1.1   Write $f(x) = 8x + 3x^8 - 2x^5$ in descending order.
$$3x^8 - 2x^5 + 8x$$
How many terms does $f(x)$ have? 3
What degree is $f(x)$? 8
What is the lead coefficient of $f(x)$? 3

Write $g(x) = 1 - 9x$ in descending order.
$$-9x + 1$$
How many terms does $g(x)$ have? 2
What degree is $g(x)$?  1
What is the lead coefficient of $g(x)$? $-9$

Write $p(x) = 2x^7 + x^5 - 3x^9$ in descending order.
$$-3x^9 + 2x^7 + x^5$$
How many terms does $p(x)$ have? 3
What degree is $p(x)$? 9
What is the lead coefficient of $p(x)$? $-3$

Simplify: $(3x^2 + 3) - (8x^2 - 2x)$
$$3x^2 + 3 - 8x^2 + 2x$$
$$3x^2 - 8x^2 + 2x + 3$$
$$-5x^2 + 2x + 3$$

Simplify: $(7x + 4x^2 + 5) + (x^2 + 3)$
$$7x + 4x^2 + 5 + x^2 + 3$$
$$4x^2 + x^2 + 7x + 5 + 3$$
$$5x^2 + 7x + 8$$

Simplify: $(2x - 9)^2$
$$(2x - 9)(2x - 9)$$
$$4x^2 - 18x - 18 + 81$$
$$4x^2 - 36x + 81$$

Simplify: $(5x^2 - 3)(x + 10)$
$$5x^3 + 50x^2 - 3x - 30$$

1.2   Expand the binomial: $(x + 2)^5$
$$x^5 + 5x^4(2) + 10x^3(2)^2 + 10x^2(2)^3 + 5x(2)^4 + 2^5$$
$$x^5 + 10x^4 + 40x^3 + 80x^2 + 80x + 32$$

Expand the binomial: $(2x + 5)^3$
$$(2x)^3 + 3(2x)^2(5) + 3(2x)(5)^2 + 5^3$$
$$8x^3 + 60x^2 + 150x + 125$$

The $a^5$ term of the binomial expansion of $(a - 5)^9$ is given by which expression?
$$\binom{9}{5} a^5(-5)^4$$

The $a^5$ term of the binomial expansion of $(3a + 1)^8$ is given by which expression?
$$\binom{8}{5} (3a)^5(1)^3$$

1.3 Divide using Long Division:

$$\frac{x^2 + 11x + 28}{x + 5} \qquad\qquad \frac{2x^3 - x - 5}{x - 2} \qquad\qquad \frac{x^3 + 2x^2 + 5x + 1}{x^2 + 2x + 3}$$

$$\begin{array}{r} x + 6 - \frac{2}{x+5} \\ x+5\overline{)x^2 + 11x + 28} \\ \underline{-(x^2 + 5x)} \\ 6x + 28 \\ \underline{-(6x + 30)} \\ -2 \end{array}$$

$$\begin{array}{r} 2x^2 + 4x + 7 + \frac{9}{x-2} \\ x-2\overline{)2x^3 + 0x^2 - x - 5} \\ \underline{-(2x^3 - 4x^2)} \\ 4x^2 - x \\ \underline{-(4x^2 - 8x)} \\ 7x - 5 \\ \underline{-(7x - 14)} \\ 9 \end{array}$$

$$\begin{array}{r} x + \frac{2x+1}{x^2+2x+3} \\ x^2+2x+3\overline{)x^3 + 2x^2 + 5x + 1} \\ \underline{-(x^3 + 2x^2 + 3x)} \\ -2x + 1 \end{array}$$

1.4 What is the dividend polynomial?
$$x^2 - 2x + 7$$

What is the divisor polynomial?
$$x - 6$$

Interpret the results of the synthetic division.
$$x + 4 + \frac{31}{x - 6}$$

$$\begin{array}{c|rrr} 6 & 1 & -2 & 7 \\ & \downarrow & 6 & 24 \\ \hline & 1 & 4 & 31 \end{array}$$

What is the remainder of $\dfrac{3x^3 + x^2 - 5x - 7}{x - 2}$

$$\begin{array}{c|rrrr} 2 & 3 & 1 & -5 & -7 \\ & \downarrow & 6 & 14 & 18 \\ \hline & 3 & 7 & 9 & \boxed{11} \end{array}$$

Remainder is 11.

**Mixed Review:**

Simplify:

$$(9x - 11) - (2x - 14) + (10x - 31)$$
$$9x - 11 - 2x + 14 + 10x - 31$$
$$9x - 2x + 10x - 11 + 14 - 31$$
$$17x - 28$$

Use synthetic division to simplify:

$$\frac{x^5 - 7x^4 + 2}{x - 3}$$

$$\begin{array}{c|rrrrrr} 3 & 1 & -7 & 0 & 0 & 0 & 2 \\ & \downarrow & 3 & -12 & -36 & -108 & -324 \\ \hline & 1 & -4 & -12 & -36 & -108 & \boxed{-322} \end{array}$$

$$x^4 - 4x^3 - 12x^2 - 36x - 108 - \frac{322}{x - 3}$$

Simplify:

$$(3x - 5)(8x^2 - 11x + 13)$$
$$24x^3 - 33x^2 + 39x - 40x^2 + 55x - 65$$
$$24x^3 - 73x^2 + 94x - 65$$

Prove whether or not $(x - 5)$ is a factor of $x^3 - 3x^2 - 3x - 35$ and write a sentence explaining your reasoning.

$$\begin{array}{c|rrrr} 5 & 1 & -3 & -3 & -35 \\ & \downarrow & 5 & 10 & 35 \\ \hline & 1 & 2 & 7 & \boxed{0} \end{array}$$

Since the remainder is 0, then $(x - 5)$ is a factor of $x^3 - 3x^2 - 3x - 35$.