Mini-Lecture 5.1
Exponents and Scientific Notation

Learning Objectives:

1. Use the product rule for exponents.
2. Evaluate expressions raised to the zero power.
3. Use the quotient rule for exponents.
4. Evaluate expressions raised to the negative nth power.
5. Convert between scientific notation and standard notation.
6. Key vocabulary: *exponential expressions, scientific notation*.

Examples:

1. Use the product rule to simplify each expression.

   a) $2^3 \cdot 2^4$ b) $m \cdot m^9 \cdot m^7$ c) $(-6xy)(6y)$ d) $(-3a^3b^2)(-5a^3b)$

2. Evaluate or simplify each expression.

   a) 2^0 b) -5^0 c) $(-10)^0$ d) $(2x+1)^0$

3. Use the quotient rule to simplify each expression.

   a) $\dfrac{x^8}{x^3}$ b) $-\dfrac{10y^{11}}{2y^7}$ c) $\dfrac{15x^6y^5}{9xy^3}$ d) $\dfrac{36a^2b^3c^{12}}{-4abc^9}$

4. Simplify and write using positive exponents only.

   a) 2^{-4} b) $(-3)^{-2}$ c) $\dfrac{y^{-3}}{y^6}$ d) $2a^{-3}$

   e) $\dfrac{x^{-5}x^4}{x^{-2}}$ f) $\dfrac{12ab^{-3}}{4a^{-3}b^3}$ g) $\dfrac{20x^{-8}yz^{-13}}{2xyz}$ h) $(3a^3b)(-2a^{-4}b^{-2})$

5. Write each number in scientific notation or in standard notation.

   a) 645,000 b) 0.005621 c) 3.6×10^{-4} d) 9.5×10^5

Teaching Notes:

- Students need a lot of repetition and practice in order to master these objectives.
- Students often move constants along with a variable that has a negative exponent. For example, in 4d) a common answer is $2a^{-3} = 1/(2a^3)$.
- Refer students to the exponent rule charts and the ***Writing a Number in Scientific Notation*** chart in the text.

Answers: 1a) 128, b) m^{17}, c) $-36xy^2$, d) $15a^6b^3$, 2a) 1, b) -1, c) 1, d) 1; 3a) x^5, b) $-5y^4$, c) $\dfrac{5x^5y^2}{3}$, d) $-9ab^2c^3$; 4a) $\dfrac{1}{16}$,

b) $\dfrac{1}{9}$, c) $\dfrac{1}{y^9}$ d) $\dfrac{2}{a^3}$; e) x, f) $\dfrac{3a^4}{b^6}$; g) $\dfrac{10}{x^9z^{14}}$, 5a) 6.45×10^5, b) 5.621×10^{-3}, c) 0.00036, d) 950,000

Mini-Lecture 5.2
More Work with Exponents and Scientific Notation

Learning Objectives:

1. Use the power rules for exponents.
2. Use all exponent rules and definitions to simplify exponential expressions.
3. Compute, using scientific notation.
4. Key vocabulary: *exponential expression, scientific notation*.

Examples:

1. Simplify using the product rules for exponents. Write each answer using positive exponents only.

   a) $(x^3)^2$

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

   c) $\left(\dfrac{x^2}{y^3}\right)^2$

   d) $(m^3)^{-4}$

   e) $(2x^2 yz^3)^2$

   f) $\left(\dfrac{3x^4}{y^{-2}}\right)^5$

   g) $(4x^{-5} y^3 z^0)^{-3}$

   h) $(-2^{-3} y^{-3})^{-4}$

2. Simplify using exponent rules and definitions. Write each answer using positive exponents only.

   a) $\left(\dfrac{a^{-3}b^{-4}}{c^{-9}}\right)^{-2}$

   b) $(-4x^2)^3$

   c) $\left(\dfrac{n^6}{2m^{-3}}\right)^{-5}$

   d) $\dfrac{7^{-2} x^{-2} y^{10}}{x^3 y^{-4}}$

   e) $(-2x^0 y^2)^{-3}$

   f) $x^3 (x^3 by)^{-3}$

   g) $\left(\dfrac{2z^{-3}}{y}\right)\left(\dfrac{7y^{-5}}{z^{-2}}\right)^{-1}$

   h) $(3x^4 y^2)^{-3}(2x^8 y^3)$

3. Perform each indicated operation using the properties of exponents. Write each answer in scientific notation.

   a) $(4.9\times10^{-9})(6\times10^7)$

   b) $(4\times10^{-6})^5$

   c) $\dfrac{1.2\times10^8}{3\times10^{-4}}$

Teaching Notes:

- Some students are confused by when to add exponents versus when to multiply exponents.
- Encourage students to write the exponent rules on an index card to view while doing homework.
- Refer students to the **Summary of Rules for Exponents** chart in the text.

Answers: 1a) x^6, b) $x^4 y^6$, c) $\dfrac{x^4}{y^6}$, d) $\dfrac{1}{m^{12}}$, e) $4x^4 y^2 z^6$, f) $243x^{20} y^{10}$, g) $\dfrac{x^{15}}{64y^9}$, h) $4096y^{12}$; 2a) $\dfrac{a^6 b^8}{c^{18}}$, b) $-64x^6$, c) $\dfrac{32}{m^{15} n^{30}}$,

d) $\dfrac{y^{14}}{49x^5}$, e) $-\dfrac{1}{8y^6}$, f) $\dfrac{1}{b^3 x^6 y^3}$, g) $\dfrac{2y^4}{7z^5}$, h) $\dfrac{2}{27x^4 y^3}$;   3a) 2.94×10^{-1}, b) 1.024×10^{-27}, c) 4.0×10^{11}

Mini-Lecture 5.3
Polynomials and Polynomial Functions

Learning Objectives:

1. Identify term, constant, polynomial, monomial, binomial, trinomial, and the degree of a term and of a polynomial.
2. Define polynomial functions.
3. Review combining like terms.
4. Add polynomials.
5. Subtract polynomials.
6. Recognize the graph of a polynomial function from the degree of the polynomial.
7. Key vocabulary: *term, constant, polynomial, monomial, binomial, trinomial, degree.*

Examples:

1. Find the degree of each polynomial, state how many terms it has, and indicate whether it's a monomial, binomial, or trinomial.

   a) $3x$ 　　　　 b) $9x^2$ 　　　　 c) $-2x^3 + 5$ 　　　　 d) $x^2 y^2 - 4x + 3$

2. Define a polynomial function.

3. Simplify each polynomial by combining like terms.

   a) $2x + 3x$ 　　　　 b) $10y - 8y$ 　　　　 c) $xy + 3x - 2xy$

   d) $-x + 2x - 6x^2 - 3x^2$ 　　 e) $-9y + 8y + 2y^5$ 　　 f) $-2xy^2 + 3x - x + 8xy^2 - \dfrac{3}{5}$

4. Add the polynomials.

   a) $(-3y^2 - 2y + 5) + (2y + 7)$ 　　 b) $(2x^2 - 3x) + (-6x^2 - 7x)$ 　　 c) $\begin{array}{r} 5x^2 + 3x - 2 \\ +(7x^2 - 5x - 3) \\ \hline \end{array}$

5. Subtract the polynomials.

   a) $\begin{array}{r} -6x^2 - 3x + 9 \\ -\quad (7x + 10) \\ \hline \end{array}$ 　　 b) 　　 c) $(2x - 2) - (-x - 2)$

6. Match each equation with its graph.

1) 　　 2) 　　 3)
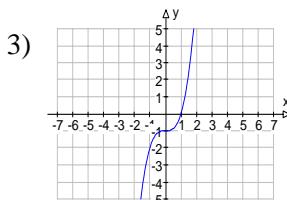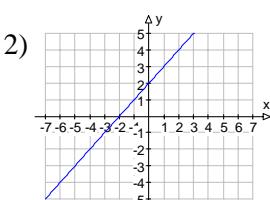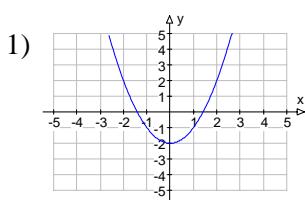
   a) $y = x^3 - 1$ _____
   b) $y = x^2 - 2$ _____
   c) $y = x + 2$ _____

Teaching Notes:

- Most students find these polynomial operations easy.
- Tell students that identifying the degree of a polynomial is important for later work with factoring and solving equations.
- Remind students that this section is a review of distributing and collecting like terms.
- Some students forget to distribute the minus sign when lining up vertically.

Answers: *1a) 1,1 monomial, b) 2,1,monomial, c) 3,2,binomial, d) 4,3,trinomial; 3a) 5x, b) 2y, c) −xy+3x, d) x-9x²,*

e) −y+2y⁵, f) $6xy^2 + 2x - \dfrac{3}{5}$; 4a) -3y²+12, b) -4x²-10x, c) 12x²-2x-5, 5a) -6x²-10x-1, b) −x²+7, c) 3x; 6a)graph 3;

b) graph 1; c) graph 2

Mini-Lecture 5.4
Multiplying Polynomials

Learning Objectives:

1. Multiply two polynomials.
2. Multiply binomials.
3. Square binomials.
4. Multiply the sum and difference of two terms.
5. Multiply three or more polynomials.
6. Evaluate polynomial functions.
7. Key vocabulary: *FOIL.*

Examples:

1. Multiply.

   a) $(2x)(4x)$
   b) $(-6a^2)(5a^3)$
   c) $(4.1\,x\,y^2 z^{10})(6\,xy^5 z)$
   d) $2x(3x-4)$

   e) $-3y(5xy+2x)$
   f) $-2b^2 z(2z^2 a + baz - b)$
   g) $(x+3)(2x^2 - x + 5)$

2. Multiply.

   a) $(x+3)(3x-4)$
   b) $(x+2)(x+3)$
   c) $\begin{array}{r} 4y-3 \\ \times\ 2y-2 \\ \hline \end{array}$

   d) $(x+6)(x+6)$
   e) $(3x^2 - 4y^2)(x^2 - 6y^2)$
   f) $\left(3y - \dfrac{1}{4}\right)\left(4y - \dfrac{1}{6}\right)$

3. Multiply.

   a) $(x+2)^2$
   b) $(x-4)^2$
   c) $(x+7)^2$

4. Multiply.

   a) $(x+5)(x-5)$
   b) $(2xy-3b)(2xy+3b)$
   c) $\left(5x - \dfrac{1}{2}\right)\left(5x + \dfrac{1}{2}\right)$
   d) $\left[6-(2b-2)\right]^2$

5. Multiply.

   a) $(x+3)(x-2)(2x-1)$
   b) $(y-2)^4$
   c) $(x-y)(x+y)(x+y)$

6. If $f(x) = x^2 - 2x$, find the following.

   a) $f(a)$
   b) $f(c)$
   c) $f(a+b)$
   d) $f(a-2)$

Teaching Notes:

- Encourage students to multiply binomials with FOIL mentally whenever possible. This will make factoring easier for them in future sections.
- Many students distribute the exponent when squaring a binomial, even after repeated reminders to multiply the binomial by itself.
- Refer students to the *Square of a Binomial* and *Product of the Sum and Difference of Two Terms* charts in the text.

Answers: 1a) $8x^2$, b) $-30a^5$, c) $24.6x^2 y^7 z^{11}$, d) $6x^2 - 8x$, e) $-15xy^2 - 6xy$, f) $-4ab^2 z^3 - 2ab^3 z^2 + 2b^3 z$, g) $2x^3 + 5x^2 + 2x + 15$;

2a) $3x^2 + 5x - 12$, b) $x^2 + 5x + 6$; c) $8y^2 - 14y + 6$, d) $x^2 + 12x + 36$; e) $3x^4 - 22x^2 y^2 + 24y^4$, f) $12y^2 - \dfrac{3}{2}y + \dfrac{1}{24}$; 3a) $x^2 + 4x + 4$;

b) $x^2 - 8x + 16$; c) $x^2 + 14x + 49$; 4a) $x^2 - 25$; b) $4x^2 y^2 - 9b^2$; c) $25x^2 - \dfrac{1}{4}$, d) $64 - 32b + 4b^2$; 5a) $2x^3 + x^2 - 13x + 6$,

b) $y^4 - 8y^3 + 24y^2 - 32y + 16$; c) $x^3 - x^2 y - xy^2 - y^3$; 6a) $a^2 - 2a$, b) $c^2 - 2c$, c) $a^2 + 2ab + b^2 - 2a - 2b$, d) $a^2 - 6a + 8$

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Mini-Lecture 5.5
The Greatest Common Factor and Factoring by Grouping

Learning Objectives:

1. Identify the GCF.
2. Factor out the GCF of a polynomial's term.
3. Factor polynomials by grouping.
4. Key vocabulary: *greatest common factor (GCF)*.

Examples:

1. Find the greatest common factor of each list of monomials.

   a) $4, 24$ b) $15x, 20$ c) $15x^2, 20x$ d) $9x^2 y, 27xy^2$

2. Factor out the greatest common factor.

   a) $16x - 12$ b) $28x + 28$ c) $5z - 25xz^4$

   d) $18x + 9x^2 - 6x^3$ e) $18a^3 b - 12ab + 9ab^2 - 12a^2 b$ f) $3x(y - 5) + (y - 5)$

3. Factor each polynomial by grouping.

   a) $xy + y + 5x + 5$ b) $2y - 12 - xy + 6x$

   c) $xy + 9x - 7y - 63$ d) $5xy - 10x + 7y - 14$

Mixed Practice. Factor each polynomial.

   a) $16x^3 - 12x$ b) $-27xy^3 + 18x^4 y$ c) $8a^2 b^2 c - 12ab^2 c - 8ac + 6a$

   d) $9y(z + 2) - 4(z + 2)$ e) $4xy - 8x + 7y - 14$ f) $x^3 + 5x^2 + x + 5$

Teaching Notes:

- Remind students to check their factoring answers by multiplication.
- Some students need to rewrite the coefficients in problem 2 in factored form in order to see the greatest common factor.
- Some students omit the 1 in the answer to Problem 2b).
- Many students are confused at first by factor by grouping problems where a negative sign must be factored out of the second grouping, as in problem 3b).

Answers: 1a) 4, b) 5, c) 5x, d) 9xy; 2a) 4(4x-3), b) 28(x+1), c) 5z(1-5xz³), d) 3x(6+3x-2x²), e) 3ab(6a²-4+3b-4a), f) (y-5)(3x+1); 3a) (x+1)(y+5), b) (y-6)(2-x), c) (y+9)(x-7), d) (y-2)(5x+7);
Mixed Practice. a) 4x(4x²-3), b) 9xy(-3y²+2x³), c) 2a(4ab²c-6b²c-4c+3), d) (9y-4)(z+2), e) (y-2)(4y+7), f) (x+5)(x²+1)

Mini-Lecture 5.6
Factoring Trinomials

Learning Objectives:

1. Factor trinomial of the form $x^2 + bx + c$.
2. Factor trinomial of the form $ax^2 + bx + c$
   a. Method 1 - Trial and Check
   b. Method 2 - Grouping
3. Factor by substitution.
4. Key vocabulary: *prime, perfect square trinomial.*

Examples:

1. Factor each trinomial.

   a) $x^2 + 3x + 2$ b) $x^2 + 6x + 8$ c) $x^2 - 6x + 8$ d) $x^2 + x - 2$

   e) $x^2 - x - 2$ f) $x^2 - 3x - 10$ g) $2x^2 + 4x - 48$ h) $3x^2 - 3x - 18$

   i) $x^2 + 15x + 16$ j) $x^2 y^2 - 6xy^2 + 8y^2$ k) $x^5 + 4x^4 - 5x^3$

2. Factor each trinomial.
   a) Trial and check method.

   a) $4y^2 + 12y + 9$ b) $8x^2 - 18x + 9$ c) $6x^2 + 5x - 6$

   d) $7x^2 - 31x - 20$ e) $6x^2 + 27x - 15$ f) $6x^2 y^2 - 7xy^2 - 20y^2$

   Factor the trinomials.

   b) Grouping method.

   g) $10x^2 - 7x - 33$ h) $20x^2 + 23x + 6$ i) $3x^2 - 8x - 11$

3. Use substitution to factor each trinomial completely.
   a) $x^4 - 5x^2 - 6$ b) $9x^6 + 6x^3 - 8$ c) $(a + 4)^2 + 7(a + 4) + 12$

Teaching Notes:

- Some students can factor trinomials very quickly using the trial and check method.
- Some students become very frustrated with the trial and check method and appreciate seeing the grouping method because it provides a recipe that works for any non-prime polynomial.
- Remind students to always try to factor a GCF first.
- Refer to the end of section exercises for mixed practice.
- Refer students to the **Factoring a Trinomial of the Form** $ax^2 + bx + c$ and **Factoring a Trinomial of the Form** $ax^2 + bx + c$ **by Grouping** charts in the text.

Answers: 1a) (x+2)(x+1), b) (x+4)(x+2), c) (x-4)(x-2), d) (x+2)(x-1), e) (x-2)(x+1), f) (x-5)(x+2), g) 2(x+6)(x-4), h) 3(x-3)(x+2), i) prime, j) y²(x-4)(x-2), k) x³(x-4)(x-1); 2a) (2y+3)(2y+3), b) (4x-3)(2x-3), c) (3x-2)(2x+3), d) (7x+4)(x-5), e) 3(2x-1)(x+5), f) y²(2x-5)(3x+4); g) (5x-11)(2x+3); h) (4x+3)(5x+2); i) (3x-11)(x+1)
3a) (x²-6)(x²+1), b) (3x³+4)(3x³-2), c) (a+8)(a+7)

Mini-Lecture 5.7
Factoring by Special Products

Learning Objectives:

1. Factor a perfect square trinomial.
2. Factor the difference of two squares.
3. Factor the sum or difference of two cubes.

Examples:

1. Factor completely or state the polynomial is prime.

   a) $x^2 + 4x + 4$ b) $x^2 - 12x + 36$ c) $9x^2 + 6x + 1$

   d) $3x^2 - 12x + 12$ e) $25x^2 y^3 - 10xy^3 - y^3$ f) $x^2 + 39xy + 40y^2$

2. Factor completely.

   a) $x^2 - 49$ b) $y^2 - 81$ c) $\dfrac{1}{16} - 25z^2$

   d) $(x+3)^2 - 64$ e) $3x^2 - 75$ f) $x^2 + 10x + 25 - x^4$

3. Factor completely.

   a) $x^3 + 8$ b) $x^3 + 1$ c) $y^3 - 27$ d) $64 - x^3$

   e) $p^3 + 8q^3$ f) $x^3 y^2 + 125y^2$ g) $a^3 b^2 - 27b^2$ h) $54y^3 + 250$

Mixed practice.

   a) $64 - x^2$ b) $x^3 + 16x^2 + 64x$ c) $1000y^3 - 1$

   d) $x^2 - 6xy + 9y^2$ e) $18x^2 - 98$ f) $(2x+3)^2 - 64$

Teaching Notes:

- Encourage students to always check if the first and last terms of a trinomial are perfect squares. If they are, then perfect square trinomial factoring may apply.
- Some students understand the difference of a square formula better if 2a) and 2b) are also done using trinomial factoring with a $0x$ middle term.
- Some students find the sum and difference of cubes formulas confusing at first and need to see many examples.
- Remind students to factor out a GCF whenever possible.

Answers: 1a) $(x+2)^2$, b) $(x-6)^2$, c) $(3x+1)^2$, d) $3(x-2)^2$, e) $y^3(5x-1)^2$, f) prime; 2a) $(x+7)(x-7)$, b) $(y+9)(y-9)$, c) $\left(\dfrac{1}{4}+5z\right)\left(\dfrac{1}{4}-5z\right)$, d) $(x+11)(x-5)$, e) $3(x+5)(x-5)$, f) $(x+5+x^2)(x+5-x^2)$; 3a) $(x+2)(x^2-2x+4)$, b) $(x+1)(x^2-x+1)$, c) $(y-3)(y^2+3y+9)$, d) $(4-x)(16+4x+x^2)$, e) $(p+2q)(p^2-2pq+4q^2)$, f) $y^2(x+5)(x^2-5x+25)$, g) $b^2(a-3)(a^2+3a+9)$, h) $2(3y+5)(9y^2-15y+25)$; *Mixed Practice:* a) $(8+x)(8-x)$, b) $x(x+8)^2$, c) $(10y-1)(100y^2+10y+1)$, d) $(x-3y)^2$, e) $2(3x+7)(3x-7)$, f) $(2x+11)(2x-5)$

Mini-Lecture 5.8
Solving Equations by Factoring and Problem Solving

Learning Objectives:

1. Solve polynomial equations by factoring.
2. Solve problems that can be modeled by polynomial equations.
3. Find the x-intercept of a polynomial function.
4. Key vocabulary: *polynomial equation, quadratic equation, standard form, zero-factor property*.

Examples:

1. Solve each equation.

   a) $x^2 - 11x + 30 = 0$ b) $6x^2 + 13x + 6 = 0$ c) $x^2 + 3x = 70$

   d) $x(3x + 4) = 4$ e) $x(x - 8) = x^2 + 5x$ f) $\dfrac{x^2}{56} + \dfrac{1}{8} = \dfrac{x}{7}$

   g) $(3x + 2)(x - 9)(5x - 1) = 0$ h) $x^3 = 25x$ i) $x^3 + 7x^2 = 18x$

   j) $x^5 = 64x^3$ k) $x^3 - x = -3x^2 + 3$

2. Solve.
   a) One number exceeds another number by 6 and the product of the two numbers is 72. Find the numbers.
   b) A certain rectangle's length is 3 feet longer than its width. If the area of the rectangle is 70 square feet, find its dimensions.
   c) One leg of a right triangle is 14 inches longer than the smaller leg, and the hypotenuse is 16 inches longer than the smaller leg. Find the lengths of the sides of the triangle.

3. Match each polynomial function with its graph.
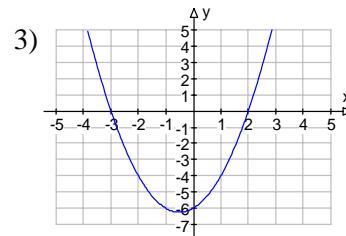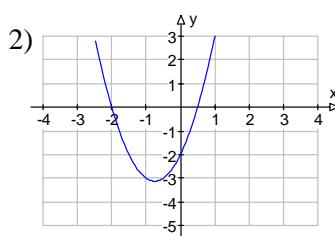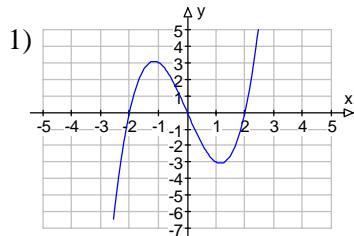
   a) $f(x) = (x - 2)(x + 3)$ b) $f(x) = (2x - 1)(x + 2)$ c) $h(x) = x(x + 2)(x - 2)$

Teaching Notes:

- Remind students to always put the equation in standard form before factoring.
- Some students try to use the zero-factor property before the equation is in standard form. For example in 2c) : $x^2 + 3x = 70 \rightarrow x(x + 3) = 70 \rightarrow x = 70, x + 3 = 70$ … etc.
- Many students find the applied problems difficult and need to see more examples.
- Remind students to check whether their answers are reasonable for applied problems.
- Refer students to the ***Solving a Polynomial Equation by Factoring*** chart in the text.

Answers: 1a) {0}, b) {5}, c) {0,-7}, d) $\left\{\dfrac{3}{2}, -\dfrac{4}{5}\right\}$; 2a) {6,5}, b) $\left\{-\dfrac{2}{3}, -\dfrac{3}{2}\right\}$, c) {-10,7}, d) $\left\{-2, \dfrac{2}{3}\right\}$, e) {0}, f) {1,7};

g) $\left\{-\dfrac{2}{3}, \dfrac{1}{5}, 9\right\}$, h) {-5,0,5}, i) {-9,0,2}, j) {-8,0,8}, k) {-3,-1,1}; 2a) 6 and 12, or, -12 and -6, b) 10 ft by 7 ft,

c) 10 in, 24 in, 26 in; 3a) graph 3; b) graph 2; c) graph 1

Additional Exercises 5.1
Form I

Name _____

Date _____

Simplify each expression. Write answers with positive exponents.

1. $2^3 \cdot 2^4$

2. -4^0

3. $\dfrac{t^4}{t^9}$

4. $\dfrac{25y^4}{5y^{-4}}$

5. $5a^{-4} \cdot 4a^{-2}$

6. $\dfrac{x^{-3}}{x^{-5}}$

Write each number in scientific notation.

7. 534

8. 0.00373

9. 42,300

Write each number in standard notation, without exponents.

10. 9.59×10^2

11. 7.64×10^{-2}

12. 8.578×10^4

Simplify. Assume that variables in the exponent represent nonzero integers and that x, y, and z are not 0.

13. $y^a \cdot y^{2a}$

14. $x^b \cdot x^c$

15. $\dfrac{z^7}{z^{3n}}$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.1
Form II

Name _____

Date _____

Simplify each expression. Write answers with positive exponents.

1. $3^3 \cdot 3^5 \cdot 3^7$

2. $(2 + x)^0 + 2x^0$

3. $\dfrac{a^{14}b^7}{a^8 b}$

4. $\dfrac{x^{-6}x^3}{x^{-7}}$

5. $5a^{-3} \cdot 6a^{-2} \cdot 4a^{-5}$

6. $\dfrac{x^{-5}x^{-4}}{x^{-8}}$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Write each number in scientific notation.

7. 0.00546

8. 0.00000241

9. 786,900,000

7. _____

8. _____

9. _____

Write each number in standard notation, without exponents.

10. 3.005×10^4

11. 5.13×10^{-6}

12. 2.415×10^4

10. _____

11. _____

12. _____

Simplify. Assume that variables in the exponent represent nonzero integers and that x, y, and z are not 0.

13. $y^4 \cdot y^{5a+2}$

14. $\dfrac{x^{4a}}{x^{-3a}}$

15. $\dfrac{z^{4t} \cdot z^{2t-1}}{z^{3t-2}}$

13. _____

14. _____

15. _____

Additional Exercises 5.1
Form III

Simplify each expression. Write answers with positive exponents.

1. $2^{-3} - 4^{-1}$

2. $(-3x^4 y^{-2})(6x^3 y^5 z^2)$

3. $\dfrac{24x^4 y^9 z}{-8x^2 y^5 z}$

4. $\dfrac{-35x^9 y^4}{5x^2 y^{-2}}$

5. $5a^{-3} \cdot 4a^{-2} \cdot 3a^5$

6. $\dfrac{24z^3 y^{-5}}{28z^{-2} y^{-3}}$

Write each number in scientific notation.

7. 42,896,600,000

8. 0.000450045

9. 72,800,000,000,000

Write each number in standard notation, without exponents.

10. 3.1416×10^2

11. 4.2506×10^{-5}

12. 6.95786×10^6

Simplify. Assume that variables in the exponent represent nonzero integers and that x, y, and z are not 0.

13. $x^{-4} \cdot x^{5a+2} \cdot x^{6-3a}$

14. $\dfrac{x^{3n+m} y^{k-4}}{x^{2n-2m} y^{k+2}}$

15. $\dfrac{z^{3b} \cdot y^{a-5} \cdot x^{2c-4}}{z^{2-2b} \cdot y^{2a-3} \cdot x^{-c}}$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.2
Form I

Name _____

Date _____

Simplify. Write each answer using positive exponents only.

1. $(2^{-2})^3$

2. $(x^{-2})^4$

3. $\left(\dfrac{3}{5}\right)^{-2}$

4. $\left(\dfrac{5^{-2}}{x^{-4}y}\right)^{-2}$

5. $(5x^4y^2)^{-2}$

6. $\dfrac{\left(z^4\right)^{-3}}{z^4 \cdot z^{-2}}$

Perform each indicated operation. Write each answer in scientific notation.

7. $(5 \times 10^6)^3$

8. $\dfrac{4.5 \times 10^{-8}}{5 \times 10^{-4}}$

9. $\dfrac{0.075}{0.15}$

Simplify. Assume that variables in the exponent represent nonzero integers and that all other variables are not 0.

10. $(y^{2n-2})^4$

11. $\dfrac{\left(x^{4b}\right)^3}{x^{3b-4}}$

12. $\left(\dfrac{3y^{4a}}{y^{2a+3}}\right)^2$

Solve. Write the answer in scientific notation.

13. A certain computer can do a simple computation in 10^{-7} seconds. Express how long it would take this computer to do this task 5000 times.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

Additional Exercises 5.2
Form II

Name _____

Date _____

Simplify. Write each answer using positive exponents only.

1. $(4^3)^{-2}$

2. $(x^{-6})^{-2}$

3. $(-2^{-4}y^2z^{-3})^{-2}$

4. $\left(\dfrac{4a^{-5}}{3b^6}\right)^2$

5. $(4x^{-3}y^4z^{-1})^3$

6. $\dfrac{a^4\left(3a^2b\right)^3}{\left(3ab^2\right)^{-1}}$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Perform each indicated operation. Write each answer in scientific notation.

7. $(4 \times 10^5)(3.1 \times 10^2)$

8. $(3.9 \times 10^3)(1.3 \times 10^4)^{-1}$

9. $\dfrac{3.6 \times 10^4}{\left(9 \times 10^{-3}\right)\left(2 \times 10^{-4}\right)}$

7. _____

8. _____

9. _____

Simplify. Assume that variables in the exponent represent nonzero integers and that all other variables are not 0.

10. $\dfrac{x^{5a}(x^{5a})^3}{x^{5a-2}}$

11. $\dfrac{b^{-4y+7}b^y}{b}$

12. $\left(\dfrac{2y^{4a}}{y^{-a+2}}\right)^3$

10. _____

11. _____

12. _____

Solve. Write the answer in scientific notation.

13. To convert from square inches to square meters, multiply by 6.452×10^{-4}. The area of a square is 9×10^{-2} square inches. Convert this area to square meters.

13. _____

Additional Exercises 5.2
Form III

Name _____

Date _____

Simplify. Write each answer using positive exponents only.

1. $\left(\dfrac{2^4}{3^3}\right)^{-2}$

1. _____

2. $(3^{-2}z^4y^8)^{-3}$

2. _____

3. $\dfrac{9x^6y^2z}{27x^2y^{-5}}$

3. _____

4. $\dfrac{3^{-2}x^2y^{-6}}{7^{-2}x^{10}y^{-1}}$

4. _____

5. $\left(\dfrac{6^2x^5y^{-4}}{3^3x^4y^{-3}}\right)^{-2}$

5. _____

6. $(4a^7y^6)^{-2}(10a^3y^2)(2a^3y^2)^{-3}$

6. _____

Perform each indicated operation. Write each answer in scientific notation.

7. $\dfrac{0.00006\times12000}{0.003\times0.000004}$

7. _____

8. $(6.4\times10^3)(1.6\times10^4)(3.2\times10^4)^{-2}$

8. _____

9. $\dfrac{\left(2.1\times10^{-7}\right)\left(3\times10^{-4}\right)}{\left(7\times10^4\right)\left(3\times10^{-2}\right)}$

9. _____

Simplify. Assume that variables in the exponent represent nonzero integers and that all other variables are not 0.

10. $(x^{-2a-1})^2(x^{3a+3})^{-1}(x^{3-3a})^{-3}$

10. _____

11. $\left(\dfrac{x^{3a+1}y^{a-5}}{x^{2a+2}y^{3a+3}}\right)^3$

11. _____

12. $\dfrac{3^3y^{2a+3}\cdot x^{3a-4}}{5^2y^{4a+5}\cdot x^a}$

12. _____

Solve. Write the answer in scientific notation.

13. Find a cube's volume if each side is 0.0374 meters long.

13. _____

Additional Exercises 5.3
Form I

Name _____

Date _____

Find the degree of each polynomial and indicate whether the polynomial is a monomial, binomial, trinomial, or none of these.

1. -64

2. $5x - 4$

3. $9x^2 + 3$

4. $4x^2 - 5x + 7$

Perform the indicated operations.

5. $(3y^2 + 2) + (2y^2 + 1)$

6. $(7x^2 + 5) - (4x^2 + 2)$

7. $\begin{array}{r} 9y^2 - 4y - 6 \\ - \quad\quad 2y - 1 \\ \hline \end{array}$

8. $(8y^2 - 7) + (2y^2 - 6) + (4 - 3y^2)$

9. $(x^2 + 5x - 4) + (7x^2 - 6x - 5)$

10. $(15y^2 - 3y + 6) - (14y^2 - 8y - 1)$

If $P(x) = x^2 - 2x - 5$ and $Q(x) = 4 - x^2$, find each function value.

11. $P(0)$

12. $Q(-2)$

13. $P(-1)$

14. $Q(2)$

15. A ball dropped from a cliff that is 145 feet above the ground. Neglecting air resistance, the height of the ball in feet at any time t, in seconds, can be described by the polynomial function $P(t) = -16t^2 + 145$. Find the height of the ball at $t = 3$ seconds.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.3
Form II

Name _____

Date _____

Find the degree of each polynomial and indicate whether the polynomial is a monomial, binomial, trinomial, or none of these.

   1. $6x$

   2. $7x^2y$

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

   4. $5x^2 - 2xy^2$

Perform the indicated operations.

   5. $(6y^2 - 11) + (6y^2 - 5)$

   6. $(2x^2 - 9) + (3x^2 - 4x + 3)$

   7.
$$\begin{array}{r} 4x^2 - 6x + 9 \\ + \ \ 2x^2 + 4x - 5 \\ \hline \end{array}$$

   8. $-10xy^2 + 7x - x + xy^2 + 12x^2y$

   9. $(11y^2 - 4y + 5) - (9y^2 - 7y - 2)$

   10. Find the sum of $10xyz + 3x - y$ and $-10xyz - 2x + y - 7$.

If $P(x) = 2x^2 - 3x + 7$ and $Q(x) = 8 - x^3$, find each function value.

   11. $P(-3)$

   12. $Q(2)$

   13. $P(4)$

   14. $Q(-3)$

   15. A projectile is fired upward from the ground with an velocity of 250 feet per second. Neglecting air resistance, the height of the projectile in feet at any time t, in seconds, can be described by the polynomial function $P(t) = -16t^2 + 250t$. Find the height at $t = 4$ seconds.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.3
Form III

Name _____

Date _____

Find the degree of each polynomial and indicate whether the
polynomial is a monomial, binomial, trinomial, or none of these.

1. $9x^2$

2. $3x^2y - 3y$

3. $5x^2 - 2xy^2 + 7x^2y^3$

4. $2x^3 - 6x^4 + 7x^5 - 2$

Perform the indicated operations.

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

6. $(19ab - 12a^2b + 5b^2) - (20ab - 8a^2b - 4b)$

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

8. Subtract $5x - 3$ from the sum of $8x^2 - 3x + 2$ and $6x - 10x^2 - 4$.

9. $\left(\dfrac{1}{4}x^2 + \dfrac{1}{3}x - \dfrac{1}{2}\right) - \left(\dfrac{1}{8}x^2 - \dfrac{1}{2}x + \dfrac{3}{4}\right)$

10.

$$\left(\frac{2}{9}yx^2 + \frac{1}{9}xy^2 - \frac{4}{9}xy + \frac{2}{3}x\right) - \left(\frac{1}{3}yx^2 - \frac{2}{9}xy^2 + \frac{2}{3}xy + 7\right)$$

If $P(x) = x^3 - 4x^2 + 7x - 6$ and $Q(x) = 3x^2 - 9x + 4$, find each
function value.

11. $P(2)$

12. $Q(3)$

13. $P(-3)$

14. $Q(4)$

15. An object is thrown upward with an initial velocity of 32
feet per second from the rim of a canyon. The rim is 850
feet above the canyon floor. Neglecting air resistance, the
height of the projectile in feet at any time t, in seconds,
can be described by the polynomial function $P(t) = -16t^2 + 32t + 850$. Find the height at $t = 8$ seconds.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.4
Form I

Name _____

Date _____

Multiply.

1. $(7y)(-6y)$

2. $(-5x^4)(2x^2)$

3. $4x(6x - 7)$

Use the FOIL order to multiply.

4. $(x + 5)(x - 3)$

5. $(y - 5)(y - 6)$

6. $(2x - 7)(x + 3)$

Use special product methods to multiply.

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

8. $(2y - 3)^2$

9. $[3 + (x + 4)][3 - (x + 4)]$

Multiply.

10. $(x - 4)(x + 4)(x^2 + 16)$

11. $(z + 2)(z - 2)(z^2 - 4)$

If $f(x) = x^2 - 1$, find the following.

12. $f(a + 1)$

13. $f(a + h) - f(a)$

Multiply. Assume that variables represent positive integers.

14. $(x^n + 4)(x^{2n} - 3)$

15. $(x^{3n} - y^{3m})(x^{3n} + y^{3m})$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.4
Form II

Name _____

Date _____

Multiply.

    1. $(14a^2b)(-3ab^3)$

    2. $(-3ab)(xa^2 - ya^2 - 5)$

    3. $(a + 5)(4a^2 - a + 6)$

Use the FOIL order to multiply.

    4. $(x - 2)(x + 8)$

    5. $(3y - 3)(2y - 7)$

    6. $(x - 3z)(x + 4z)$

Use special product methods to multiply.

    7. $(4x + 2y)(4x - 2y)$

    8. $(3z - 4)^2$

    9. $[6 - (2b - 3)][6 + (2b - 3)]$

Multiply.

    10. $(x - 7)(x + 7)(x^2 + 49)$

    11. $(x - 3)^4$

If $f(x) = 2x^2 - 5$, find the following.

    12. $f(y - 2)$

    13. $f(a + h) - f(a)$

Multiply. Assume that variables represent positive integers.

    14. $(4x^a y^b)(xy^{2b} - x^{2a}y)$

    15. $(x^n + 3y)(x^{2n} - 2y^2)$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.4
Form III

Multiply.

1. $(4x^2y)(-6x^2 + 2xy - 4y^2)$

2. $(2x - 3)(5x^2 - x + 1)$

3. $(2y^3 - 7)(3y^2 + 4y + 1)$

Use the FOIL order to multiply.

4. $\left(6x + \dfrac{1}{3}\right)\left(9x + \dfrac{1}{2}\right)$

5. $(2y - 5z)(4y + 7z)$

6. $\left(8x^2 + \dfrac{1}{3}y\right)\left(3x^2 - \dfrac{1}{2}y\right)$

Use special product methods to multiply.

7. $\left(4x + \dfrac{1}{5}y^2\right)\left(4x - \dfrac{1}{5}y^2\right)$

8. $[(3x - 2) + 1]^2$

9. $[5 + (2x^2 + 3x)][5 - (2x^2 + 3x)]$

Multiply.

10. $(x - 2)(2x - 1)(x + 3)$

11. $(x^2 - 4)(x^4 + 10)(x^2 + 4)$

If $f(x) = 3x^2 - 4x + 3$, find the following.

12. $f(z + 3)$

13. $f(a + h) - f(a)$

Multiply. Assume that variables represent positive integers.

14. $(2xy^a - x^b y)(xy^{2a} - 3x^{2b}y)$

15. $(-2x^3y^{n+1})(4xy^{2n} - 3x^2y^{n-1})$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.5
Form I

Name _____

Date _____

Find the GCF of each list of monomials.

    1. x^4, x^2, x^5

    2. $4x^2y, 12x^2y^2, 8xy^2$

Factor out the GCF.

    3. $20x^2 - 30x$

    4. $8(x - 2) + 3x(x - 2)$

    5. $4xy(y + 5) - (y + 5)$

    6. $12x^5 - 18x^4 + 3x^2$

    7. $7y^5 + 21y^4 + 14y^3$

Factor each polynomial by grouping.

    8. $x^2 + 2x - 5x - 10$

    9. $xy + 4y - x - 4$

    10. $ab - 7a - 3b + 21$

    11. $x^3 - 6x^2 + x - 6$

    12. $3x^3 - 3x^2 + 2x - 2$

Solve.

    13. The material needed to manufacture a box with two square ends is given by the polynomial $2x^2 + 4xy$, where x is the length of the square ends and y is the length of the other sides. Factor this polynomial.

    14. An object dropped from 256 above the ground has a height of $-16t^2 + 256$ feet after t seconds. Factor this polynomial.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

Additional Exercises 5.5
Form II

Name _____

Date _____

Find the GCF of each list of monomials.

1. $6x^3y^2$, $18x^2y^4$, $24x^4y^5$

2. $7x^4y$, $28x^3y^2$, $14x^2y^3$

Factor out the GCF.

3. $6a^2b^2 - 9ab^4$

4. $x^2(4y + 1) - 4(4y + 1)$

5. $4xy^3 - 2x^3y^4 + 10x^2y^6$

6. $7a - 21 + 4a^2 - 12a$

7. $x^3 - 3yx^2 + 5x - 15y$

Factor each polynomial by grouping.

8. $8xy - 6y + 4x - 3$

9. $21x^2 - 14x - 6x + 4$

10. $2x^2 - x + 4xy - 2y$

11. $25x^2 - 15x + 5xy - 3y$

12. $x^3 + 4x^2 - 6x - 24$

Solve.

13. The material needed to manufacture a box whose opposite sides are identical is given by the polynomial $2xy + 2yz + 2xz$, where x, y, and z are the lengths of the different sides. Factor this polynomial in terms of the reciprocals of each length.

14. An object shot from the ground with an initial velocity of 80 feet per second has a height of $-16t^2 + 80t$ feet after t seconds. Factor this polynomial.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

Additional Exercises 5.5
Form III

Name _____

Date _____

Find the GCF of each list of monomials.

1. $3x^2y^2z^2$, $18x^3yz^4$, $9xy^3z^3$

2. $8ab^3c^5$, $12a^4b^2c^3$, $16a^3b^4c^2$

Factor out the GCF.

3. $3ab^2(b+7) - (b+7)$

4. $16a^3b^3 - 4a^2b^3 + 4ab^2 - 24ab^3$

5. $14x^3y^2 - 28x^2y^3 + 7x^2y^2 - 7xy$

6. $3y^4z^2 - 6y^3z^3 + 3y^2z^4$

7. $\dfrac{4}{3}m^2n^4 + \dfrac{5}{6}m^3n^5 - \dfrac{4}{9}m^4n^6$

Factor each polynomial by grouping.

8. $6x^2 - 4xz - 15x + 10z$

9. $14x^2 - 28x - 2xy + 4y$

10. $4mn^4 + \dfrac{5}{2}mn^2 - \dfrac{4}{3}n^2 - \dfrac{5}{6}$

11. $2x^{5a}y^{2b} + 2x^ay^{6b} - x^{6a}y^b - x^{2a}y^{5b}$

12. $\dfrac{1}{5}a^{2m}b^{3n} + \dfrac{1}{5}a^{3m}b^{2n} - \dfrac{1}{6}a^{3m}b^{2n} - \dfrac{1}{6}a^{4m}b^n$

Solve.

13. A design for a spherical metal shell is needed. The shell has a thickness of t, so that its inner radius is r and its outer radius is $R = r + t$. The volume of the material used for the shell is given by the polynomial $4\pi R^2 - 4\pi r^2$. Factor this polynomial. Then rewrite the polynomial in simplest form in terms of the inner radius r and thickness t.

14. A model rocket is fired from the floor of a canyon that is 256 feet the canyon edge. If the object has an initial upward velocity of 128 feet per second, it will have a height of $-16t^2 + 128t - 256$ feet with respect to the edge after t seconds. Factor this polynomial.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

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Additional Exercises 5.6
Form I

Name _____

Date _____

Factor each trinomial.

1. $x^2 + 4x + 3$

2. $x^2 - 5x - 6$

3. $x^2 - 4x - 21$

4. $x^2 - 13x + 22$

5. $7x^2 - 22x + 3$

6. $6x^2 + 37x + 6$

Use substitution to factor each polynomial completely.

7. $x^4 + x^2 - 2$

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

9. $(11x + 5)^2 + 9(11x + 5) + 8$

10. $(3y - 4)^2 - 13(3y - 4) + 36$

11. $x^6 + 17x^3 - 18$

12. $2x^4 + 3x^2 + 1$

Solve.

13. Find all positive and negative integers b such that $x^2 + bx + 2$ can be factored.

14. Find all positive and negative integers b such that $5x^2 + bx + 3$ can be factored.

15. The volume $V(x)$ of a box in terms of its height x is given by the function $V(x) = x^3 - x^2 - 6x$. Factor this expression for $V(x)$.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.6
Form II

Name _____

Date _____

Factor each trinomial.

1. $x^2 + 11x + 30$

2. $x^2 - 4x - 45$

3. $x^2 + 2xy - 15y^2$

4. $2x^2y - 16xy + 24y$

5. $12x^2 + 17x + 6$

6. $20xy^2 + 9xy - 20x$

Use substitution to factor each polynomial completely.

7. $x^4 + x^2 - 12$

8. $x^6 - 5x^3 - 24$

9. $(a + 7)^2 - 3(a + 7) - 40$

10. $x^4 - 19x^3 - 42x^2$

11. $2(x + 8)^2 + 11(x + 8) - 6$

12. $2x^6 - 17x^3 + 35$

Solve.

13. Find all positive and negative integers b such that $x^2 + bx - 15$ factors.

14. Find all positive and negative integers b such that $3x^2 + bx + 4$ factors.

15. The volume $V(x)$ of a box in terms of its height x is given by the function $V(x) = x^3 - 2x^2 - 15x$. Factor this expression for $V(x)$.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.6
Form III

Name _____

Date _____

Factor each trinomial.

1. $x^2 + 11xy + 28y^2$

2. $3x^2 + 33xy + 84y^2$

3. $8x^5 - 16x^4 - 10x^3$

4. $x^2 + 11x - 12$

5. $10x^2 + 7x - 45$

6. $24x^2y^2 - 28x^2y - 20x^2$

Use substitution to factor each polynomial completely.

7. $3x^4 + 16x^2 + 21$

8. $4x^6 - 4x^3 - 24$

9. $5(2a + 5)^2 - 5(2a + 5) - 10$

10. $6x^4 - 47x^3 - 34x^2$

11. $\dfrac{1}{2}(2a+3)^2 + \dfrac{17}{18}(2a+3) - \dfrac{1}{9}$

12. $5x^6 - 22x^3 + 21$

Solve.

13. Find all positive and negative integers b such that $x^2 + bx - 25$ factors.

14. Find all positive and negative integers b such that $4x^2 + bx - 8$ factors.

15. The volume $V(x)$ of a box in terms of its height x is given by the function $V(x) = 2x^3 - x^2 - 15x$. Factor this expression for $V(x)$.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.7
Form I

Name _____

Date _____

Factor the following.

1. $x^2 + 24x + 144$

2. $x^2 + 20x + 100$

3. $y^4 - 81$

4. $x^2 - 30x + 225$

5. $(4x - 1)^2 - 16$

6. $x^2 - 4x + 4 - y^2$

7. $54x^3 + 128$

8. $t^3 - 1$

9. $x^3 + 1000$

10. $b^3 - 8a^3$

11. $x^2 + 8x + 16 - y^2$

12. $(2x + 1)^2 - 25$

13. $ab^3 - 1000a^4$

14. $x^2 - 14x + 49 - y^2$

15. $x^4 - 64$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.7
Form II

Name _____

Date _____

Factor the following.

1. $64x^2 - 80x + 25$

2. $y^2 - 121$

3. $75x^2 - 30xy + 3y^2$

4. $25y^2 - 36$

5. $81y^2 - 100$

6. $(5x - 2)^2 - 25y^2$

7. $x^2 + 12x + 36 - y^4$

8. $a^3b + 125b^4$

9. $x^3 - y^3$

10. $125x^3 + 8y^3$

11. $(4x + 3)^2 - 25$

12. $a^2 - 18a + 81 - b^4$

13. $x^2 - \dfrac{1}{144}$

14. $45x^2 - 30xy + 5y^2$

15. $m^2 - 32m + 256 - n^2$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.7
Form III

Name _____

Date _____

Factor the following.

1. $16x^2y^2 + 8x^2y + x^2$

2. $49x^2 - 42x + 9$

3. $12x^2y - 3y$

4. $9xy^2 - 900x$

5. $x^4 - 1296$

6. $x^6 + y^9$

7. $(3x - 1)^3 + 8$

8. $x^3 + 343$

9. $64x^3 - 27y^3$

10. $169b^3a^4 + 26b^3a^2 + b^3$

11. $a^3x^2 - 216x^2$

12. $x^2 + \dfrac{2}{3}x + \dfrac{1}{9} - y^2$

13. $27xy^3 + 125x^4$

14. $\left(\dfrac{2}{5}x + 2\right)^3 + \dfrac{1}{64}$

15. $x^6y^4 + x^2y^4$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.8
Form I

Name _____

Date _____

Solve each equation.

1. $(x - 5)(x - 6) = 0$

2. $(x + 2)(x - 3) = 0$

3. $x^2 - 2x - 8 = 0$

4. $x^3 + x^2 = 6x$

5. $4y^3 = 144y$

6. $x^2 + x = 72$

7. $x^2 - 4x - 21 = 0$

8. $y^3 = 36y$

9. $z^2 - 8z + 16 = 49$

10. $t^2 - 5t = t(7 + t)$

11. $x^4 - x^2 = 4x^2 - 4$

12. $(x + 5)(x - 7)(x - 9) = 0$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

Solve.

13. One number exceeds another number by 6 and their product is 91. Find the numbers.

13. _____

14. A rectangular floor has an area of 24 square meters. The length of the floor is 2 meters less than twice the width. What is the length and width of the floor?

14. _____

15. A board is leaning against a wall. The top of the board is 4 feet above the ground, and the bottom of the board is 3 feet from the bottom of the wall. How long is the board?

15. _____

Additional Exercises 5.8
Form II

Name _____

Date _____

Solve each equation.

1. $(3x - 12)(2x + 9) = 0$

2. $(x - 1)(x + 4)(2x - 6) = 0$

3. $10x^2 + 22x - 24 = 0$

4. $\dfrac{x^2}{30} + \dfrac{x}{10} = \dfrac{1}{3}$

5. $16x^2 - 40x + 25 = 0$

6. $12x^2 + 14x = 0$

7. $28t^3 = 63t$

8. $5x(9x - 10) = 0$

9. $2x(2x - 1) = -x^2 + 3$

10. $t^2(7t + 3) = 22t$

11. $x^3 + 4x^2 = 2x + 8$

12. $5(2x + 5) - x = 7(3 - x)$

Solve.

13. If the sum of two numbers is 2 and their product is $\dfrac{8}{9}$, find the numbers.

14. A gardener wants to put a uniform border of gravel around the outside of a 16-foot by 20-foot garden. Find how wide the border should be if she has enough gravel to cover 352 square feet.

15. A 10-foot ladder is placed against a wall so the bottom of the ladder is 6 feet from the bottom of the wall. How high from the ground is the top of the ladder?

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 5.8
Form III

Name _____

Date _____

Solve each equation.

1. $(7x + 8)(3x - 5) = 0$

2. $6(3x + 11)(4x - 9) = 0$

3. $(x + 8)(x - 6)(2x - 11) = 0$

4. $3y^2 - 2y - 16 = 0$

5. $\dfrac{x^2}{10} + \dfrac{3x}{20} = 1$

6. $\dfrac{x^2}{5} - \dfrac{x}{3} + \dfrac{1}{20} = 0$

7. $(6x - 1)(4x + 3) = 0$

8. $-9(t + 2) - 5t = -6(3t - 3)$

9. $7y^2 + 13y - 24 = 0$

10. $\left(\dfrac{5}{2}x - \dfrac{3}{4}\right)\left(\dfrac{9}{5}x + \dfrac{3}{5}\right) = 0$

11. $z^3 + 7z^2 = 3z + 21$

12. $2y^2 - \dfrac{3}{5}y - \dfrac{2}{3} = 0$

Solve.

13. The sum of the square of two consecutive even integers is 580. Find the integers.

14. A contractor is going to lay a concrete sidewalk around a park. The park dimensions within the sidewalk are 150 feet by 110 feet. How wide will the sidewalk be if the contractor has enough concrete to cover 1596 square feet?

15. A support cable runs from the top of a radio transmission tower to the ground. The distance between the base of the tower and the place where the cable is anchored is 90 feet. If the cable is 410 feet long, how tall is the tower?

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Section 5.1 Exponents and Scientific Notation

Objective: Calculate using scientific notation.
Suggested Format: Small group format
Time: 10 minutes

Answer each of the following questions. You may wish to use a calculator.

1. Each side of a cube is 2.1×10^3 cm. Calculate the volume of the cube in cubic centimeters. Give your answer in scientific notation.

2. The distance light travels in one year is approximately 5.87×10^{14} miles. How far does light travel in 4 weeks? Write your answer in scientific notation, rounded to three decimal places.

3. According to the Medical College of Wisconsin, the average American consumes 83 grams of fat in a single day. If the population of the U.S. is 301,139,947 people, what is the total number of fat grams consumed by Americans in a single day? Write your answer in scientific notation, rounded to three decimal places.

Section 5.2 More Work with Exponents and Scientific Notation

Objective: Write expressions containing positive and negative exponents in simplified form.
Suggested Format: Think and Pair
Time: 15 minutes

Work each problem as quickly as you can. Speed is the goal in this part.

Simplify the following.

1. $4x^{-3}$ 1. _____

2. $(-6)^{-2} + (3)^{-2}$ 2. _____

3. $\left(\dfrac{5x^{-2}y^3}{x^{-4}y^2} \right)^2$ 3. _____

4. Evaluate $x^2 - y$ when $x = -2$ and $y = -3$.   4. _____

5. $3x^0 + (7x^4)^0$ 5. _____

Now work the following problems at a steady speed you are comfortable with. Then confirm your results on both parts with your partner.

6. $(6x^{-1}y^2)^{-2}$ 6. _____

7. $(2)^{-3} + (-4)^{-2}$ 7. _____

8. $\left(\dfrac{3x^{-4}}{y^{-3}} \right)^{-3}$ 8. _____

9. $(2x^2y^3)^0 + 2x^0 - (5x)^0$ 9. _____

10. Evaluate $x^3 - y^2$ when $x = -1$ and $y = -2$.   10. _____

Chapter 5 Test Form A

Simplify each expression. Write with positive exponents.

1. $\left(3x^2\right)\left(2x^{-4}\right)\left(6x\right)^{-3}$ **1.** _____

2. $\left(\dfrac{2x^{-4}y^3}{3xy^2}\right)^{-2}$ **2.** _____

3. $\dfrac{\left(4ab^2\right)^{-1}\left(8a^{-1}b^3\right)^2}{2a^{-2}b^{-3}}$ **3.** _____

4. Write in scientific notation: 362,000   **4.** _____

5. Write without exponents: 2.3×10^{-5} **5.** _____

6. Use scientific notation to find the quotient.   **6.** _____

$\dfrac{\left(0.036\right)\left(0.00008\right)}{0.0064}$

Perform the indicated operations.

7. $\left(2x^2-4x+8\right)-\left(x^2+3x-2\right)$ **7.** _____

8. $\left(5x^3y+2x-3\right)+\left(2x^3y+4\right)$ **8.** _____

9. $-2x^3y\left(2x^2-4x+4\right)$ **9.** _____

10. $\left(2x-3\right)\left(4x+5\right)$ **10.** _____

11. $\left(4x-5\right)^2$ **11.** _____

12. $\left(3x-1\right)\left(x^2-2x-3\right)$ **12.** _____

13. $\left(2x-3\right)\left(2x+3\right)$ **13.** _____

Chapter 5 Test Form A *cont'd*

Factor each polynomial completely.

14. $6x^3 y - 21x^2 y^2$ 14. _____

15. $2x^2 + 10x - 12$ 15. _____

16. $9x^2 + 24x + 16$ 16. _____

17. $27x^2 - 12y^2$ 17. _____

18. $5x^2 + 18x - 8$ 18. _____

19. $x^3 + 8$ 19. _____

20. $2x^2 - 6x + xy - 3y$ 20. _____

Solve each equation.

21. $-6(x - 3)(2x + 7) = 0$ 21. _____

22. $(x + 2)(x - 1) = -2(x - 4)$ 22. _____

23. $x^3 - 7x^2 + 12x = 0$ 23. _____

24. The sum of twice a number and its square is 24.   24. _____
    Find the number.

25. One number exceeds another number by 9,   25. _____
    and their product is 112. Find the numbers.

Chapter 5 Test Form B

Simplify each expression. Write answers with positive exponents.

1. $\dfrac{\left(6a^{-2}b^{0}\right)^{2}\left(3^{-1}ab\right)^{2}}{2^{2}a^{4}b^{-2}}$

1. _____

2. $\dfrac{a^{4m-1}}{a^{m}}\cdot\dfrac{a^{2m}}{a^{2}}$

2. _____

3. $\left(3x^{-2}y^{2}\right)\left(9x^{2}y^{4}\right)^{-1}$

3. _____

4. Use scientific notation to find the quotient.
$\dfrac{\left(2.8\times10^{5}\right)\left(1.2\times10^{-8}\right)}{4.8\times10^{-3}}$

4. _____

5. Write in scientific notation. 0.00000735

5. _____

6. Write without the exponents. -2.34×10^{5}

6. _____

Perform the indicated operations.

7. $\left(2x-3y\right)+\left(2x^{2}-3x-y\right)-\left(y-3\right)$

7. _____

8. Subtract $2x^{3}-4x^{2}-6$ from $4x^{3}-7x^{2}-6$

8. _____

9. $\left(2a-5b\right)\left(3a+4b\right)$

9. _____

10. $-6xy^{2}\left(x-2y\right)\left(x+3y\right)$

10. _____

11. $\left(2x+3y\right)^{2}$

11. _____

12. $\left(3x-5\right)\left(3x+5\right)$

12. _____

Factor each polynomial completely.

13. $-12a^{7}b^{5}+6a^{4}b^{7}$

13. _____

14. $x^{2}+6x-27$

14. _____

Chapter 5 Test Form B *cont'd*

   15. $25m^2 - 30mn + 9n^2$ **15.** _____

   16. $18x^2 - 7 - 39x$ **16.** _____

   17. $-6x^3 - 27x^2 - 30x$ **17.** _____

   18. $a^2 - 2ab + 4a - 8b$ **18.** _____

   19. $27x^3 + 8y^3$ **19.** _____

Solve each equation.

   20. $2(x-3)(x+4)(2x-5)=0$ **20.** _____

   21. $x^2 + 9x = -20$ **21.** _____

   22. $9x^3 = 36x$ **22.** _____

   23. $2x^2 - 3x = 14$ **23.** _____

   24. A ball is dropped from the top of a 576 foot   **24.** _____
        building. Its height $h(t)$ at time t seconds is
        given by $h(t) = -16t^2 + 576$. Determine how
        long it takes the ball to hit the ground.

   25. One number exceeds another number by 5, and   **25.** _____
        their product is 66. Find the numbers.

Chapter 5 Test Form C

Simplify each expression. Write answers with positive exponents.

1. $\dfrac{\left(6x^2 y^{-3}\right)^2 \left(8x^{-2} y^0\right)}{12x^4 y}$

1. _____

2. $\left(\dfrac{2x^2 y^{-2}}{4x^{-5}}\right)^{-3}$

2. _____

3. $\dfrac{x^{3m+7} \cdot x^{m-2}}{x^{m-4}}$

3. _____

4. Use scientific notation to find the quotient.
$\dfrac{\left(1.8\times10^{-4}\right)\left(3\times10^6\right)}{9\times10^{-5}}$

4. _____

5. Write in scientific notation. -0.00036

5. _____

6. Write without exponents. 8.43×10^7

6. _____

Perform the indicated operations.

7. $\left(3x^2 - 2x + 11\right) - \left(5x^2 + 1\right) + \left(x^2 - 8\right)$

7. _____

8. $\left(4x - 7y\right)\left(3x + 2y\right)$

8. _____

9. $3x^3 y^4 \left(2x^2 - 4y^3\right)$

9. _____

10. $\left(x + \dfrac{3}{4}\right)\left(x - \dfrac{1}{4}\right)$

10. _____

11. $\left(3x - 7\right)^2$

11. _____

12. $\left(2x - 7\right)\left(2x + 7\right)$

12. _____

Factor each polynomial completely.

13. $-18x^3 y^2 z - 24xy^3$

13. _____

14. $3x^2 + 6x - 72$

14. _____

Chapter 5 Test Form C *cont'd*

15. $25x^2 + 40xy + 16y^2$ 15. _____

16. $2x^3 - 16$ 16. _____

17. $m^4 - 81$ 17. _____

18. $x^2 - 4x + 4 - 16y^2$ 18. _____

19. $21x^4 - 12x^3 + 6x^2$ 19. _____

Solve each equations.

20. $x(2x - 3)(4x - 1) = 0$ 20. _____

21. $5x^2 + 27x - 56 = 0$ 21. _____

22. $x^2 - 8x = 20$ 22. _____

23. $6x(x - 3) = x + 7$ 23. _____

24. The length of a rectangle is 2 meters less than   24. _____
    twice the width. Find the dimensions of the
    rectangle if its area is 84 square meters.

25. One number exceeds another number by 7.   25. _____
    Their product is 120. Find the numbers.

Chapter 5 Test Form D

Circle the correct answer.

Simplify each expression. Write answers with positive exponents.

1. $\left(-4x^3y\right)^{-3}\left(3x^{-2}y^4\right)^2$

    a. $\dfrac{72y^{13}}{x^{23}}$ **b.** $\dfrac{576y^3}{x^{13}}$ **c.** $-\dfrac{9y^5}{64x^{13}y^3}$ **d.** $-\dfrac{9y^5}{64x^{13}}$

2. $\left(\dfrac{3a^2}{5}\right)^2$

    a. $\dfrac{9a^4}{5}$ **b.** $\dfrac{3a^4}{5}$ **c.** $\dfrac{9a^4}{25}$ **d.** $1\dfrac{25}{9a^4}$

3. $\left(\dfrac{x^{-2}y^3}{z}\right)^{-3}$

    a. $\dfrac{x^6y^9}{z^3}$ **b.** $\dfrac{z^3}{x^6y^9}$ **c.** $\dfrac{x^6z^3}{y^9}$ **d.** $\dfrac{x^5z^3}{y^6}$

4. $7x^0 + \left(14x^2\right)^0$

    a. 7   **b.** 8   **c.** 0   **d.** 2

5. Use scientific notation to find the quotient. $\dfrac{(0.0002)(24{,}000)}{0.0050}$

    a. 9.6×10^3 **b.** 9.6×10^4 **c.** 9.6×10^{-1} **d.** 9.6×10^2

6. Write in scientific notation. -2.46×10^6

    a. 0.00000246   **b.** −2,460,000   **c.** −0.00000246   **d.** −246,000,000

Perform the indicated operations.

7. $\left(3x^2y^2 + 2xy - 4x\right) + \left(-2x^2y - 3xy + 4x\right)$

    a. $x^2y^2 - xy$ **b.** 0   **c.** $x^2y + xy$ **d.** $3x^2y^2 - 2x^2y - xy$

Chapter 5 Test Form D *cont'd*

8. Subtract $\left(4x^3 - x^2 - 5\right)$ from $\left(4x^4 - 6x^2 + 6\right)$

    a. $-4x^4 + 4x^3 - 7x^2 + 1$ **b.** $4x^4 - 4x^3 - 7x^2 + 1$

    c. $4x^4 - 4x^3 - 5x^2 + 11$ **d.** $7x^2 + 1$

9. $-3x(x + 4)(x - 9)$

    a. $-3x^2 + 15x + 108$ **b.** $-3x^3 + 15x^2 + 108x$

    c. $3x^3 - 15x^2 - 108x$ **d.** $3x^3 - 15x^2 - 108x$

10. $(3x + 4y)(x - 6y)$

    a. $3x^2 - 21xy - 24y^2$ **b.** $3x - 14xy - 4y^2$

    c. $3x^2 - 14xy - 24y^2$ **d.** $4x^2 + xy - 2y^2$

11. $(3x - 2y)^2$

    a. $9x^2 - 12xy + 4y^2$ **b.** $9x^2 - 12xy - 4y^2$ **c.** $9x^2 - 4y^2$ **d.** $9x^2 + 4y^2$

12. $(4x - 7)(4x + 7)$

    a. $16x^2 - 28x - 49$ **b.** $16x^2 + 28x - 49$ **c.** $16x^2 + 49$ **d.** $16x^2 - 49$

13. $(x - 2)(x^2 + 6x - 4)$

    a. $x^3 + 8x^2 + 8x + 8$ **b.** $x^3 + 4x^2 - 16x - 4$

    c. $x^3 + 4x^2 - 16x + 8$ **d.** $x^3 + 4x^2 + 8x - 8$

Factor each polynomial completely.

14. $-16a^3b^2 + 20a^4b$

    a. $-4a^3b(4b - 5a)$ **b.** $-4a^3b(4b + 5a)$

    c. $2ab(-8a^2b + 10a^3)$ **d.** $2a^3b(-8b + 10a)$

15. $x^2 - 5x - 6$

    a. $(x - 3)(x - 2)$ **b.** $(x - 6)(x + 1)$

    c. $(x + 6)(x - 1)$ **d.** $(x + 3)(x - 2)$

Chapter 5 Test Form D *cont'd*

16. $3m^3 + 9m^2 - 12m$

    a. $3(m^2 + 4)(m - 1)$ **b.** $3m(m + 4)(m - 1)$

    c. $3m(m - 4)(m + 1)$ **d.** $3m(m - 2)^2$

17. $25x^2 - 20xy + 4y^2$

    a. $(5x + 2y)^2$ **b.** $5(x - 2y)^2$

    c. $(5x - 2y)^2$ **d.** $(5x - 2y)(5x + 2y)$

18. $-6a^2 + 4ab + 2b^2$

    a. $(3a + b)(2b - 2a)$ **b.** $-2(3a - b)(a + b)$

    c. $-2(3a + b)(a - b)$ **d.** $-2(3a - b)(a - b)$

19. $16x^2 - 81y^2$

    a. $(4x - 9y)^2$ **b.** $(4x - 9y)(4x - 9y)$

    c. $(4x + 9y)^2$ **d.** $(4x + 9y)(4x - 9y)$

Solve each equation.

20. $-3(x + 2)(x - 5) = 0$

    a. $-2, 0, 5$ **b.** $-5, 0, 2$ **c.** $-2, 5$ **d.** $-5, 2$

21. $4x^2 - 7x - 2 = 0$

    a. $-2, \dfrac{1}{4}$ **b.** $-\dfrac{1}{4}, 2$ **c.** $-2, -\dfrac{1}{4}$ **d.** $\dfrac{1}{4}, 2$

Chapter 5 Test Form D *cont'd*

22. $2x^3 + 15x = 13x^2$

     a. $0, \dfrac{3}{2}, 5$ **b.** $\dfrac{3}{2}, 5$ **c.** $-\dfrac{3}{2}, 0, 5$ **d.** $-5, -\dfrac{3}{2}$

23. A stone is dropped from a 324 foot cliff. Its height $h(t)$ at time t seconds is given by $h(t) = -16t^2 + 324$. Determine how long it takes the stone to hit the ground.

     a. 4.5 sec   **b.** 3.5 sec   **c.** 5 sec   **d.** 6 sec

24. The sum of a number and its square is 30. Find the number

     a. −3, 10   **b.** −10, 3   **c.** −6, 5   **d.** −5, 6

25. A rectangular room with an area of 280 square feet has a width that is 6 feet more than the length. Find the dimensions of the room.

     a. 14 feet by 20 feet   **b.** 20 feet by 26 feet
     c. 12 feet by 18 feet   **d.** 16 feet by 22 feet

Chapter 5 Test Form E

Circle the correct answer.

Simplify each expression. Write answers with positive exponents.

1. $3a^2b\left(-2a^{-3}b^4\right)^{-2}$

    a. $\dfrac{12a^6}{b^5}$ **b.** $\dfrac{a^2}{36b^8}$ **c.** $-\dfrac{3a^4}{b^9}$ **d.** $\dfrac{3a^8}{4b^7}$

2. $\left(\dfrac{2x^2y^{-2}}{3x^{-2}y^4}\right)^3\cdot\left(\dfrac{9x^3y^{-2}}{4x^{-3}}\right)$

    a. $\dfrac{2x^4}{3y}$ **b.** $\dfrac{2x^{18}}{3y^{20}}$ **c.** $\dfrac{x^4}{2y}$ **d.** $\dfrac{x^{14}}{2y^{17}}$

3. $\dfrac{x^{2a+1}}{x^{3a-3}}$

    a. x^{5a-2} **b.** x^{5a+2} **c.** x^{-a+4} **d.** x^{-a-2}

4. $\left(-4a^{-5}b^2\right)^{-3}$

    a. $\dfrac{a^{15}}{6b^6}$ **b.** $-\dfrac{1}{64a^2b}$ **c.** $-\dfrac{a^{15}}{64b^6}$ **d.** $-\dfrac{a^2}{64b}$

5. Use scientific notation to find the quotient. $\dfrac{\left(4.8\times10^{-7}\right)\left(3.2\times10^4\right)}{3.84\times10^{-6}}$

    a. 4×10^3 **b.** 4×10^{-4} **c.** 4×10^2 **d.** 0.4×10^{-3}

6. Use scientific notation to find the quotient $\dfrac{(210)(0.0035)}{3.84\times10^{-6}}$

    a. 19×10^2 **b.** 1.91×10^{-9} **c.** 2×10^2 **d.** 1.91×10^5

Perform the indicated operations.

7. $\left(7x^2-2\right)+\left(3x+4\right)-\left(9x^2-4x\right)$

    a. x^2-2x **b.** $-2x^2-x+2$ **c.** $16x^2-x+2$ **d.** $-2x^2+7x+2$

Name: **Date:**

Instructor: **Section:**

Chapter 5 Test Form E *cont'd*

8. $(5x^2y)(3xy^4z)$

     a. $15x^3y^5z$ **b.** $15x^2y^4z$ **c.** $15x^3y^4z$ **d.** $8x^3y^5z$

9. $(3x-5y)(x+6y)$

     a. $3x^2+23xy+30y^2$ **b.** $3x^2-23xy+30y^2$

     c. $3x^2+13xy-30y^2$ **d.** $3x^2+xy-30y^2$

10. $2mn^3(m-2)(m+5)$

     a. $m^3n^3-10mn^3$ **b.** $2m^3n^3+6m^2n^3-20mn^3$

     c. $2m^3n^3+14m^2n^3-20mn^3$ **d.** $2m^3n^3+6m-10n$

11. $(7x-4)^2$

     a. $49x^2-56x+16$ **b.** $49x^2-16$ **c.** $49x^2+16$ **d.** $49x^2-56x-16$

12. $(3x-8)(3x+8)$

     a. $9x^2+24x-64$ **b.** $3x^2-64$ **c.** $9x^2-24x-64$ **d.** $9x^2-64$

13. $(2x+3)(x^2-4x+5)$

     a. $2x^3-3x^2+22x+15$ **b.** $2x^3-8x^2-12x+15$

     c. $2x^3-5x^2-2x+15$ **d.** $2x^3-8x^2+22x+15$

Factor each polynomial completely.

14. $3x^2+21x+36$

     a. $(3x+9)(x+4)$ **b.** $3(x+3)(x+4)$

     c. $(x+3)(3x+12)$ **d.** $3(x+6)(x+2)$

Chapter 2 Test Form E *cont'd*

15. $16x^4 y^2 - 54xy^2$

   a. $2xy^2 (2x - 3)^2$ **b.** $4(x^2 y - 4xy)$

   c. $2xy^2 (8x^3 - 27)$ **d.** $2xy^2 (2x - 3)(4x^2 + 6x + 9)$

16. $8m^2 + 14m - 15$

   a. $2(4m - 3)(m + 5)$ **b.** $(4m + 3)(2m - 5)$

   c. $(4m - 5)(2m + 3)$ **d.** $(4m - 3)(2m + 5)$

17. $9m^2 - 42mn + 49n^2$

   a. $(3m - 7n)^2$ **b.** $(3m - 7n)(3m + 7n)$

   c. $(9m - 49n)^2$ **d.** $(3m + 7n)^2$

18. $5x^2 + 30xy + 45y^2$

   a. $(5x + 3y)^2$ **b.** $5(3x + y)^2$ **c.** $5(x + 3y)^2$ **d.** $5(x + 3y)(x + y)$

19. $x^3 + x^2 - 16x - 16$

   a. does not factor   **b.** $x^2 (x + 1) - 16(x + 1)$

   c. $(x^2 - 16)(x + 1)$ **d.** $(x + 1)(x + 4)(x - 4)$

Solve each equation.

20. $3x(x - 5)(2x - 3) = 0$

   a. $-5, 0, \dfrac{3}{2}$ **b.** $0, \dfrac{3}{2}, 5$ **c.** $-3, \dfrac{3}{2}, 5$ **d.** $-3, \dfrac{3}{2}, 4$

Chapter 5 Test Form E *cont'd*

21. $2x^2 + x - 10 = 0$

    a. $-2, \dfrac{5}{2}$ **b.** $-\dfrac{2}{5}, 2$ **c.** $2, \dfrac{5}{2}$ **d.** $-\dfrac{5}{2}, 2$

22. $3x^2 - 15x = 18$

    a. $-1, 6$ **b.** $-1, 3, 6$ **c.** $-6, 11$ **d.** $-1, 0, 6$

23. $(x+3)(x-2) = 2x + 6$

    a. $-3, 2$ **b.** $-3, 4$ **c.** $-4, -3$ **d.** $-4, 3$

A stone is thrown upward from the top of the cliff, which is 864 feet high, with an initial velocity of 48 feet per second. Neglecting air resistance, the height $h(t)$ of the stone t seconds after it is thrown is given by $h(t) = -16t^2 + 48t + 864$.

24. When will the stone hit the ground?

    a. 10 sec   **b.** 9 sec   **c.** 6 sec   **d.** 4 sec

25. Find the height of the stone when $t = 5$.

    a. 896 feet   **b.** 800 feet   **c.** 704 feet   **d.** 416 feet

Chapter 5 Test Form F

Circle the correct answer.

Simplify each expression. Write down with positive exponents.

1. $\dfrac{\left(4m^{-2}n^3\right)^2\left(3m^4n^{-2}\right)^2}{8m^{-4}n}$

   a. 0   **b.** $18m^8n$ **c.** $\dfrac{m^{12}}{32n}$ **d.** $\dfrac{m^{12}}{n}$

2. $\dfrac{x^{4y-3}\cdot x^{1+3y}}{x^{1-5y}}$

   a. x^{12y-3} **b.** x^{2y-1} **c.** x^{9y} **d.** x^{64y-3}

3. Use scientific notation to find the quotient. $\dfrac{\left(2.7\times10^{-6}\right)\left(3\times10^4\right)}{9\times10^{-6}}$

   a. 0.9×10^{-18} **b.** 9×10^{-30} **c.** 0.9×10^4 **d.** 9×10^3

4. $6^1+4x^0+3^0$

   a. 8   **b.** 6   **c.** 11   **d.** $72x$

Perform the indicated operations.

5. Subtract $\left(x^2-4x-3\right)$ from $\left(3x^2-6x+8\right)$

   a. $2x^2-10x+5$ **b.** $2x^2-2x+11$
   c. $4x^2-10x+5$ **d.** $2x^2-2x+5$

6. $3\left(x+\dfrac{5}{3}\right)\left(x-\dfrac{7}{3}\right)$

   a. $x^2-2x-35$ **b.** $3x^2+12x-\dfrac{35}{3}$

   c. $3x^2+2x-\dfrac{35}{3}$ **d.** $3x^2-2x-\dfrac{35}{3}$

Name: **Date:**

Instructor: **Section:**

Chapter 5 Test Form F *cont'd*

7. $3m^3n^2(m-2)(n-1)$

  a. $3m^4n^3 + 6m^3n^2$ **b.** $-9m^4n^3 + 6m^3n^2$

  c. 0 **d.** $3m^4n^3 - 3m^4n^2 - 6m^3n^3 + 6m^3n^2$

8. $(6x-4)^2$

  a. $36x^2 - 16$ **b.** $36x^2 + 16$ **c.** $36x^2 - 48x - 16$ **d.** $36x^2 - 48x + 16$

9. $(3x-8)(3x+8)$

  a. $9x^2 - 64$ **b.** $9x^2 + 64$ **c.** $9x^2 + 24x - 64$ **d.** $9x^x - 24x + 64$

10. $(3a+2b)(4a-5b)$

  a. $12a^2 - 7ab - 10b^2$ **b.** $12a^2 + 23ab - 10b^2$

  c. $12a^2 + 7ab - 10b^2$ **d.** $12a^2 - 23ab + 10b^2$

11. $(2x-5)(x^2 - 7x + 5)$

  a. $2x^3 - 9x^2 - 25x - 25$ **b.** $2x^3 - 19x^2 + 45x - 25$

  c. $2x^3 + 9x^2 + 25x - 25$ **d.** $2x^3 + 19x + 45x - 25$

Factor each polynomial completely.

12. $-10x^5y^2 - 25x^3y^2$

  a. $-5x^2y^2(2x^2 + 5y)$ **b.** $-5x^3y^2(2x - 5y)$

  c. $-5x^3y^2(2x^2 + 5)$ **d.** $-5x^2y^2(2x^3 + 5xy)$

13. $18x^2 - 84xy + 98y^2$

  a. $2(3x - 7y)(3x + 7y)$ **b.** $2(3x + 7y^2)$

  c. $6(2x - 7y)^2$ **d.** $2(3x - 7y)^2$

Chapter 5 Test Form F *cont'd*

14. $32x^2 + 36xy - 35y^2$

     a. $(8x - 7y)(3x + 7y)$ **b.** $(16x - 5y)(2x + 7y)$

     c. $(8x - 5y)(4x + 7y)$ **d.** $(8x + 5y)(4x - 7y)$

15. $125a^3 - 8b^3$

     a. $(5a - 2b)(25a^2 + 20ab + 4b^2)$ **b.** $(5a - 2b)(5a^2 + 10ab + 2b^2)$

     c. $(5a - 2b)(25a^2 + 10ab + 4b^2)$ **d.** $3b(5a - 2b)(25a^2 - 10ab + 4b^2)$

16. $120b^3 + 129b^2 - 18b$

     a. $3b(5b - 6)(8b + 1)$ **b.** $3(5b^2 + 6)(8b - 1)$

     c. $3b(5b - 6)(8b - 1)$ **d.** $(5b + 6)(8b - 1)$

17. $x^2 + 4x + 4 - 49y^2$

     a. $(x - 2 - 7y)(x - 2 + 7y)$ **b.** $(x + 2 - 7y)(x + 2 + 7y)$

     c. $(x - 2 + 7y)(x + 2 - 7y)$ **d.** $(x + 2 - 7y)^2$

18. $256a^4 - b^4$

     a. $(16a^2 - b^2)^2$ **b.** $(16a^2 + b^2)(4a - b)(4a + b)$

     c. $(4a - b)^2(4a + b)^2$ **d.** $(16a^2 + b^2)(16a^2 - b^2)$

Solve each equation.

19. $7x^2(5x + 7)(3x - 4) = 0$

     a. $-\dfrac{7}{5}, 0, \dfrac{4}{3}$ **b.** $-\dfrac{7}{5}, \dfrac{4}{3}$ **c.** $-\dfrac{5}{7}, 0, \dfrac{3}{4}$ **d.** $-\dfrac{4}{3}, 0, \dfrac{7}{5}$

20. $x^2 - x - 20 = 0$

     a. $-2, 10$ **b.** $-5, 4$ **c.** $-4, 5$ **d.** $-10, 2$

21. $11x + 45 = 4x^2$

     a. $-\dfrac{4}{9}, -5$ **b.** $-5, -\dfrac{9}{4}$ **c.** $-\dfrac{9}{4}, 5$ **d.** $-5, \dfrac{9}{4}$

Chapter 5 Test Form F *cont'd*

22. $(x-8)^2 = 25$

    a. −3, 13   **b.** 8, 13   **c.** 3, 13   **d.** 3, 8

23. $8x(x-3) = -6x - 9$

    a. $\dfrac{3}{4}, \dfrac{3}{2}$ **b.** $\dfrac{3}{2}, 3$ **c.** $-3, -\dfrac{3}{2}$ **d.** $-\dfrac{3}{4}, \dfrac{3}{2}$

24. If the cost, $C(x)$, for manufacturing x units of a certain product is given by $C(x) = x^2 - 20x + 35$, find the number of units manufactured at a cost of \$5560.

    a. 65 units   **b.** 85 units   **c.** 70 units   **d.** 95 units

25. The product of two consecutive even integers is 2 less than 5 times the smaller one. What are the numbers?

    a. 4, 6   **b.** 0, 2   **c.** 2, 4   **d.** 6, 8