x + 2)(x + 2). The teacher may need to revisit the concept of raising a

base to a power. Explaining that raising 3^2 means to multiply the base of three two times, whereas $(x + 2)^2$ means to multiply the base of $(x + 2)$ two times.

5. Simplify: $(3x^3 - 4x^2 - 4) - (2x^3 - 3x^2 + 3)$

A common error for students is they may not recognize that the subtraction operation applies to all terms in the second polynomial. This commonly results in the negative sign (subtraction) only being distributed to the first term of the second trinomial. This may indicate the students is confused about distributing a negative sign. The teacher should revisit the integer operation rules and remind students to always watch for this and possibly use a highlighter to help them identify signs. It may help some students to subtract vertically and/or rewrite the subtraction problem as "addition of the opposite".

6. Simplify the following expression. Write your answers using only positive exponents. Show your work/thinking.

$$\frac{8x^2 - 10x - 3}{2x - 3}$$

A common student misconception when dividing by a binomial is to attempt to divide terms before the polynomials are factored. This indicates the student may not understand that simplifying fractions requires dividing out common factors. The teacher should make sure the student understands the difference between terms and factors. A strategy that might be useful for some students is to begin with a numerical example to illustrate the idea of common factors:

$$\frac{33}{3} = \frac{3 \cdot 11}{3} = 11$$

By rewriting a composite number in factored form, students can visualize the steps needed when dividing by a binomial. Another strategy would be to have students check their answer using the inverse operation of multiplication to help them verify if their result is correct

**Dividing by a binomial crosses over with A.2c (factoring). It would benefit students to have prior instruction/knowledge of factoring trinomials (A.2c) in one variable of degree two before dividing polynomial expression by a binomial expression.