SECTION 7A Ready To Go On? Skills Intervention

7-3 Multiplication Properties of Exponents

Finding Product of Powers

Product of Powers Property: The product of two powers with the same base equals that base raised to the sum of the exponents. For example $5^4 \cdot 5^2 = 5^{4+2}$.

Simplify.

A. $2^7 \cdot 2^3$ — What is the base of each expression? 2

$2^7 \cdot 2^3 = 2^{7} + 3 = 2^{10}$ — Add the exponents.

B. $a^4 \cdot a^{-3} \cdot a^2$ — Are the bases the same? Yes So, add the exponents.

$a^{4-3+2} = a^{3}$

Finding Powers of Products

Power of a Power Property: A power raised to another power equals that base raised to the product of the exponents. For example $(4^3)^5 = 4^{3 \cdot 5} = 4^{15}$.

Power of a Product Property: A product raised to a power equals the product of each factor raised to that power. For example $(2^2y^3)^4 = (2^2)^4(y^3)^4 = 2^8y^{12}$.

Simplify.

A. $(2x^3)^4$

$(2)^4 \cdot (x^3)^4$ — Use the Power of a Product Property.

$16 \cdot x^{3 \cdot 4}$ — When you raise a power to another power, multiply exponents.

$16 \cdot x^{12}$ — Simplify.

B. $(-5a^3)^2$

$(-5)^2 \cdot (a^3)^2$ — Use the Power of a Product Property.

$25 \cdot (a^{3 \cdot 2})$ — Simplify.

$25a^{6}$

C. $(ab^2)^3 \cdot (a^4b^2)^2$

$a^3b^{2 \cdot 3} \cdot a^{4 \cdot 2}b^{2 \cdot 2}$ — Use the Power of a Product Property.

$a^3b^6 \cdot a^8b^4$ — Simplify.

$a^{3+8}b^{6+4}$ — Use the Product of Powers Property.

$a^{11}b^{10}$ — Simplify.

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SECTION 7A Ready to Go On? Problem Solving Intervention

7-3 Multiplication Properties of Exponents

A number written in scientific notation has two parts that are multiplied. The first part is a number that is greater than or equal to 1 and less than 10. The second part is a power of 10.

Light travels at a speed of 3.0×10^8 meters per second. If light travels for 4.5 seconds, how far does it travel? Write your answer in scientific notation and in standard form.

Understand the Problem

1. What number(s) are given in scientific notation? 3.0×10^8 m/s
2. What number(s) are given in standard form? 4.5 seconds
3. What are you being asked to find? How far light travels in 4.5 seconds.

Make a Plan

4. What operation must be used to solve the problem? Multiplication
5. Write the multiplication expression. $4.5 \cdot (3.0 \times 10^8)$

Solve

6. What is the product of the expression? $(4.5)(3.0) \times 10^8 = 13.5 \times 10^8$
7. What units should your answer have? Meters
8. Is the answer 13.5×10^8 written in scientific notation? No
   a. How many places does the decimal point need to be moved? 1
   b. In what direction does the decimal point need to be moved? Left
   c. Write the answer in scientific notation. 1.35×10^9
9. Write the answer in standard form.
   a. How many places does the decimal point need to be moved? 9
   b. In what direction does the decimal point need to be moved? Right
   c. Write the answer in standard form. 1,350,000,000 meters

Look Back

10. Estimate your answer to see if it is correct.
    What does 4.5 round to? 5
    What is $(5 \cdot 3) \times 10^8$? 15×10^8
11. Is your estimate close to your numeric answers in Exercises 8c and 9c? Yes

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SECTION 7A Ready To Go On? Skills Intervention

7-4 Division Properties of Exponents

Finding Quotients of Powers

Quotient of Powers Property: The quotient of two nonzero powers with the same base equals the base raised to the difference of the exponents. For example $\frac{5^8}{5^3} = 5^{8-3}$.

Simplify $\frac{3a^7y^{10}}{a^2y^8}$.

When finding the quotient of two powers you subtract the exponents.

$\frac{3a^7y^{10}}{a^2y^8} = 3a^{7-2}y^{10-8} = 3a^5y^2$

Dividing Numbers in Scientific Notation

Simplify $(3 \times 10^8) \div (6 \times 10^5)$ and write the answer in scientific notation.

$(3 \times 10^8) \div (6 \times 10^5) = \frac{3 \times 10^8}{6 \times 10^5}$ — Rewrite as a quotient.

$= \frac{3}{6} \times \frac{10^8}{10^5}$ — Write as a product of quotients.

$= 0.5 \times 10^{3}$ — Simplify each quotient and simplify the exponent.

$= 5 \times 10^{-1} \times 10^{3}$ — Write 0.5 in scientific notation.

$= 5 \times 10^{2}$ — Add the exponents.

Finding Positive Powers of Quotients

Positive Power of a Quotient Property: A quotient raised to a positive power equals the quotient of each base raised to that power.

Simplify $\left(\frac{3a^4}{6a^2b^2}\right)^2$.

$\left(\frac{3a^4}{6a^2b^2}\right)^2 = \frac{(3a^4)^2}{(6a^2b^2)^2}$ — Use the Power of a Quotient Property.

$= \frac{(3)^2(a^4)^2}{(6)^2(a^2)^2(b^2)^2}$ — Use the Power of a Product Property.

$= \frac{9a^{4 \cdot 2}}{36(a^{2 \cdot 2})(b^{2 \cdot 2})}$ — Simplify and Use the Power of a Power Property.

$= \frac{9a^8}{36(a^4)(b^4)} = \frac{a^4}{4b^4}$ — Simplify.

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SECTION 7A Ready To Go On? Quiz

7-1 Integer Exponents

Evaluate each expression for the given value(s) of the variable(s).

1. a^{-4} for $a = 3$ — $\frac{1}{81}$
2. w^{-6} for $w = -5$ — $-\frac{1}{15{,}625}$
3. $w^{-2}y$ for $w = 5$ and $y = -3$ — $-\frac{3}{25}$
4. a^0 for $a = 12$ — 1
5. $(6 - w)^{-8}$ for $w = 7$ — 1
6. a^0b^{-3} for $a = 5$ and $b = 10$ — $\frac{1}{1000}$

Simplify.

7. $6w^{-4}$ — $\frac{6}{w^4}$
8. $\frac{y^7}{w^{-3}}$ — w^3y^7
9. $3x^{-2}y^0$ — $\frac{3}{x^2}$
10. $\frac{w^{-6}}{b^{-4}}$ — $\frac{b^4}{w^6}$

11. Engineering notation can be written in terms of a base unit, with a power of 10 that is a multiple of 3. The table shows some of these equivalences. Simplify each expression.

Selected Engineering Prefixes					
Giga	Mega	Kilo	Milli	Micro	Nano
10^9	10^6	10^3	10^{-3}	10^{-6}	10^{-9}

Giga 1,000,000,000 Kilo 1000

Milli 0.001 Micro 0.000001

Mega 1,000,000 Nano 0.000000001

7-2 Powers of 10 and Scientific Notation

12. Find the value of 10^5. — 100,000
13. Write 0.00000004 as a power of 10. — 4×10^{-8}
14. Write 1,000,000,000,000 as a power of 10. — 10^{12}
15. Find the value of 15.7×10^5. — 1,570,000
16. The wavelength of red light is 0.0000007 m. Write this length in scientific notation. — 7×10^{-7} m

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SECTION 7A

Ready to Go On? Quiz continued

7-3 Multiplication Properties of Exponents

Simplify.

17. $3^5 \cdot 3^2$ — 3^7

18. $5^4 \cdot 5^{-2}$ — 5^2 or 25

19. $a^6 \cdot a^7$ — a^{13}

20. $w^7 \cdot w^{-9} \cdot w^{-2}$ — $\frac{1}{w^4}$

21. The closest star to Earth is Proxima Centauri, which is 4.3 light-years away (one light-year equals 5.88×10^{12} miles). How far, in miles, is Proxima Centauri from Earth? Write your answer in scientific notation and standard form.

2.5284×10^{13} miles; 25,284,000,000,000 miles

Simplify.

22. $(2x^5)^3$ — $8x^{15}$

23. $(a^5b^3)^4$ — $a^{20}b^{12}$

24. $(-6w^6)^2$ — $36w^{12}$

25. $(ab)^2(a^3b^4)^3$ — $a^{11}b^{14}$

7-4 Division Properties of Exponents

Simplify.

26. $\frac{7^9}{7^7}$ — 49

27. $\frac{15x^6}{5x^3}$ — $3x^3$

28. $\frac{a^9b^{10}}{a^{11}b^3}$ — $\frac{b^7}{a^2}$

29. $\frac{8x^3y^5}{x^3y}$ — $8y^4$

30. $\left(\frac{2}{3}\right)^3$ — $\frac{8}{27}$

31. $\left(\frac{5w^4}{w^2y^6}\right)^2$ — $\frac{25w^4}{y^{12}}$

32. $\left(\frac{3}{4}\right)^{-3}$ — $\frac{64}{27}$

33. $\left(\frac{a^2b^5}{ab^6}\right)^{-2}$ — $\frac{b^2}{a^2}$

Simplify each quotient and write the answers in scientific notation.

34. $(9 \times 10^{10}) \div (3 \times 10^4)$ — 3×10^6

35. $(4.5 \times 10^6) \div (9 \times 10^9)$ — 5×10^{-4}

36. $(2 \times 10^5) \div (5 \times 10^5)$ — 4×10^{-1}

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SECTION 7A

Ready To Go On? Enrichment

Digits

Using the digits 1, 2, 3 and 4 and addition, subtraction, multiplication, division, parentheses, and exponents, write an expression equivalent to the numbers 1 to 20.

- You must use all four digits in each expression.
- You may use any of the operations but each symbol may be used only once in each expression.

An example has been done for you. There may be more than one correct expression for a given number. Sample answers given

1 = $3 \cdot 2 - (4 + 1)$

2 = $\frac{3 \cdot 2}{1} - 4$

3 = $4 - 3 + 2 \cdot 1$

4 = $\frac{(3 - 2) \cdot 4}{1}$

5 = $3 \cdot 1 + 4 - 2$

6 = $3^1 \cdot (4 - 2)$

7 = $4 + 3 \cdot 1^2$

8 = $(4 - 2) \cdot (3 + 1)$

9 = $(4 + 1 - 2) \cdot 3$

10 = $4 \cdot 3 - \frac{2}{1}$

11 = $2^3 + (4 - 1)$

12 = $2^3 + (4 \cdot 1)$

13 = $2^4 - (3 \cdot 1)$

14 = $(4 + 3) \cdot \frac{2}{1}$

15 = $(4 + 2 - 1) \cdot 3$

16 = $(3 + 2 - 1) \cdot 4$

17 = $(4 + 2) \cdot 3 - 1$

18 = $2^4 + (3 - 1)$

19 = $2^4 + (3 \cdot 1)$

20 = $(3 + 2) \cdot \frac{4}{1}$

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SECTION 7B

Ready To Go On? Skills Intervention

7-5 Polynomials

Find these vocabulary words in Lesson 7-5 and the Multilingual Glossary.

Vocabulary			
monomial	degree of a monomial		polynomial
degree of a polynomial	standard form of a polynomial		leading coefficient
quadratic	cubic	binomial	trinomial

Writing Polynomials in Standard Form

Write each polynomial in standard form and give the leading coefficient.

A. $a + 5 + 6a^3$

Identify the degree of each term: $\underbrace{a}_{1} + \underbrace{5}_{0} + \underbrace{6a^3}_{3}$

Is descending order least to greatest or greatest to least? Greatest to least

Arrange in descending order: $6a^3 +$ ___a___ + ___5___

What is the leading coefficient? ___6___

B. $-4a^2 + 12 + a^6 + 7a^3$

Identify the degree of each term: $\underbrace{-4a^2}_{2} + \underbrace{12}_{0} + \underbrace{a^6}_{6} + \underbrace{7a^3}_{3}$

Arrange in descending order: $a^6 +$ ___$7a^3$___ − ___$4a^2$___ + 12

What is the leading coefficient? ___1___

Classifying Polynomials

Classify each polynomial according to its degree and number of terms.

A. $6x^3 + 3x^2 - 5$ Degree: 3 Terms: ___3___

What is the name for an expression with a degree of 3? ___Cubic___

What is the name for an expression having 3 terms? ___Trinomial___

$6x^3 + 3x^2 - 5$ is a ___cubic___ trinomial.

B. $8 - 5y^2 + y - 6y^4$ Degree: ___4___ Terms: 4

$8 - 5y^2 + y - 6y^4$ is a quartic ___polynomial___.

Degree	Name
0	Constant
1	Linear
2	Quadratic
3	Cubic
4	Quartic

Terms	Name
1	Monomial
2	Binomial
3	Trinomial
4 or more	Polynomial

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SECTION 7B

Ready To Go On? Skills Intervention

7-6 Adding and Subtracting Polynomials

Adding Polynomials

Add.

A. $(4x^3 - 3x) + (5x^3 + 4x - 7)$

Which terms are like terms? $4x^3$ and ___$5x^3$___; $-3x$ and ___$4x$___

$(4x^3 +$ ___$5x^3$___$) + (-3x +$ ___$4x$___$) + (-7)$ Group like terms.

___9___$x^3 +$ ___x___ $- 7$ Combine like terms.

B. $(8y^7 - 4y^3) + (2y^5 + 3)$

Which terms are like terms? ___None___

Arrange the terms in descending order:

$8y^7 +$ ___$2y^5$___ − ___$4y^3$___ + 3

Subtracting Polynomials

Subtract.

Remember that subtracting polynomials is the same as ___adding___ the opposite.

A. $(8y^3 + 6y^2) - (3y^2 + 2y)$

Identify like terms: $6y^2$ and ___$3y^2$___

Rewrite the subtraction as addition of the opposite. $(8y^3 + 6y^2) + (-3y^2 -$ ___$2y$___$)$

Rearrange terms so that like terms are together. $8y^3 +$ (___$6y^2$___ $- 3y^2) -$ ___$2y$___

Combine like terms. $8y^3 +$ ___$3y^2$___ − ___$2y$___

B. $(w^2 - 4) - (-3w^3 + 7w)$

Are there any like terms? ___No___

Rewrite the subtraction as addition of the opposite. $(w^2 - 4) +$ (___$3w^3$___ $- 7w)$

Combine like terms and arrange in descending order. $3w^3 +$ ___w^2___ − ___$7w$___ $- 4$

C. $(8n^3 - 3n) - (2n^3 - 7)$

$(8n^3 - 3n) + (-2n^3 +$ ___7___$)$ Rewrite subtraction as addition of the opposite.

Use the vertical method and align like terms. Use 0 for place holders.

$8n^3 + 0n^2 -$ ___$3n$___ $+ 0$

− ___$2n^3$___ $+ 0n^2 + 0n +$ ___7___

___$6n^3$___ − ___$3n$___ $+ 7$ Add.

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SECTION 7B Ready To Go On? Skills Intervention

7-7 Multiplying Polynomials

Multiplying Monomials
Multiply $(a^3b^4)(-7a^2b^3)$.

$-7(a^3 \cdot \underline{a^2})(b^4 \cdot \underline{b^3})$ Rearrange terms so that like bases are together.

$= -7a^{\underline{5}}b^{\underline{7}}$ Should you add or subtract exponents? Add

Multiplying a Polynomial by a Monomial
Multiply $3xy(7x^2 + 4x^2y)$.

$3xy(7x^2 + 4x^2y)$

$= 3xy(\underline{7x^2}) + \underline{3xy}(4x^2y)$ Distribute $3xy$.

$= (3 \cdot 7)(x \cdot \underline{x^2})y + (3 \cdot \underline{4})(x \cdot \underline{x^2})(y \cdot \underline{y})$ Group like bases together.

$= \underline{21}x^3y + \underline{12x^3y^2}$ Multiply.

Multiplying Binomials
Multiply $(4x^2 + 3y)(2x^2 + y)$.

What does FOIL mean? Multiply the first terms, the outside terms, the inside terms and the last terms.

$4x^2(2x^2) + \underline{4x^2}(y) + \underline{3y}(2x^2) + \underline{3y}(y)$ Use the FOIL method.

$= 8x^4 + \underline{4x^2y} + \underline{6x^2y} + 3y^2$ Multiply.

$= 8x^4 + \underline{10x^2y} + \underline{3y^2}$ Combine like terms.

Multiplying Polynomials
Multiply $(a^2 + 2a)(7a^2 - 5a - 3)$.

To multiply polynomials with more than two terms you can use the Distributive Property several times or multiply vertically.

$(a^2 + 2a)(7a^2 - 5a - 3)$ Use the Distributive Property.

$= a^2(7a^2 - 5a - 3) + \underline{2a}(\underline{7a^2} - \underline{5a} - \underline{3})$

$= a^2(7a^2) + \underline{a^2}(-5a) + \underline{a^2}(-3) + \underline{2a}(7a^2) + \underline{2a}(-5a) + \underline{2a}(-3)$ Distribute again.

$= 7a^4 - \underline{5a^3} - 3a^2 + \underline{14a^3} - 10a^2 - \underline{6a}$ Multiply.

$= 7a^4 + \underline{9a^3} - \underline{13a^2} - 6a$ Combine like terms.

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SECTION 7B Ready To Go On? Skills Intervention

7-8 Special Product of Binomials

Find these vocabulary words in Lesson 7-8 and the Multilingual Glossary.

Vocabulary	
perfect-square trinomial	difference of two squares

Finding Products in the Form $(a + b)^2$.

A. Multiply $(x + 9)^2$.

What is the rule for $(a + b)^2$? $a^2 + 2\underline{ab} + b^2$

Let $a = x$ and $b = \underline{9}$.

$(x + 9)^2 = (x)^2 + 2(\underline{x})(9) + (\underline{9})^2$

$= x^2 + \underline{18}x + \underline{81}$

B. Multiply $(3x + 5y)^2$.

Let $a = 3x$ and $b = \underline{5y}$.

$(3x + 5y)^2 = (3x)^2 + 2(\underline{3x})(5y) + (\underline{5y})^2$

$= \underline{9}x^2 + \underline{30}xy + \underline{25}y^2$

Finding Products in the Form $(a - b)^2$.

A. Multiply $(x - 5)^2$.

What is the rule for $(a - b)^2$? $a^2 - 2\underline{ab} + \underline{b}^2$

Let $a = x$ and $b = \underline{5}$.

$(x - 5)^2 = (x)^2 - 2(\underline{x})(5) + (\underline{5})^2$

$= x^2 - \underline{10}x + \underline{25}$

B. Multiply $(4x - 3)^2$.

Let $a = \underline{4x}$ and $b = \underline{3}$.

$(4x - 3)^2 = (4x)^2 - 2(\underline{4x})(\underline{3}) + (\underline{3})^2$

$= \underline{16}x^2 - \underline{24}x + \underline{9}$

Finding Products in the Form $(a + b)(a - b)$.

A. Multiply $(x + 8)(x - 8)$.

What is the rule for a difference of two squares $(a + b)(a - b)$? $a^2 - \underline{b^2}$

Let $a = x$ and $b = \underline{8}$.

$(x + 8)(x - 8) = (x)^2 - \underline{8}^2$

$= x^2 - \underline{64}$ Simplify.

B. Multiply $(3x + 4)(3x - 4)$.

Let $a = 3x$ and $b = \underline{4}$.

$(3x + 4)(3x - 4) = (\underline{3x})^2 - (4)^2$

$= \underline{9}x^2 - \underline{16}$ Simplify.

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SECTION 7B Ready to Go On? Problem Solving Intervention

7-8 Special Products of Binomials

A circular fish pond has a radius of $(x - 12)$ feet. Write a polynomial that represents the area of the fish pond. The formula for the area of a circle is $A = \pi r^2$, where r represents the radius of the circle. Leave the symbol π in your answer.

Understand the Problem

1. What are you being asked to find? The area of the pond
2. What piece of information are you given regarding the pond? The radius is $(x - 12)$ feet.
3. How do you find the area of a circle? $A = \pi r^2$

Make a Plan

4. Write an expression representing the area of the fish pond. $\pi(x - 12)^2$
5. What are two possible ways that $(x - 12)^2$ can be simplified? Using the Distributive Property more than once, FOIL or a perfect-square trinomial

Solve

6. What is $(x - 12)^2$? $x^2 - \underline{24x} + \underline{144}$
7. Write an expression representing the area of the pond. $\pi x^2 - \underline{24\pi x} + \underline{144\pi}$

Look Back

8. Suppose that $x = 20$. What would the length of the radius be $(x - 12)$? 8
9. What would the area of the pond equal using $A = \pi r^2$?

$A = \pi\underline{8}^2$

$A = \underline{64}\pi$

10. What is the value of the expression in Exercise 7, using $x = 20$?

$A = \pi x^2 - 24\pi x + 144\pi$

$= \pi(20)^2 - 24\pi(\underline{20}) + 144\pi$

$= \underline{400}\pi - \underline{480}\pi + 144\pi$

$= \underline{64}\pi$

11. Are your answers to Exercises 9 and 10 the same? Yes

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SECTION 7B Ready to Go On? Quiz

7-5 Polynomials

Write each polynomial in standard form and give the leading coefficient.

1. $7x^2 + 4x^5 - 2r$ — $4x^5 + 7x^2 - 2r$; 4
2. $y^3 + 3 - 8y^2 + 4y$ — $y^3 - 8y^2 + 4y + 3$; 1
3. $-8w^4 - 3w + w^5$ — $w^5 - 8w^4 - 3w$; 1
4. $3 + y + 5y^2$ — $5y^2 + y + 3$; 5
5. $9 + 4x^4$ — $4x^4 + 9$; 4
6. $-2a^2 + 9 + a^8 + 2a$ — $a^8 - 2a^2 + 2a + 9$; 1

Classify each polynomial according to its degree and number of terms.

7. $3a^2 + 4a - a^4 + 3a^3$ — Quartic polynomial
8. $4x^2 + 8 - 3x$ — Quadratic trinomial
9. $3x^3 + 5x^2 - 1$ — Cubic trinomial
10. $7 - 5b^4 + 2b + 5b^2$ — Quartic polynomial
11. $7w^2$ — Quadratic monomial
12. $3a^4 - 6a^8 + 2a + 9$ — 8th degree polynomial

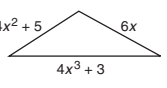
13. The function $P(x) = x^3 - 3x^2 + 12$ gives the profit on a product. What is the profit on 800 units? $510,080,012

7-6 Adding and Subtracting Polynomials

Add or subtract.

14. $(12x^4 + 5x^3) + (6x^3 + 7x)$ — $12x^4 + 11x^3 + 7x$
15. $(4x^2 - 3) + (10x^2 + 5x - 7)$ — $14x^2 + 5x - 10$
16. $(13d^6 - 4d^2) + (3d^4 + 2)$ — $13d^6 + 3d^4 - 4d^2 + 2$
17. $(7y^3 + 5y^2) - (3y^2 + 4y)$ — $7y^3 + 2y^2 - 4y$
18. $(8w^2 - 4w) - (6w^2 + 6w)$ — $2w^2 - 10w$
19. $(a^2 - 11) - (-6a^3 + 3a)$ — $6a^3 + a^2 - 3a - 11$

20. The measures of the sides of a triangle are shown as polynomials. Write a simplified polynomial to represent the perimeter of the triangle. $4x^3 + 4x^2 + 6x + 8$



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SECTION 7B Ready to Go On? Quiz continued

7-7 Multiplying Polynomials

Multiply.

21. $4h^3 \cdot 6h^6$

$24h^9$

22. $(x^9y^5)(-7x^2y^4)$

$-7x^{11}y^9$

23. $3mn(6m^2 + 4m^3n)$

$18m^3n + 12m^4n^2$

24. $(4w + 3)^2$

$16w^2 + 24w + 9$

25. $(3x^3 + 2y)(5x + y)$

$15x^4 + 3x^3y + 10xy + 2y^2$

26. $(a^2 + 4)(3a^2 - 4a - 7)$

$3a^4 - 4a^3 + 5a^2 - 16a - 28$

27. Write a simplified polynomial expression for the area of a rectangle whose length is $x + 8$ units and whose width is $x - 5$ units.

$(x^2 + 3x - 40)$ square units

7-8 Special Products of Binomials

Multiply.

28. $(x + 8)^2$

$x^2 + 16x + 64$

29. $(2x + 3)^2$

$4x^2 + 12x + 9$

30. $(3x + 7y)^2$

$9x^2 + 42xy + 49y^2$

31. $(a - 5)^2$

$a^2 - 10a + 25$

32. $(x - y)^2$

$x^2 - 2xy + y^2$

33. $(4x - 3)^2$

$16x^2 - 24x + 9$

34. $(x - 3)(x + 3)$

$x^2 - 9$

35. $(6x - 7)(6x + 7)$

$36x^2 - 49$

36. A swimming pool has a radius of $x - 4$ inches. Write a polynomial that represents the area of the swimming pool. (The formula for the area of a circle is $A = \pi r^2$, where r represents the radius of the circle.) Leave the symbol π in your answer.

$(\pi x^2 - 8\pi x + 16\pi)$ in.^{2}

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SECTION 7B Ready to Go On? Enrichment

Pascal's Triangle

Pascal's Triangle is a geometric arrangement of numbers. These numbers represent the binomial coefficients. That is, they represent the coefficients of the terms of the expansion of $(x + y)^n$. The first seven rows of Pascal's Triangle look like this.

Row 0: 1
Row 1: 1 1
Row 2: 1 2 1
Row 3: 1 3 3 1
Row 4: 1 4 6 4 1
Row 5: 1 5 10 10 5 1
Row 6: 1 6 15 20 15 6 1

Notice that each number is the sum of the two numbers above it.

For example what two numbers were added to get 10 in the 5th row? 4 and 6

What are the numbers for the 7th row? 1, 7, 21, 35, 35, 21, 7, 1

As an example, find $(x + y)^3$.

Look at row 3, what are the coefficients of the expansion? 1, 3, 3, 1

The first term of the expansion starts with the highest power of x, namely x^3, and the lowest power of y, namely $y^0 = 1$. The power of x increases by 1 for each successive term and the power of y increases by 1 for each successive term.

$(x + y)^3 = \underbrace{1 \cdot x^3 \cdot y^0}_{x^3} + \underbrace{3 \cdot x^2 \cdot y^1}_{3x^2y} + \underbrace{3 \cdot x^1 \cdot y^2}_{3xy^2} + \underbrace{1 \cdot x^0 \cdot y^3}_{y^3}$

$= x^3 + 3x^2y + 3xy^2 + y^3$

Expand each of the following polynomials.

1. $(x + y)^4$

$x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4$

2. $(x + 1)^5$

$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$

3. $(x + 3)^4$

$x^4 + 12x^3 + 54x^2 + 108x + 81$

4. $(x + 2)^3$

$x^3 + 6x^2 + 12x + 8$

5. $(x + 1)^9$

$x^9 + 9x^8 + 36x^7 + 84x^6 + 126x^5 + 126x^4 + 84x^3 + 36x^2 + 9x + 1$

6. $(x + 2y)^5$

$x^5 + 10x^4y + 40x^3y^3 + 80x^2y^3 + 80xy^4 + 32y^5$

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SECTION 8A Ready To Go On? Skills Intervention

8-1 Factors and Greatest Common Factors

Find these vocabulary words in Lesson 8-1 and the Multilingual Glossary.

Vocabulary	
prime factorization	greatest common factor

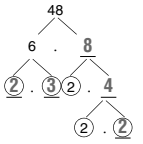
Writing Prime Factorizations

Write the prime factorization of 48.

What is a prime number? A number with only two factors, itself and 1.

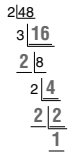
Method 1 Factor tree

Choose any two factors of 48 to begin. Keep finding factors until each branch ends in a prime factor. Circle the prime factors.



Method 2 Ladder diagram

Choose a prime factor of 48 to begin. Keep dividing by prime factors until the quotient is 1.



The prime factorization of 48 is $2 \cdot 2 \cdot \underline{2} \cdot \underline{2} \cdot \underline{3}$ or $2^{\underline{4}} \cdot \underline{3}$.

Finding the GCF of Monomials

Find the GCF of each pair of monomials.

A. $9a^3$ and $3a$

$9a^3 = 3 \cdot \underline{3} \cdot a \cdot \underline{a} \cdot \underline{a}$ Write the prime factorization of each coefficient and write the powers as products.

$3a = 3 \cdot \underline{a}$ Align the common factors.

What are the factors common to both monomials? 3 and $\underline{a}$

Multiply the common factors. The GCF of $9a^3$ and $3a$ is $\underline{3a}$.

B. $24x^3$, $30x^5$

$24x^3 = 2 \cdot 2 \cdot \underline{2} \cdot \underline{3} \cdot x \cdot \underline{x} \cdot \underline{x}$ Write the prime factorization of each coefficient and write the powers as products.

$30x^5 = 2 \cdot \underline{3} \cdot \underline{5} \cdot x \cdot x \cdot \underline{x} \cdot \underline{x} \cdot \underline{x}$ Align the common factors.

What are the factors common to both monomials? 2, $\underline{3}$ and $\underline{x^3}$

Multiply the common factors. The GCF is $\underline{6x^3}$.

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SECTION 8A Ready To Go On? Problem Solving Intervention

8-1 Factors and Greatest Common Factors

Factors that are shared by two or more numbers are called common factors. The largest common factor is called the GCF, or greatest common factor.

A softball league bought new equipment for the teams. The league bought 40 balls and 24 bats. How many teams are there if all the equipment is distributed evenly between the teams? How many bats and balls does each team receive?

Understand the Problem

1. How many bats and balls were purchased? 24 bats and 40 balls

2. How is the equipment divided? Evenly between the teams

3. What are you being asked to find? How many teams there are and how many bats and balls each team receives.

Make a Plan

4. If the equipment is to be divided evenly between teams then 40 and 24 must be divisible by the same number.

5. What are the factors of 24: 1, 2, 3, 4, 6, 8, 12, 24

40: 1, 2, 4, 5, 8, 10, 20, 40

Solve

6. Which factors are common to 24 and 40? 1, 2, 4, 8

7. What is the largest common factor? 8

8. So, there are 8 softball teams.

9. Since there are 40 balls and 8 teams, how many balls does each team receive? 5

10. Since there are 24 bats and 8 teams, how many bats does each team receive? 3

Look Back

11. How many balls does each team receive? 5 How many teams are there? 8

What is the product of number of teams and number of balls? 40

12. How many bats does each team receive? 3 How many teams are there? 8

What is the product of number of teams and numbers of bats? 24

13. Do your answers to Exercises 11 and 12 match the information in the problem statement? Yes

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