**Harold’s Partial Fraction Decomposition (Calculus)**

**Cheat Sheet**

9 February 2025

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| **Partial Fractions** | (<http://en.wikipedia.org/wiki/Partial_fraction_decomposition>) |
| **Condition** | where are polynomials |
| **Preparation** | Case 1: Perform long division first  Case 2: Proceed to the cases below |
| **Case I: Simple linear ( degree)** |  |
| **Case II: Multiple degree linear ( degree)** |  |
| **Case III: Simple quadratic ( degree)** |  |
| **Case IV: Multiple degree quadratic ( degree)** |  |
|  |  |
| **Example Expansion** |  |
|  |  |
| **Typical Solution for Cases I & II** |  |
| **Typical Solution for Cases III & IV** |  |

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| **Steps to Solve** | **Calculus Example** |
| **1. Write down problem** |  |
| **2. Check if long division is needed** | Not needed since degree of numerator (top) is less than degree of denominator (bottom) |
| **3. Factor the denominator** |  |
| **4. Expand function with A, B, Cs** |  |
| **5. Find a common denominator** |  |
| **6. Focus on numerator** |  |
| **7. FOIL if necessary** |  |
| **8. Expand/distribute the A, B, Cs** |  |
| **9. Regroup by powers of x.** |  |
| **10. Factor by powers of x.** |  |
| **11. Introduce ghost factors if needed** (0, 1) |  |
| **12. Match left and right coefficients for a system of equations** |  |
| **13. Solve system of equations** | Pick simplest method below |
| **a. Substitution method** | **,** |
| **b. Row elimination method** | -------------------------  ------------------------- |
| **c. Augmented matrix method** | Use TI-84 function  **,** |
| **14. Reassemble newly expanded function** |  |
| **15. Verify function for accuracy** | *Verify the two equations are the same by plugging in any value for x and see if f(x) is the same for both.* |
| **16. Restate problem with expanded function** |  |
| **17. Integrate restated problem** |  |
| **18. Simplify** |  |
| **19. DONE** |  |