National Council of Teachers of Mathematics Annual Meeting – Denver, CO April 19, 2013

Session 534

Creating Opportunities for Students to Engage in Reasoning and Proof

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Task A

MAKING CONJECTURES Complete the conjecture based on the pattern you observe in the specific cases.

29. Conjecture: The sum of any two odd numbers is _____.

1 + 1 = 2	7 + 11 = 18
1 + 3 = 4	13 + 19 = 32
3 + 5 = 8	201 + 305 = 506

30. Conjecture: The product of any two odd numbers is _____.

$1 \times 1 = 1$	$7 \times 11 = 77$
$1 \times 3 = 3$	$13 \times 19 = 247$
$3 \times 5 = 15$	$201 \times 305 = 61,305$

McDougal Littell (2004), Geometry, p. 7, #29-30

Task A'

For problems 29 and 30, complete the conjecture based on the pattern you observe in the examples. Then explain why the conjecture is always true <u>or</u> show a case in which it is not true.

29. Conjecture: The sum of any two odd numbers is _____.

1 + 1 = 2	7 + 11 = 18
1 + 3 = 4	13 + 19 = 32
3 + 5 = 8	201 + 305 = 506

30. Conjecture: The product of any two odd numbers is ____?

$1 \times 1 = 1$	$7 \times 11 = 77$
$1 \times 3 = 3$	$13 \times 19 = 247$
$3 \times 5 = 15$	$201 \times 305 = 61,305$

Task B

VISUAL REASONING Explain why the following method of drawing a parallelogram works. State a theorem to support your answer. See margin.



McDougal Littell (2004), Geometry, p. 343, #29

Task B'

Consider the construction below.



Use the construction with a variety of starting segments.

- 1. Make a conjecture about the type of figure that the construction produces.
- 2. Using the properties that you know about that figure, create a mathematical argument that explains why that figure is produced each time by the construction.

Task C

GEOMETRY For Exercises 45 and 46, use the diagram below that shows the perimeter of the pattern consisting of trapezoids.



- 45. Write a formula that can be used to find the perimeter of a pattern containing n trapezoids.
- 46. What is the perimeter of the pattern containing 12 trapezoids?

Glencoe (2005), Algebra I, p. 237, #45-46

Task C'

Use the diagram below that shows a pattern consisting of trapezoids.



- 1. Make as many observations as you can about the trapezoid pattern.
- 2. Find the perimeter of the first four trapezoid patterns shown above.
- 3. Find the perimeter of the pattern that contains 12 trapezoids without drawing a picture.
- 4. Write a generalization that can be used to find the perimeter of a pattern containing any number of trapezoids.
- 5. Using words, numbers and/or connections to the visual diagram, prove that the generalization you created in part 4 will always work.

TASK D

- a. Simplify each expression.
 - $(-2)^2$ $(-2)^3$ $(-2)^4$ $(-2)^5$
 - $(-3)^2$ $(-3)^3$ $(-3)^4$ $(-3)^5$
- b. *Make a Conjecture* Do you think a negative number raised to an even power will be positive or negative? Explain.
- c. Do you think a negative number raised to an odd power will be positive or negative? Explain.

TASK E

The measure of each interior angle of a regular *n*-side polygon is 180(n-2)/n. For example, the interior angle measure of a regular (equilateral) triangle is $180(3-2)/3=60^{\circ}$.



- 77. Find the interior angle measure of a square.
- 78. Find the interior angle measure of a regular pentagon.
- 79. Find the interior angle measure of a regular hexagon.
- 80. Does the interior angle measure of a regular n-sided polygon increase or decrease as the n increase?

Multiplying Monomials



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Example 3 $(-3a^3b^2)(5ab^4) =$ Example 4 $\frac{20x^2y}{3} \cdot \frac{12x^3y^5}{5} =$ =	$ = (-3 \cdot 5)(a^3 \cdot a)(b^2 \cdot b^4) $ = $-15a^4b^6$ Answer $(\frac{20}{3} \cdot \frac{12}{5})(x^2 \cdot x^3)(y \cdot y^5) $ $16x^5y^6$ Answer		Check for Understanding Here is a suggested use of the Oral Exercises to check students' understanding as you teach the lesson. Oral Exs. 1-4: use after Example 1. Oral Exs. 5-18: use after
Example 5 $(3x^4y^6)(-2x^4y) +$	$(8x^{4}y^{2})(x^{4}y^{3}) = -6x^{6}y^{7} + 8x^{6}y^{6}$ = $2x^{6}y^{7}$ Answer	, / /*	Example 3. Oral Exs. 19–20: use after Example 5.
Oral Exercises Simplify. 1. $x^2 \cdot x^5 x^7$ 2. $t^4 \cdot 5$ 5. $(2s)(5s)^{10s^2}$ 6. $(3r)$ 9. $(2x^2)(3x^3)^{5x^2}$ 10. $(4x^4)^{1/2}$ 13. $(5x^5y)(3x^2y^2)^{1/5x^5}y^2$ 14. $(4y^6)^{1/2}$ 17. $(x^2y^3)(x^4y) \times 5y^4$ 18. $(r^2s)^{1/2}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Guided Practice Simplify. 1. $b^4 \cdot b^2 \ b^5$ 2. $(mn^2)(m^2n) \ m^3n^3$ 3. $(-3a^2b^2)(2ab^3) \ -6a^3b^5$ 4. $(-3x^2y^3)(2xy^2)(-4x^3y) \ 24x^6y^8$ 5. $(\frac{3}{5}b^2)(15b^3) \ 9b^5$ 6. $(4-3^3)(1-x^2)(-3x) \ -7x^6$
Written Exercises Simplify. 1. $n^3 \cdot n^5 n^5$ 4. $n^2 \cdot n^2 \cdot n^{n^5}$ 7. $(n^2 n)(nn^4) m^3 n^5$	2. $a^2 \cdot a^2 a^4$ 5. $(2x^2)(5x^5) \ 10x^7$ 8. $(x^3_2)(x^2_{-2}^3) \ y^5 x^4$	3. $x^3 \cdot x^4 \cdot x^2 x^3$ 6. $(5a^5)(6a^6)$ 30a ¹ 9. $(2ab)(3ab^5)$ $6a^2b^6$	6. $(4m^2)(\frac{1}{4}m^2)(-7m) - 7m^2$ Summarizing the Lesson Tell the students that they have learned how to multi- ply monomials using the Rule of Exponents for Prod- ucts of Powers. Ask them to give examples of the rule.
10. $(5x^{2}y)(3x^{3}y^{4}) + (5x^{3}y^{5})$ 13. $(-3x^{3})(-2x^{3}y) + 6x^{4}y^{5}$ 16. $(3y^{2}x)(4y^{4}z^{2}) + (2y^{2}z^{3})$ 19. $(-x^{2}y^{3})(3xy^{2})(-2x^{3}y) + 6x^{6}y^{6}$ 21. $(\frac{2}{3}x^{4})(\frac{3}{2}t^{2})t^{6}$ 23. $(\frac{1}{3}x^{2})(\frac{3}{2}t^{2})t^{6}$ 25. $(3x^{3})(\frac{1}{6}x^{2})(8x) + 4x^{6}$ 27. $(3p^{3}q)(-\frac{5}{6}q^{3})(-p^{4}) + \frac{5}{2}p^{7}q^{4}$ 29. $(4xy)(2xy^{3})(-2y^{2}) + 16x^{2}y^{6}$	11. $(4x^5)(-3x^2)^{-12x^7}$ 14. $(3p^2s^3)(-5p^2s)^{-12x^7}$ 17. $(2p^2q)(3pq)(4q)^{-24p^3\sigma^3}$ 20. $(-r^2s)(-22, (\frac{2}{7}a^2))(21)^{-2}$ 24. $\frac{4h^3k^2}{7}, \frac{21}{21}$ 26. $(8c^2)(-d)^2$ 28. $(-a^3b)(-3b)(-3b)(-3b)(-3b)(-3b)(-3b)(-3b)(-$	12. $(5y^3)(-2y^4) = 10y^7$ 15. $(5a^2b^5c)(2ab^4c^2) = 10a^3b^5c^4$ 18. $(ab^2)(5a^2b^3)(3a^3) = 15a^6b^5$ $(3rs^3)(-s^2) = 3r^3s^5$ $(a^5) = 6a^7$ $\frac{14k^5}{2} = 6b^4k^7$ $y(-\frac{1}{4}cd^2) = 2c^3a^3$ $-a^2b^2)(-ab^3) = a^6b^6$ $a^3b(-a^3) = 5a^6b^5$ Polynomials 153	Suggested Assignments Minimum Day 1: 153/2–18 even Assign with Lesson 4-2. Day 2: 153/19–37 odd S 154/Mixed Review <i>R</i> 151/Self-Test 1 Average 153/3–36 mult. of 3, 38, 41, 42 S 154/Mixed Review <i>R</i> 151/Self-Test 1 Maximum 153/3–48 mult. of 3 S 154/Mixed Review <i>B</i> 154/06/K Review
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Brown, R.G., Dolciani, M.P., Sorgenfrey, R.H., & Cole, W.L. (2004). Algebra Structure and Method Book 1 Teacher's Edition (pp. 152-153). Boston, MA: McDougal Littell.