

Integration Methods II: Partial Fractions and Trig Substitutions

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Overview

The objective of this lab is to use Maple to help you practice your integration skills in partial fractions and trigonometric substitutions.

Maple Essentials

- Three maplets *Trig Substitutions*, *Partial Fractions: General Decomposition*, and *Partial Fractions: Finding Coefficients* are available from the course website (last column in Lab 6):

<http://www.math.sc.edu/calclab/142L-S06/labs>

Those maplets are designed to help you to understand named methods following individual steps with randomly generated problems. In a near future, they will be able to take user-specified problems.

- Important Maple commands introduced in this lab:

Command/Example	Description
<code>convert(f, parfrac, options);</code> Examples: <code>convert(x/(x-2)^3/(x^2+x+1), parfrac);</code> <code>convert(x/(x-b)^3/(x^2+1), parfrac, x);</code>	Convert a rational function f into its partial fraction form
<code>completesquare</code> Examples: <code>completesquare(x^2+2*x+2);</code> <code>completesquare(f(x), x);</code>	Complete squares (need to load the <code>student</code> package first.)

Related course material

§8.4 and §8.5 of the textbook.

Activities

1. Use maple commands `convert` and `completesquare` to perform partial fractions for the following rational functions:

(a) $f_1(x) = \frac{1}{x^2 - 6x - 7}$. (see ex. 10 on page 543)

(b) $f_2(x) = \frac{x^5 - 4x^3 + 1}{x^3 - 4x}$. (see ex. 20 on page 544)

(c) $f_3(x) = \frac{x^2}{(x+1)^3}$. (see ex. 25 on page 544)

(d) $f_4(x) = \frac{x^3 + x^2 + x + 2}{(x^2 + 1)(x^2 + 2)}$. (see ex. 30 on page 544)

(e) $f_5(x) = \frac{x^4 + 6x^3 + 10x^2 + x}{x^2 + 6x + 10}$. (see ex. 32 on page 544)

(f) $f_6(x) = \frac{x^2 + 1}{(x^2 + 2x + 3)^2}$. (see ex. 37 on page 544)

Remarks:

- (a) Don't forget to include `with(student):` to load the `student` package.
 - (b) You may want to define your own partial fraction operator, say `MyPF`, as follows:

```
> MyPF:=f->completesquare(convert(f,parfrac,x));
```

You can then use it as a maple command to do partial fractions and completing squares for a rational function, say $R(x)$, as follows:

```
> MyPF(R(x));
```
2. Use the *Integration Methods* tutor introduced in Lab 4 to help you to evaluate integrals of the above rational functions.
 3. Launch each of the *Trig Substitutions*, the *Partial Fractions: General Decomposition*, and the *Partial Fractions: Finding Coefficients* maplets from the course web and do a few practice problems.

Assignment

Exercises 45 and 46 on page 536; exercises 38 and 39 on page 544.