

1. Fractions within Fractions
2. You should be familiar with factoring polynomials, and with multiplying, adding and reducing fractions. In this lesson, we will simplify multi-layered fractions.
3. Here is an example where the numerator of the fraction contains smaller fractions which are added. The same is true of the denominator. One approach to simplifying this multi-layered fraction is to simplify the numerator and denominator separately as the first step.
4. There is a lot of work presented here, but it is the standard approach to adding fractions: supplying missing factors to find a common denominator.
5. Once the numerator and denominator have been combined into a single fraction, this is now a division problem. The numerator is divided by the denominator, so we multiply the numerator by the reciprocal of the denominator, cancelling common factors.
6. A second approach is to find a common denominator across all four of the small fractions. We have denominators of  $(x - 1)$ ,  $x$ , and another factor of  $(x + 1)$  will appear in the difference of squares factoring of  $x^2 - 1$ . If we multiply the numerator and denominator of the large fraction by these three factors, all of the denominators of the smaller fractions will be cancelled, and we will have a fraction with only two layers. The polynomials should be expanded, then like terms added.
7. We can confirm that the two approaches yield the same answer by expanding the product on the right hand solution.
8. To recap: One approach is to simplify the numerator and denominator separately. The other is to clear the smaller fractions by multiplying by all of the factors.