Math 2301 Section 11.3: The Product and Quotient Rules Algebra Supplement

The algebra you need to know for this section includes multiplying polynomials, simplifying rational expressions and exponent rules.

Exponent Rules (as needed) – When you multiply to terms with the same base, you add the exponents.

Quick Examples:

1. $x\left(x^3\right)=x^1x^3=x^{1+3}=x^4$
2. $2x\left(5x^{-3}\right)=2(5)x^1x^{-3}=10x^{1-3}=10x^{-2}$

Multiplying Polynomials - When you multiply two polynomials, you must distribute each term from the first polynomial to each term in the second polynomial. If you are multiplying two binomials (two-term polynomials), we frequently refer to this process as FOIL.

Quick Examples:

1. $3x\left(x^2-5x+7\right)=3x\left(x^2\right)+3x\left(-5x\right)+3x\left(7\right)=6x^3-15x^2+21x$
2. $\left(2x+3\right)\left(x-5\right)=2x\left(x\right)+2x\left(-5\right)+3\left(x\right)+3\left(-5\right)=2x^2-10x+3x-15=2x^2-7x-15$
3. $$\begin{aligned}\left(x-1\right)\left(x^2+2x-7\right)&=x\left(x^2\right)+x\left(2x\right)+x\left(-7\right)-1\left(x^2\right)-1\left(2x\right)-1\left(-7\right)\\&=x^3+2x^2-7x-x^2-2x+7\\&=x^3+x^2-9x+7\end{aligned}$$

Simplifying Rational Expressions – You can only cancel in a big fraction (rational expression) if the factor is common to all parts of the expression that are separated by addition, subtraction and division. For this reason, we first write everything in factored form (as multiplication) before canceling. My saying is, "It must be in EVERYthing before you can cancel it from ANYthing."

Quick Examples:

1. $\dfrac{3x+9}{6}=\dfrac{3\left(x+3\right)}{3\left(2\right)}=\dfrac{\cancel{3}\left(x+3\right)}{\cancel{3}\left(2\right)}=\dfrac{x+3}{2}$
2. $\dfrac{x\left(x+2\right)-4\left(x+2\right)^2}{\left(x+2\right)^3}=\dfrac{\left(x+2\right)\left[x-4\left(x+2\right)\right]}{\left(x+2\right)\left(x+2\right)^2}=\dfrac{\cancel{\left(x+2\right)}\left[x-4\left(x+2\right)\right]}{\cancel{\left(x+2\right)}\left(x+2\right)^2}=\dfrac{\left[x-4\left(x+2\right)\right]}{\left(x+2\right)^2}$

This could be simplified further but is not the point of the review.