p 310

59. side: $3y^4$ $\quad V = s^3$

$$V = (3y^4)^3 = 3^3 y^{12} = 27y^{12}$$

63.
$$\frac{(-4)^6}{(-4)^3} = (-4)^3 = -64$$

62. $\dfrac{y^{10}}{y^9} = y^1$ or y

64. $\dfrac{(-6)^{13}}{(-6)^{11}} = (-6)^2 = 36$

66. $\dfrac{x^8y^6}{xy^5} = x^7y$

68. $\dfrac{9a^4b^7}{27ab^2} = \dfrac{a^3b^5}{3}$ or $\frac{1}{3}a^3b^5$

70. $23^0 = 1$

72. $(4y)^0 = 1$

74. $-2x^0 = -2(1) = -2$

76. $-3^0 + 4^0 = -1 + 1 = 0$

78. $(-9)^2 = 81$

80. $\left(\frac{2}{3}\right)^3 = \frac{8}{27}$

82. $\left(\frac{pt}{3}\right)^3 = \frac{p^3t^3}{27}$

86. $(3y^4)(-5y)$ $= -15y^5$

88. $(y^2z^2)(y^{15}z^{13})$ $= y^{17}z^{15}$

90. $(-3s^5t)(-7st^{10}) = +21s^6t^{11}$

5.2: Adding and Subtracting Polynomials

Expression, term

Expression: any "legal" combination of letters, numbers, & symbol of arithmetic operation

(for our purposes – for now we won't include division)

EX: 3

x

$6x + 4$

$3x^7 - \frac{2}{3}x^5 + \sqrt{2}x - 12$

NON-EX: $\frac{1}{x}$

$\frac{3x+5}{2x-5}$

$\sqrt{x}$

Term: a product of numbers and/or letters

EX: 3

x

$14x^2y^3$

NON-EX: $x+2$

$\frac{1}{x}$

Coefficient (numerical)

EX: $3x^2y^4$ 3

x^2 1

Monomial : one term

Binomial : two terms $x+2$

$3x^2 - 4x$

$16x - 12y$

Trinomial : three terms $x^2 + 2x - 5$

Polynomials : "many" terms

Polynomial

A **polynomial in x** is a finite sum of terms of the form ax^n, where a is a real number and n is a whole number.

Types of Polynomials

A **monomial** is a polynomial with exactly one term.

A **binomial** is a polynomial with exactly two terms.

A **trinomial** is a polynomial with exactly three terms.

Degree of a Term

The degree of a term is the sum of the exponents on the variables contained in the term.

Ex:

Term	Degree
$3x$	1
$4x^2$	2
$6x^2y^3$	5
$-17x^6$	6
x	1

$x^2y^7z^5$	14
$8x^2$	2
2^3x^2	2
2^3xx	2
$12x^0$	0
0	none

Ex: (p 320)

Find the degree of a polynomial

Find the value of each polynomial when **(a)** $x = 0$ *and* **(b)** $x = -1$. *See Examples 4 and 5.*

16. $x^2 - 4$

18. $-2x^3 + 3x^2 - 6$

Simplify

24. $18x^3 - 4x^3$

32. $\frac{1}{6}x^4 - \frac{1}{7}x^2 + 5 - \frac{1}{2}x^4 - \frac{3}{7}x^2 + \frac{1}{3}$

Perform the Following:

36. $(3x^2 + 7) + (3x^2 + 9)$

40. $(5x^2 + 4) - (-2y^2 + 4)$

44. $(-7x^2 + 4x + 7) - (-8x + 2)$

46.
$$\begin{array}{r} 7x^3 + 3 \\ +2x^3 + 1 \\ \hline \end{array}$$

48.
$$\begin{array}{r} 5u^5 - 4u^2 + 3u - 7 \\ -(3u^5 + 6u^2 - 8u + 2) \\ \hline \end{array}$$

60. $(6y^5 - 6y^3 + 4) + (-2y^5 - 8y^3 - 7)$

62. $(-a^2 + 1) - (a^2 - 3) + (5a^2 - 6a + 7)$

68. Subtract $(5y + 7x^2)$ from the sum of $(8y - x)$ and $(3 + 8x^2)$.

70. Subtract $(4x^2 - 2x + 2)$ from the sum of $(x^2 + 7x + 1)$ and $(7x + 5)$.

80. $(3x - 2 + 6y) + (7x - 2 - y)$

86. $(3x^2y - 6xy + x^2y^2 - 5) - (11x^2y^2 - 1 + 5yx^2)$

92. $-7x(x)$

94. $6r^3(7r^{10})$

96. $-z^2y(11zy)$

5.3: Multiplying Polynomials

Ex: (p 327)

2. $9t^6(-3t^5)$

4. $(-5.2x^4)(3x^4)$

6. $\left(-\frac{3}{4}y^7\right)\left(\frac{1}{7}y^4\right)$

8. $(x)(5x^4)(-6x^7)$

18. $-x(6y^3 - 5xy^2 + x^2y - 5x^3)$

22. $(x + 2)(x + 9)$

24. $(y - 10)(y + 11)$

26. $\left(x + \frac{3}{5}\right)\left(x - \frac{2}{5}\right)$

28. $(5x^2 + 2)(6x^2 + 2)$

34. $(x^2 + 4)^2$

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

42. $(3 + b)(2 - 5b - 3b^2)$

44. $(y - 1)^3$

46. $(3x + 4)^3$

50. $(4x - 5)(8x^2 + 2x - 4)$

52. $(3x^2 - x + 2)(x^2 + 2x + 1)$

56. $-5x(x^2 - 3x + 10)$

60. $\left(m + \frac{2}{9}\right)\left(m - \frac{1}{9}\right)$

68. $(5x + 4)(x^2 - x + 4)$

70. $(a^2 + 3a - 2)(2a^2 - 5a - 1)$

5.4: Special Products

Ex: (p 334)

4. $(y - 12)(y + 4)$

6. $(3y - 5)(2y - 7)$

12. $(x + 7)^2$

24. $(4x - 5)(4x + 5)$

26. $\left(10x + \frac{2}{7}\right)\left(10x - \frac{2}{7}\right)$

28. $(2x - y)(2x + y)$

36. $(6a + 7)(6a + 5)$

38. $(x - 10)(x + 10)$

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

44. $(x - 2)(x^2 - 4x + 2)$

48. $(11x - 7y)(11x + 7y)$

54. $(x^5 + 5)(x^2 - 8)$

62. $\left(\frac{2}{3}a - b^2\right)\left(\frac{2}{3}a - b^2\right)$

70. $(3x + 5)(3x - 5)$

74. $\left(\frac{a}{2} + 4y\right)\left(\frac{a}{2} - 4y\right)$

78. $(b + 3)(2b^2 + b - 3)$

82. $\frac{x^3y^6}{xy^2}$

84. $\frac{-6a^8y}{3a^4y}$

86. $\frac{-48ab^6}{32ab^3}$

5.5: Negative Exponents & Scientific Notation

Look at division

Negative Exponents

If a is a real number other than 0 and n is an integer, then

$$a^{-n} = \frac{1}{a^n}$$

Negative Exponents

If a is a real number other than 0 and n is an integer, then

$$a^{-n} = \frac{1}{a^n} \quad \text{and} \quad \frac{1}{a^{-n}} = a^n$$

Ex: (p 343)

2. 6^{-2}

8. $\left(\frac{1}{8}\right)^{-2}$

16. $\frac{r^{-5}}{s^{-2}}$

22. $4^{-2} - 4^{-3}$

24. $\frac{-1}{y^{-6}}$

Summary of Exponent Rules

If m and n are integers and a, b, and c are real numbers, then:

Product rule for exponents: $a^m \cdot a^n = a^{m+n}$

Power rule for exponents: $(a^m)^n = a^{m \cdot n}$

Power of a product: $(ab)^n = a^n b^n$

Power of a quotient: $\left(\frac{a}{c}\right)^n = \frac{a^n}{c^n}, \quad c \neq 0$

Quotient rule for exponents: $\frac{a^m}{a^n} = a^{m-n}, \quad a \neq 0$

Zero exponent: $a^0 = 1, \quad a \neq 0$

Negative exponent: $a^{-n} = \frac{1}{a^n}, \quad a \neq 0$

Ex: (p 343)

46. $\dfrac{-5x^4y^5}{15x^4y^2}$

48. $(-5a^4b^{-7})(-a^{-4}b^3)$

52. $\left(\dfrac{a^5b}{a^7b^{-2}}\right)^{-3}$

56. $\dfrac{5^{-1}z^7}{5^{-2}z^9}$

58. $\dfrac{6^{-5}x^{-1}y^2}{6^{-2}x^{-4}y^4}$

60. $\left(\dfrac{r^{-2}s^{-3}}{r^{-4}s^{-3}}\right)^{-3}$

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

5.6: Dividing Polynomials

Dividing a Polynomial By a Monomial

Divide each term of the polynomial by the monomial.

$$\frac{a+b}{c} = \frac{a}{c} + \frac{b}{c}, \quad c \neq 0$$

Ex: (p 350)

2. $\dfrac{15x^2 - 9x^5}{x}$

4. $\dfrac{8x^3 - 4x^2 + 6x + 2}{2}$

8. $\dfrac{6x^5 + 3x^4}{3x^4}$

34. $\dfrac{m^3n^2 - mn^4}{mn}$