5.1

81. $$\left(\frac{\overset{3^2}{9}ab^{-2}}{\underset{2^3}{8}a^{-2}b}\right)^{-2}\left(\frac{3a^{-2}b}{2a^{2}b^{-2}}\right)^{3}$$

$$= \frac{3^{-4}a^{-2}b^{4}}{2^{-6}a^{4}b^{-2}} \cdot \frac{3^{3}a^{-6}b^{3}}{2^{3}a^{6}b^{-6}}$$

$$= \frac{3^{-4+3}a^{-2+(-6)-4-6}b^{4+3-(-2)-(-6)}}{2^{-6+3}}$$

$$= \frac{3^{-1}a^{-18}b^{15}}{2^{-3}} = \frac{2^{3}b^{15}}{3a^{18}} = \boxed{\frac{8b^{15}}{3a^{18}}}$$

79. $\dfrac{(3x^{-2}y)^{-2}}{(4xy^{-2})^{-1}} = \dfrac{3^{-2}x^{4}y^{-2}}{4^{-1}x^{-1}y^{2}}$

$= \dfrac{4^{1}x^{5}}{3^{2}y^{4}} = \boxed{\dfrac{4x^{5}}{9y^{4}}}$

Scientific Notation

$3.14 \times 10^{7} = 31400000$

$2.18 \times 10^{-5} = 0.0000218$

$\boxed{}.\ldots \times 10^{\text{integer}}$

single digit 1–9

$4523600 = 4.5236 \times 10^{6}$

$0.00000000023 = 2.3 \times 10^{-10}$

5.2 Introduction to Polynomials

A polynomial is an expression consisting of variables and constants, using only the operations of addition, subtraction, multiplication, and non-negative integer exponents.

A polynomial with one term is a monomial.

e.g. $3x^2$ or $5xy^3$

A polynomial with two terms is a binomial.

e.g. $7xy^5 - 3x$ or $xyzw + 23x^2$ or $x - 2$

A polynomial with three terms is a trinomial.

e.g. $x^2 + 5x - 6$

The <u>degree of a monomial</u> is the sum of the exponents of the variables.

$7x^{1}y^5$ has degree 6

$xyzw$ has degree 4

$13x^3yz^2$ has degree <u>6</u>

$-2ab^3$ has degree <u>4</u>

The <u>degree of a polynomial</u> is the greatest of the degrees of any of its terms.

$\overset{2}{x^2} + \overset{1}{5x} - \overset{0}{6}$ has degree 2

$\overset{2}{3xy} - \overset{4}{15x^3y} + \overset{5}{2v^3xz}$ has degree <u>5</u>

$\underset{3}{15xy^2} - \underset{1}{\sqrt{2}x} + \underset{3}{32xyz} - \underset{0}{5000}$ has degree <u>3</u>

The terms of a polynomial in only one variable are usually arranged in descending order, so that the exponents of the variable decrease from left to right, in the form

$$f(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \cdots + a_2x^2 + a_1x^1 + a_0x^0$$

$a_n, \ldots, a_0$ are real-numbered coefficients

a_nx^n is the lead term (term containing the variable with the largest exponent)

a_n is the leading coefficient (coefficient of the variable with the largest exponent)

a_0 is the constant term (term without a variable)

n is the degree of the polynomial (largest exponent)

The linear function $f(x) = mx^1 + b$ is a polynomial of degree one.
A second-degree polynomial of the form $f(x) = ax^2 + bx + c$ is called a quadratic function.
A third-degree polynomial is called a cubic function.

Problems from Section 5.2:

Is it a polynomial? If so, state the lead term, leading coefficient, degree, and constant term.

16. $P(x) = 3x^4 - 3x - 7$

Lead term: $3x^4$
Leading coefficient: 3
Degree: 4
Constant term: -7

18. $R(x) = \frac{3x^2 - 2x + 1}{x}$

not a polynomial (no variables in denominator)

Lead term:
Leading coefficient:
Degree:
Constant term:

20. $f(x) = x^2 - \sqrt{x+2} - 8$

not a polynomial (no variables under radicals)

Lead term:
Leading coefficient:
Degree:
Constant term:

22. $g(x) = -4x^5 + 3x^2 + x - \sqrt{7}$

Lead term: $-4x^5$
Leading coefficient: -4
Degree: 5
Constant term: $-\sqrt{7}$

To evaluate a polynomial, replace the variable by its value and simplify.

$-(1)^2 = -(1^2)$

$-1^2 = -1$

$(-1)^2 = 1$

6. Given $R(x) = -x^3 + 2x^2 - 3x + 4$, evaluate $R(-1)$.

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

$= 1 + 2 + 3 + 4 =$

$= \boxed{10}$

Polynomials can be added by combining like terms.

36. $(3x^2 - 2x + 7) + (-3x^2 + 2x - 12)$

$x^2 + x \neq x^3$

$= 3x^2 - 3x^2 - 2x + 2x + 7 - 12$

$= \boxed{-5}$

42. $(3a^2 - 9a) - (-5a^2 + 7a - 6)$

$(3a^2 - 9a) + (-1)(-5a^2 + 7a - 6)$

$3a^2 - 9a + 5a^2 - 7a + 6$

$\boxed{8a^2 - 16a + 6}$

50. $(2x^4 - 2x^2 + 1) - (3x^3 - 2x^2 + 3x + 8)$

$\boxed{2x^4 - 3x^3 - 3x - 7}$

46. $(2x^{2n} - x^n - 1) - (5x^{2n} + 7x^n + 1)$

$\boxed{-3x^{2n} - 8x^n - 2}$

Homework:
5.2 #3-7odd, 15-25odd, 35-49odd