More problems for section 3.2 of *Essentials of Precalculus with Calculus Previews* by Zill and Dewar, 5e.

How to make up your own polynomial long division practice problems:

- Pick any two polynomials $Q(x)$ and $D(x)$. Carefully calculate their product.
- Pick any polynomial $R(x)$, but make sure that the degree of $R(x)$ is less than that of $D(x)$. For instance, if $D(x)$ is quadratic, $R(x)$ can be linear or constant. Add $R(x)$ to the product $Q(x)D(x)$. Call the resulting polynomial $P(x)$.
- You’ve arranged it so that $P(x) = Q(x)D(x) + R(x)$ and $\deg R(x) < \deg D(x)$. If you now divide $P(x)$ by $D(x)$, the quotient should be $Q(x)$ and remainder should be $R(x)$.
- To practice synthetic division, use $D(x)$ of the form $x - c$.

To read about synthetic division, Google the phrase “college algebra tutorial synthetic division”

You should practice writing the results of long division two ways:

$$P(x) = Q(x)D(x) + R(x) \quad \text{and} \quad \frac{P(x)}{D(x)} = \frac{Q(x)}{D(x)} + \frac{R(x)}{D(x)}.$$ 

Note that in the second, the improper rational function $\frac{P(x)}{D(x)}$ is written as the polynomial $Q(x)$ plus the proper rational function $\frac{R(x)}{D(x)}$. This is similar to what happens when we use long division on integers to write an improper fraction as a mixed number, that is, an integer plus a proper fraction.

1. Find the quotient and remainder in the following division problems.

- a. $(2x^3 + 11x^2 + 10x^2 - 5x - 1) ÷ (2x + 3)$
- b. $(2x^5 + 4x^4 - 15x^3 - 10x^2 + 26x + 3) ÷ (2x - 5)$
- c. $(2x^6 + 3x^5 + 2x^4 + 7x^3 + x^2 + 4x + 2) ÷ (x^2 + 1)$
- d. $(15x^6 - 2x^5 + 21x^4 + 11x^3 + 6x^2 + 2x) ÷ (5x^2 + x - 1)$
- e. $(2x^6 + x^5 + 4x^4 + 4x^2 + x + 3) ÷ (x^2 + 1)$
- f. $(18x^5 - x^4 - x^3 + 21x^2 + 12x + 5) ÷ (2x^2 - x + 1)$
- g. $(4x^5 - 20x^4 + 3x^3 - 6x^2 - 45x + 4) ÷ (x - 5)$
- h. $(4x^5 - 7x^3 - 8x^2 - 11x - 18) ÷ (x - 2)$
- i. $(2x^6 + 7x^5 + 10x^4 + 21x^3 + 5x^2 + 21x + 22) ÷ (x + 3)$
- j. $(x^5 + 3x^4 + x^2 - 4x + 1) ÷ (x - 1)$
- k. $(2x^5 - 4x^4 + 5x^3 - 9x^2 + 5x - 14) ÷ (x - 2)$
- l. $(4x^5 + 16x^4 + 9x^3 - 6x^2 + 7x - 11) ÷ (x + 3)$
- m. $(7x^6 + 31x^5 + 5x^4 - 48x^3 - 78x^2 + 12x + 16) ÷ (x + 4)$
- n. $(8x^4 - 44x^3 + 23x^2 - 8x - 33) ÷ (x - 5)$
- o. $(6x^4 + 9x^3 + 8x - 8) ÷ (x + 2)$
- p. $(x^4 - 2x^2 + 1) ÷ (x - 1)$
- q. $(2x^2 + 6x + 4) ÷ (x + 1)$
- r. $(3x^2 - 7x + 2) ÷ (x - 2)$