Chapter 5 Notes

Thursday, December 14, 2023 2:47 PM

5.1 The Product Rule and Power Rules for Exponents

Base	Exponent/Power
$x^3 = x \cdot x \cdot x$ (base, exponent)	$2^4 = 2 \cdot 2 \cdot 2 \cdot 2 = 16$ (base, exp)

EXAMPLE 1 Using Exponents

Write $3 \cdot 3 \cdot 3 \cdot 3$ in exponential form and evaluate.

$3^4 = 81$ $2 \wedge 4 = 16$

EXAMPLE 2 Evaluating Exponential Expressions

Evaluate. Name the base and the exponent.

(a) $5^4 = 5 \cdot 5 \cdot 5 \cdot 5 = 625$; b = 5, e = 4

(b) $-5^4 = -625$; b = 5, e = 4

(c) $(-5)^4 = (-5)(-5)(-5)(-5) = 625$; b = -5, e = 4

(d) $(-5)^3 = (-5)(-5)(-5) = -125$; b = -5, e = 3

(e) $-(-5)^3 = -(-125) = 125$; b = -5, e = 3

Product rule for exponents

Same base raised to a power multiplied, then add the exponents: $x^3 \cdot x^4 = x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x = x^{3+4} = x^7$

EXAMPLE 3 Using the Product Rule

Use the product rule for exponents to find each product if possible.

(a) $6^3 \cdot 6^5$ — $6^8 = 1{,}679{,}616$

(b) $(-4)^7(-4)^2$ — $(-4)^9 = -262{,}144$

(c) $x^2 \cdot x^1$ — $x \cdot x \cdot x = x^3$

(d) $m^4m^3m^5$ — $m^{7+5} = m^{12}$

(e) $2^3 \cdot 3^2$ — $2 \cdot 2 \cdot 2$; $8 \cdot 9 = 72$

(f) $2^3 + 2^4$ — $2 \cdot 2 \cdot 2 + 2 \cdot 2 \cdot 2 \cdot 2$; $8 + 16 = 24$

(g) $(2x^3)(3x^7)$ — $2 \cdot x \cdot x \cdot x \cdot 3 \cdot x x x x x x x = 6x^{10}$

(h) $(m+n)^2(m+n)^3$ — $(m+n)^5$

$(n^4)(n^4)(n^4) = n^{12}$ $(xy)^3 = xy \cdot xy \cdot xy = x^3y^3$

Power rules for exponents

a) $(n^4)^3$; $(n^a)^b = n^{a \cdot b}$

b) $(mn)^a = m^a n^a$

c) $\left(\frac{m}{n}\right)^a = \frac{m^a}{n^a}$; $\left(\frac{m}{n}\right)^3 = \left(\frac{m}{n}\right)\left(\frac{m}{n}\right)\left(\frac{m}{n}\right) = \frac{m^3}{n^3}$

Example 4: Use the Power Rules for exponents to simplify each expression.

a) $(2^5)^3$ — 2^{15}

b) $(5^7)^2$ — 5^{14}

c) $(x^2)^5$ — x^{10}

d) $(3xy)^2$ — $3^2x^2y^2 = 9x^2y^2$

e) $5(4pq)^2$ — $5 \cdot (4^2p^2q^2) = 5 \cdot 16p^2q^2 = 80p^2q^2$

f) $3(2m^2p^3)^4$ — $3 \cdot 16$; $48m^8p^{12}$

g) $(-5^6)^3$ — $(-5^6)(-5^6)(-5^6) = -5^{18}$

h) $\left(\frac{2}{3}\right)^5$ — $\frac{2^5}{3^5}$

i) $\left(\frac{m}{n}\right)^3$ — $\frac{m^3}{n^3}$

-5^{10} $\quad$ 3^5 $\quad$ $\frac{m^3}{h^3}$

j) $\left(\frac{1}{5}\right)^4$

$\frac{1^4}{5^4} = \frac{1}{625}$

Example 5: Simplify by using a combination of rules.

(a) $\left(\frac{2}{3}\right)^2 \cdot 2^3$

$\frac{2^2}{3^2} = \frac{4}{9} \cdot \frac{8}{1} = \frac{32}{9}$

(b) $(5x)^3 \cdot (5x)^4$

$5^3x^3 \cdot 5^4x^4$

$5^7x^7 = 78125x^7$

(c) $(2x^2y^3)^4(3xy^2)^3$ $\quad (y^2)(y^2)(y^2)$

$2^4x^8y^{12} \cdot 3^3x^3y^6$

$2^4 \cdot 3^3x^{11}y^{18} = 16 \cdot 27x^{11}y^{18}$

$432x^{11}y^{18}$

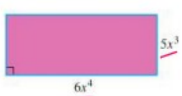
(d) $(-x^3y)^2(-x^5y^4)^3$

$(-1)^2x^6y^2 \cdot (-1)^3x^{15}y^{12}$

$+x^6y^2 \cdot (-1)x^{15}y^{12} = -x^{21}y^{14}$

Example 6: Using Area Formulas. Find an expression that represents the area in each figure.

a)

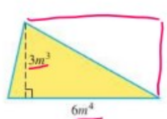


$A = lw$

$A = (6x^4)(5x^3)$

$= 30x^7$

b)



$A = \frac{1}{2}bh = \frac{1}{2}(6m^4)(3m^3)$ $\quad$ 18

$9m^7$

5.2 Integer Exponents and the Quotient Rules

OBJECTIVES

1. Use 0 as an exponent.
2. Use negative numbers as exponents.
3. Use the quotient rule for exponents.
4. Use combinations of rules.

Zero exponent: Anything raised to 0 power = 1

$(3x^2y^4)^0 = 1$

EXAMPLE 1 Using Zero Exponents

Evaluate.

(a) $60^0 = 1$

(b) $(-60)^0 = 1$

(c) $-60^0 = -1$

(d) $y^0 = 1$

(e) $6y^0 = 6 \cdot 1 = 6$

(f) $(6y)^0 = 1$

(g) $8^0 + 11^0$

$1 + 1 = 2$

(h) $-8^0 - 11^0$

$-1 - 1 = -2$

Negative exponents

They cause the base to move to the

$1+1=2$ $-1-1=-2$

Negative exponents

They cause the base to move to the opposite side of a fraction, keep the exponent, but make it positive

$5^{-1}=\frac{1}{5^1}$ $\frac{1}{5^{-2}}=5^2$

EXAMPLE 2 Using Negative Exponents

Simplify by writing with positive exponents. Assume that all variables represent nonzero real numbers.

(a) $3^{-2}=\frac{1}{3^2}$ (b) $5^{-3}=\frac{1}{5^3}$ (c) $\left(\frac{1}{2}\right)^{-3}=\left(\frac{2}{1}\right)^3=2^3$ (d) $\left(\frac{2}{5}\right)^{-4}=\left(\frac{5}{2}\right)^4=\frac{5^4}{2^4}$

(e) $\left(\frac{4}{3}\right)^{-5}$ $\left(\frac{3}{4}\right)^5=\frac{3^5}{4^5}$ (f) $4^{-1}-2^{-1}$ $\frac{1}{4}-\frac{1}{2}$ (g) p^{-2} $\frac{1}{p^2}$ (h) $\frac{1}{x^{-4}}$ $\frac{x^4}{1}=x^4$ (i) x^3y^{-4} $\frac{x^3}{y^4}$

Changing from Negative to Positive Exponents

For any nonzero numbers a and b and any integers m and n, the following are true.

$$\frac{a^{-m}}{b^{-n}}=\frac{b^n}{a^m} \quad \text{and} \quad \left(\frac{a}{b}\right)^{-m}=\left(\frac{b}{a}\right)^m$$

Examples: $\frac{3^{-5}}{2^{-4}}=\frac{2^4}{3^5}$ and $\left(\frac{4}{5}\right)^{-3}=\left(\frac{5}{4}\right)^3$

EXAMPLE 3 Changing from Negative to Positive Exponents

Simplify by writing with positive exponents. Assume that all variables represent nonzero real numbers.

(a) $\frac{4^{-2}}{5^{-3}}$ $\frac{5^3}{4^2}$ (b) $\frac{m^{-5}}{p^{-1}}$ $\frac{p}{m^5}$

(c) $\frac{a^{-2}b}{3d^{-3}}$ $\frac{bd^3}{a^2\cdot 3}=\frac{bd^3}{3a^2}$ (d) $\left(\frac{x}{2y}\right)^{-4}$ $\left(\frac{2y}{x}\right)^4=\frac{2^4y^4}{x^4}=\frac{16y^4}{x^4}$

Quotient rule for exponents

If there's the same base, you subtract the exponent in denominator from the exponent in the numerator

top - bottom

$\frac{x^5}{x^3}=x^{5-3}=x^2$

$\frac{x\cdot x\cdot x\cdot x\cdot x}{x\cdot x\cdot x}=x^2$ $\frac{x^3}{x^3}=\frac{x\cdot x\cdot x}{x\cdot x\cdot x}=1$ $x^0=$

EXAMPLE 4 Using the Quotient Rule

Simplify by writing with positive exponents. Assume that all variables represent nonzero real numbers.

(a) $\frac{5^8}{5^6}=\frac{5\cdot5\cdot5\cdot5\cdot5\cdot5\cdot5\cdot5}{5\cdot5\cdot5\cdot5\cdot5\cdot5}=5^2$ $5^{8-6}=5^2=25$ (b) $\frac{4^2}{4^9}=4^{-7}=\frac{1}{4^7}$

$5^{8-6} = 5^2 = 25$

(c) $\dfrac{5^{-3}}{5^{-7}}$ → $\dfrac{5^7}{5^3} = 5^{7-3} = \boxed{5^4}$; $5^{-3-(-7)} = 5^4$

(d) $\dfrac{q^5}{q^{-3}} = \boxed{q^8}$; $q^{5-(-3)}$; $q^5 \cdot q^3$

(e) $\dfrac{3^2x^5}{3^4x^3}$ $3^{2-4} = 3^{-2}$; $x^{5-3} = x^2$; $\dfrac{x^2}{3^2}$

(f) $\dfrac{(m+n)^{-2}}{(m+n)^{-4}}$ $\boxed{(m+n)^2}$; $\dfrac{(m+n)^4}{(m+n)^2} =$ $m+n^2$

(g) $\left(\dfrac{7x^{-3}y^2}{2^{-1}x^2y^{-5}}\right)$ $= \dfrac{2 \cdot 7y^2y^5}{x^3 \cdot x^2} = \boxed{\dfrac{14y^7}{x^5}}$

EXAMPLE 5 Using Combinations of Rules

Simplify. Assume that all variables represent nonzero real numbers.

(a) $\dfrac{(4^2)^3}{4^5} = \dfrac{4^6}{4^5}$ $(4^2)(4^2)(4^2)$; $4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$; $4^{6-5} = 4^1 = \boxed{4}$

(b) $(2x)^3(2x)^2 = (2x)^5 = 2^5x^5 = \boxed{32x^5}$

(c) $\left(\dfrac{2x^3}{5}\right)^{-4} = \left(\dfrac{5}{2x^3}\right)^4 = \dfrac{5^4}{2^4x^{12}} = \boxed{\dfrac{625}{16x^{12}}}$

(d) $\left(\dfrac{3x^{-2}}{4^{-1}y^3}\right)^{-3}$ $\left(\dfrac{4^{-1}y^3}{3x^{-2}}\right)^3 = \dfrac{4^{-3}y^9}{3^3x^{-6}} = \dfrac{y^9x^6}{4^3 \cdot 3^3} = \boxed{\dfrac{x^6y^9}{1728}}$

(e) $\dfrac{(4m)^{-3}}{(3m)^{-4}}$ → $\dfrac{(3m)^4}{(4m)^3} = \dfrac{3^4m^4}{4^3m^3} = \dfrac{3 \cdot 3 \cdot 3 \cdot 3}{4 \cdot 4 \cdot 4}\dfrac{m^4}{m^3}$; $\dfrac{3 \cdot 3 \cdot 3 \cdot 3 \cdot m}{4 \cdot 4 \cdot 4} = \boxed{\dfrac{81m}{64}}$

$6^{-1} + 4^{-1}$

$\dfrac{4 \cdot 1}{4 \cdot 6} + \dfrac{1 \cdot 6}{4 \cdot 6}$

$\dfrac{4}{24} + \dfrac{6}{24} = \dfrac{10 \div 2}{24 \div 2} \boxed{\dfrac{5}{12}}$

5.3 An Application of Exponents: Scientific Notation

how many

5.3 An Application of Exponents: Scientific Notation

OBJECTIVES

1. Express numbers in scientific notation.
2. Convert numbers in scientific notation to numbers without exponents.
3. Use scientific notation in calculations.

Scientific Notation
5 × 10^8 ← how many times to move the decimal; 5.2 × 10^6 (↑ number between 0-10; ↑ decimal between 1st + 2nd digit)

5 × 10 = 50
5×10×10 = 500
5 × 10×10×10 = 5000

5,00000000.

5.200000.

EXAMPLE 1 Using Scientific Notation

Write each number in scientific notation.

(a) 93,000,000   9.3 × 10^7

(b) 63,200,000,000   6.32 × 10^10

(c) 0.00462   4.62 × 10^-3

(d) −0.0000762   −7.62 × 10^-5

EXAMPLE 2 Writing Numbers without Exponents

Write each number without exponents.

(a) 6.2×10^3 6,2,0,0. = 6,200

(b) 4.283×10^6 4.283 × 10^6 = 4283000

(c) 7.04×10^{-3} .0.0,7.04   .00704

EXAMPLE 3 Multiplying and Dividing with Scientific Notation

Perform each calculation.

(a) $(7 \times 10^3)(5 \times 10^4)$

35×10^7 350000000

3.5×10^8

(b) $\frac{4 \times 10^{-5}}{2 \times 10^3}$ $= 2 \times 10^{-8}$

(c) $(3 \times 10^4)(8 \times 10^7)$ $= 24 \times 10^{11}$

2.4×10^{12}

(d) $\frac{6 \times 10^{-2}}{2 \times 10^8}$

3×10^{-10}

3.937×10^{-8}

$700,000 = 7 \times 10^5$

0.027559×10^{-3}

0.027559×10^{-2}

2.7559×10^{-2}

EXAMPLE 4 Using Scientific Notation to Solve an Application

A *nanometer* is a very small unit of measure that is equivalent to about 0.00000003937 in. About how much would 700,000 nanometers measure in inches? (*Source: World Almanac and Book of Facts*.)

EXAMPLE 5 Using Scientific Notation to Solve an Application

In 2008, the national debt was \$1.0025 × 10^{13} (which is more than \$10 trillion). The population of the United States was approximately 304 million that year. About how much would each person have had to contribute in order to pay off the national debt? (*Source*: Bureau of Public Land; U.S. Census Bureau.)

$\frac{1.0025 \times 10^{13}}{3.04 \times 10^8}$

304,000,000

3.04×10^8

$.329 \times 10^5$ .32900

329×10^5 $\quad .32900$

3.29×10^4

3

5.4 Adding and Subtracting Polynomials; ~~Graphing Simple Polynomials~~

OBJECTIVES

1. Identify terms and coefficients.
2. Add like terms.
3. Know the vocabulary for polynomials.
4. Evaluate polynomials.
5. Add and subtract polynomials.
6. ~~Graph equations defined by polynomials of degree 2.~~

Terms	Numerical coefficient
pieces of an expression – separated by a + or – ; all the things that are multiplied ($4x^2y$ +)	$4x^2y$ ↑ number in front

EXAMPLE 1 Identifying Coefficients

Name the coefficient of each term in these expressions.

(a) $x - 6x^4$ → 1, −6

(b) $5 - v^3$ → 5, −1

Like terms – same variable raised to same power

EXAMPLE 2 Adding Like Terms

Simplify by adding like terms.

(a) $-4x^3 + 6x^3$ → $2x^3$

(b) $9x^6 - 14x^6 + x^6$ → $-4x^6$

(c) $12m^2 + 5m + 4m^2$

Combine = add

$16m^2 + 5m$

(d) $3x^2y + 4x^2y - x^2y$ → $6x^2y$

Standard form
write the biggest exponent first $x^3 + 2x^2 - 3x + 2$

Degree of a term
x^2 – exponent of the term ← 2

Degree of a polynomial
The biggest exponent; 3rd degree – x^3

Monomial
1 term

Binomial
2 terms
$x - 2$

Trinomial
3 terms
$x^2 + 3x - 2$

Term	Degree	Polynomial	Degree
$3x^4$	4	$3x^4 - 5x^2 + 6$	4
$5x$, or $5x^1$	1	$5x + 7$	1
-7, or $-7x^0$	0	$x^2y + xy - 5y^2$	3
$2x^2y$, or $2x^2y^1$	3	$x^5 + 3x^6$	6

EXAMPLE 3 Classifying Polynomials

For each polynomial, first simplify, if possible. Then give the degree and tell whether the polynomial is a *monomial,* a *binomial,* a *trinomial,* or *none of these.*

(a) $2x^3 + 5$ → binomial

(b) $4xy - 5xy + 2xy$ → $1xy$

the polynomial is a *monomial*, a *binomial*, a *trinomial*, or *none of these*.

(a) $2x^3 + 5$ **(b)** $4xy - 5xy + 2xy$

binomial
degree 3

1xy
xy degree 2

EXAMPLE 4 Evaluating a Polynomial

Find the value of $3x^4 + 5x^3 - 4x - 4$ for **(a)** $x = -2$ and **(b)** $x = 3$.

$3(-2)^4 + 5(-2)^3 - 4(-2) - 4$
$3(16) + 5(-8) + 8 - 4$
$48 - 40 + 8 - 4$
$8 + 8$
$16 - 4$
12

$3(3)^4 + 5(3)^3 - 4(3) - 4$
$243 +$ -12 -4
362
365
65

Adding polynomials

Add any like terms
arrange in standard form

EXAMPLE 5 Adding Polynomials Vertically

(*a*) *Add*: $(6x^3 - 4x^2 + 3) + (-2x^3 + 7x^2 - 5)$.

$-2x^3 + 7x^2 - 5$

$4x^3 + 3x^2 - 2$

EXAMPLE 6 Adding Polynomials Horizontally

(*a*) *Add*: $(6x^3 - 4x^2 + 3) + (-2x^3 + 7x^2 - 5)$

$4x^3 + 3x^2 - 2$

Subtracting polynomials Turn it into addition by distributing the negative (change all the signs after the subtract)

EXAMPLE 7 Subtracting Polynomials Horizontally

(a) Perform the subtraction $(5x - 2) - (3x - 8)$.

$-3x + 8$
$2x + 6$

(*b*) *Subtract*: $(6x^3 - 4x^2 + 2) - (11x^3 + 2x^2 - 8)$.

$-5x^3 - 6x^2 + 10$

EXAMPLE 8 Subtracting Polynomials Vertically

Subtract by columns to find

$(14y^3 - 6y^2 + 2y - 5) - (2y^3 - 7y^2 - 4y + 6)$.

$+(-2y^3 + 7y^2 + 4y - 6)$

$12y^3 + y^2 + 6y - 11$

EXAMPLE 9 Adding and Subtracting Polynomials with More Than One Variable

Add or subtract as indicated.

(a) $(4a + 2ab - b) + (3a - ab + b)$

EXAMPLE 3 Adding and Subtracting Polynomials with More Than One Variable

Add or subtract as indicated.

(a) $(4a + 2ab - b) + (3a - ab + b)$

$7a + ab$

(b) $(2x^2y + 3xy + y^2) + (3x^2y + xy + 2y^2)$

$5x^2y + 4xy + 3y^2$

(c) $(8a^3 - 2a^2 + 3) + (-2a^3 + 6a - 2)$.

$6a^3 - 2a^2 + 6a + 1$

5.5 Multiplying Polynomials

OBJECTIVES

1. Multiply a monomial and a polynomial.
2. Multiply two polynomials.
3. Multiply binomials by the FOIL method.

EXAMPLE 1 Multiplying Monomials and Polynomials

Find each product.

(a) $4x^2(3x + 5)$

$12x^3 + 20x^2$

(b) $-8m^3(4m^3 + 3m^2 + 2m - 1)$

$-32m^6 - 24m^5 - 16m^4 + 8m^3$

$3x^3(2x^2 + 4x + 1)$

$6x^5 + 12x^4 + 3x^3$

EXAMPLE 2 Multiplying Two Polynomials

a) Multiply $(m^2 + 5)(4m^3 - 2m^2 + 4m)$.

	$4m^3$	$-2m^2$	$+4m$
m^2	$4m^5$	$-2m^4$	$+4m^3$
$+5$	$+20m^3$	$-10m^2$	$20m$

$4m^5 - 2m^4 + 24m^3 - 10m^2 + 20m$

b) Multiply $(x^3 + 2x^2 + 4x + 1)(3x + 5)$.

$(3x + 5)(x^3 + 2x^2 + 4x + 1)$

$3x^4 + 6x^3 + 12x^2 + 3x$

$+ 5x^3 + 10x^2 + 20x + 5$

$3x^4 + 11x^3 + 22x^2 + 23x + 5$

$(2x - 3)(4x^2 + 2x - 5)$

$4x^2 - 10x$

$-12x^2 - 6x$

$8x^3 - 8x^2 - 16x + 15$

EXAMPLE 4 Multiplying Polynomials with Fractional Coefficients

Find the product of $4m^3 - 2m^2 + 4m$ and $\frac{1}{2}m^2 + \frac{5}{2}$.

$\left(\frac{1}{2}m^2 + \frac{5}{2}\right)(4m^3 - 2m^2 + 4m)$

EXAMPLE 4 Multiplying Polynomials with Fractional Coefficients

Find the product of $4m^3 - 2m^2 + 4m$ and $\frac{1}{2}m^2 + \frac{5}{2}$.

$\left(\frac{1}{2}m^2+\frac{5}{2}\right)(4m^3-2m^2+4m)$

$2m^5 - 1m^4 + 2m^3$

$+10m^3 - 5m^2 + 10m$

$2m^5 - m^4 + 12m^3 - 5m^2 + 10m$

FOIL When multiplying 2 binomials

F - first terms

O - outer

I - inner

L - last

$(x+2)(x-3)$

EXAMPLE 5 Using the FOIL Method

Use the FOIL method to find the product $(x + 8)(x - 6)$.

$x^2 - 6x + 8x - 48$

$x^2 + 2x - 48$

EXAMPLE 6 Using the FOIL Method

Multiply $(9x - 2)(3y + 1)$.

$27xy + 9x - 6y - 2$

EXAMPLE 7 Using the FOIL Method

Find each product.

(a) $(2k + 5y)(k + 3y)$

$2k^2 + 11ky + 15y^2$

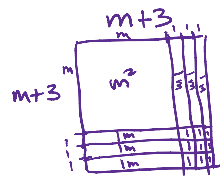
(c) $2x^2(x - 3)(3x + 4)$

$2x^2(3x^2 + 4x - 9x - 12)$

$2x^2(3x^2 - 5x - 12)$

$6x^4 - 10x^3 - 24x^2$

5.6 Special Products



OBJECTIVES

1. Square binomials.
2. Find the product of the sum and difference of two terms.
3. Find greater powers of binomials.

CAUTION: $(m+3)^2 \neq m^2+9$

$(3m)^2 = 3^2m^2 = 9m^2$

EXAMPLE 1 Squaring a Binomial

Find $(m+3)(m+3)$

$m^2+3m+3m+9$

m^2+6m+9

EXAMPLE 2 Squaring Binomials

Find each binomial square and simplify.

(a) $(5z-1)(5z-1)$

$25z^2-5z-5z+1$

$25z^2-10z+1$

(b) $(3b+5r)(3b+5r)$

$9b^2+15br+15br+25r^2$

$9b^2+30br+25r^2$

(c) $(2a-9x)(2a-9x)$

$4a^2-18ax-18ax+81x^2$

$4a^2-36ax+81x^2$

(d) $\left(4m+\frac{1}{2}\right)\left(4m+\frac{1}{2}\right)$

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

$16m^2+2m+2m+\frac{1}{4}$

$16m^2+4m+\frac{1}{4}$

(e) $x(4x-3)(4x-3)$

$x(16x^2-12x-12x+9)$

$x(16x^2-24x+9)$

$16x^3-24x^2+9x$

Conjugates: Binomials with same terms but different signs

$(x+5)(x-5)$ $(6x+7)(6x-7)$

Example 3: Find the product of each set of conjugates.

(a) $(x+4)(x-4)$

$x^2-4x+4x-16$

x^2-16 $\quad x^2+16$

(b) $(x+10)(x-10)$

$x^2-10x+10x-100$

x^2-100

(c) $(x-5)(x+5)$

x^2-25

(d) $\left(\frac{2}{3}-w\right)\left(\frac{2}{3}+w\right)$ $+\frac{2}{3}w-\frac{2}{3}w$

$\frac{2}{3}\cdot\frac{2}{3}=\frac{4}{9}$

$\frac{4}{9}-w^2$

(e) $(5m-3)(5m+3)$

$25m^2-9$

(f) $(4x-6y)(4x+6y)$

$16x^2+24xy-24xy-36y^2$

$16x^2-36y^2$

(g) $\left(z-\frac{1}{4}\right)\left(z+\frac{1}{4}\right)$

$z^2-\frac{1}{16}$

$z^2 - \frac{1}{16}$

EXAMPLE 5 Finding Greater Powers of Binomials

Find each product.

(a) $(x+5)^3$ $(x+5)(x+5)$

$(x+5)(x^2+5x+5x+25)$

$(x+5)(x^2+10x+25)$

x^3+10x^2+25x
$+5x^2+50x+125$

$x^3+15x^2+75x+125$

(c) $-2r(r+2)^3$ $(r+2)(r+2)$

$-2r(r+2)(r^2+4r+4)$

$-2r(r^3+4r^2+4r$
$+2r^2+8r+8)$

$-2r(r^3+6r^2+12r+8)$

$-2r^4-12r^3-24r^2-16r$

5.7 Dividing Polynomials Day 1

OBJECTIVES

1. Divide a polynomial by a monomial.
2. Divide a polynomial by a polynomial.

EXAMPLE 1 Dividing a Polynomial by a Monomial

Divide $5m^5 - 10m^3$ by $5m^2$.

EXAMPLE 2 Dividing a Polynomial by a Monomial

Divide.

$$\frac{16a^5 - 12a^4 + 8a^2}{4a^3}$$

EXAMPLE 3 Dividing a Polynomial by a Monomial with a Negative Coefficient

Divide $-7x^3 + 12x^4 - 4x$ by $-4x$.

EXAMPLE 4 Dividing a Polynomial by a Monomial

Divide $180x^4y^{10} - 150x^3y^8 + 120x^2y^6 - 90xy^4 + 100y$ by $30xy^2$.

Stop here and do Ch 6 next. Do long and synthetic division after Ch 6?

5.7 Day 2: Dividing Polynomials

Synthetic Division:

Recall: Use long division to find $853 \div 6$.

Long Division with Polynomials:

EXAMPLE 6 Dividing a Polynomial by a Polynomial

(a) Divide by using long division: $\frac{3x^2-5x-28}{x-4}$

b) Divide by using long division: $\frac{6k^3 - 20k - k^2 + 1}{2k - 3}$

c) Divide by using long division: $\frac{4a^2 - 22a + 32}{2a + 3}$

EXAMPLE 5 Dividing a Polynomial by a Polynomial

a) Divide. $\dfrac{3x^2 - 5x - 28}{x - 4}$

b) $\dfrac{4x^2 + x - 18}{x - 2}$

c) $\dfrac{2y^2 + 9y - 35}{y + 7}$

EXAMPLE 7 Dividing into a Polynomial with Missing Terms

a) Divide $x^3 - 1$ by $x - 1$.

b) Divide $m^3 - 1000$ by $m - 10$.

EXAMPLE 8 Dividing by a Polynomial with Missing Terms

a) Divide $x^4 + 2x^3 + 2x^2 - x - 1$ by $x^2 + 1$.

b) Divide $y^4 - 5y^3 + 6y^2 + y - 4$ by $y^2 + 2$