# 1 Adding/Subtracting/Multiplying Polynomials

**Polynomial** - An algebraic expression containing two or more terms

## Adding/Subtracting

When adding or subtracting polynomials, we add/subtract "like" terms

## Multiplying

When multiplying polynomials...
- use distributive property (sometimes more than once)
- be careful with signs

**Associative Property** - the way the factors are grouped in a multiplication problem does not change the product.

# 2 Factoring Polynomials

## Greatest Common Factor (GCF)

Divide out largest common coefficient and variable with max common exponent

## Grouping

- Group terms  factor GCF from each group
- Factor common brackets if possible

## Simple Trinomial

$x^2 + (a + b)x + ab = (x + a)(x + b)$

## Complex Trinomial

$ax^2 + bx + c, a \neq 1$
- Find factors of a & place in each bracket
- Find factors of c & place in each bracket
- Check by explanding in your head if it fits, if not, try something else

## Difference of Squares

$a^2 - b^2 = (a - b)(a + b)$

### Perfect Squares

$a^2 + 2ab + b^2 = (a + b)^2$
$a^2 - 2ab + b^2 = (a - b)^2$

### Sum and Difference of Cubes

$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

### Long Division

quotient*divisor = dividend

## 3 Rational Expressions

A rational expression is an expression that is the ratio of two polynomials,

$$f(x) = \frac{R(x)}{H(x)}$$

When working with rational expressions, it is important to state **restrictions**. Restrictions are values of the variable that cause the function to be undefined.

The two types of restrictions are **holes** and **asymptotes**. Restrictions arise from any factors that have ever appeared in the denominator.

A **hole** is a missing value in the graph. It occurs when a restriction is **removed through simplification**.

A **asymptote** is a line that the graph approaches but never crosses. It occurs when a restriction **remains afer being simplified**.

Note - 2 rational expressions are equivalent IF they are the same for all possible values of the domain.

## 4 Multiplying and Dividng Rational Expressions

### Steps

1. Factor numerator and denominator

2. Divide out common factors to simplify

3. Identify restrictions

Note - When dividing by fractions we multiply by the reciprocal, restrictions are determined by all factors that have ever appeared in the denominator

# 5 Adding and Subtracting Rational Expressions

Note: You cannot cross cancel when adding/subtracting, only when multiplying
Goal: Get a common denominator

### Steps

1. Factor denominator

2. Identify restrictions

3. Find lowest common denominator

4. Expres rational exp. with same LCD

5. Add/subtract tops & keep LCD

6. Expland out and refactor numerator to see if refactorable

# 6 Graphs of Rational Functions

Rational functions usually come out to be either linear (only holes no asymptotes) or reciprocal (can be both) functions

### Steps

1. Simplify expression

2. State and classify restrictions

3. Draw function and add any holes