MA 16020 EXAM 1 STUDY GUIDE

Average Value of a Function: For $f(x)$ defined on $[a, b]$, the average value of $f(x)$ on $[a, b]$ is:

$$f_{AVE}(x) = \frac{1}{b-a} \int_a^b f(x) \; dx$$

When to use substitution to integrate?

- **When you have something containing a function (which we call u) and that something is multiplied by the derivative of u.**

  Ex. $\int f(u(x)) \cdot u'(x) \, dx = \int f(u) \, du$

- **How do you use substitution?**
  - Determine if there is an inner function and call that u.
  - Take the derivative of u. So you have
    $$du = u'(x) \, dx$$
  - Solve for dx.
  - Transform the integral using u and dx.

When to use partial fraction decomposition to integrate?

- **When you have a fraction with polynomials on the numerator and denominator, and substitution doesn't work.**

- **How do you use partial fraction decomposition?**
  - Decompose the fraction using the steps outlined in the Handout, METHOD OF DECOMPOSING INTO PARTIAL FRACTIONS.

- **Note: Some integrals will yield $ln|?|$ and others will need a substitution.**

When to use by parts to integrate?

- **When all else fails**

- **How do you use by parts?**
  - **Choose u to be the one to differentiate**
    - **Recall the acronym that tells how to choose u.**
      L – Logarithmic
      A – Algebraic (like polynomials)
      T – Trigonometric
      E – Exponential
  - **Choose dv to be integrated**
  - **Determine du and v and apply the following formula:**
    $$u \cdot v - \int v \, du$$

- **Note:**
  1. **You may have to do a substitution within your problem.**
  2. **You may have to apply by parts more than once.**