1. Write the following products as polynomials in either $x$ or $t$. The first is done as an example for you.

(a) $5x(2x-4)$
\[
= (5x)(2x) - (5x)(4)
= 10x^2 - 20x
\]

(b) $3t(t+7)$
\[
= 3t^2 + 21t
\]

(c) $-4x(5x + 1)$
\[
= -20x^2 - 4x
\]

(d) $4(t^2 - 5t + 2)$
\[
= 4t^2 - 20t + 8
\]

(e) $x(x^2 - 2x - 3)$
\[
= x^3 - 2x^2 - 3x
\]

(f) $-5t(2t^2 + 3t - 7)$
\[
= -10t^3 - 15t^2 + 35t
\]

2. Perhaps the most important type of polynomial multiplication is that of two binomials. Make sure you are fluent with this skill. Write each of the following products as an equivalent polynomial written in standard form. The first problem is done as an example using repeated distribution.

(a) $(x+5)(x-3)$
\[
= (x+5)(x) - (x+5)(3)
= x^2 + 5x - 3x - 15
= x^2 + 2x - 15
\]

(b) $(x-10)(x-4)$
\[
= x^2 - 14x + 40
\]

(c) $(x+3)(x+12)$
\[
= x^2 + 15x + 36
\]

(d) $(2x+3)(5x+8)$
\[
= 10x^2 + 31x + 24
\]

(e) $(4x-1)(x+2)$
\[
= 4x^2 + 7x - 2
\]

(f) $(6x-5)(4x-3)$
\[
= 24x^2 - 38x + 15
\]

3. Never forget that squaring a binomial also a process of repeated distribution. Write each of the following perfect squares as trinomials in standard form.

(a) $(x+3)^2$
\[
= x^2 + 6x + 9
\]

(b) $(x-10)^2$
\[
= x^2 - 20x + 100
\]

(c) $(2t+3)^2$
\[
= 4t^2 + 12t + 9
\]
4. An interesting thing happens when you multiply two **conjugate binomials**. Conjugates have the property of having the same **terms** but differ by the operation between the two terms (in one case addition and in one case subtraction). Multiply each of the following **conjugate pairs** and state your answers in **standard form**. The first is done as an example

(a) \((x+3)(x-3)\)  
   \[= x(x-3) + 3(x-3)\]  
   \[= x^2 - 3x + 3x - 9\]  
   \[= x^2 - 9\]

(b) \((x-5)(x+5)\)  
   \[= x^2 - 25\]

(c) \((10+x)(10-x)\)  
   \[= 100 - x^2\]

(d) \((2t+3)(2t-3)\)  
   \[= 4t^2 - 9\]

(e) \((5t+1)(5t-1)\)  
   \[= 25t^2 - 1\]

(f) \((8-3t)(8+3t)\)  
   \[= 64 - 9t^2\]

5. Write each of the following products in standard polynomial form.

(a) \((x+3)(x-2)(x-8)\)

\[= x^3 - 7x^2 - 14x + 48\]

(b) \((x+2)(x-2)(x+3)(x-3)\) (Hint: try to use #4)

\[= x^4 - 13x^2 + 36\]

6. Notice again how similar polynomials are to integers, i.e. the set \(\{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}\). Write a statement below for polynomials based on the statement about integers.

**Statement About Integers**: An integer times an integer produces an integer.

**Statement About Polynomials**: A polynomial times a polynomial produces a polynomial.

7. Consider the product \((3x+1)^2\).

(a) Write this product in standard trinomial form.

\[9x^2 + 6x + 1\]

(b) Use your answer in part (a) to determine the value of \(31^2\) without your calculator.