# New Functions From Old

Douglas Meade and Xian Wu
Department of Mathematics

## *Overview*

We will learn to define functions in Maple and to study new functions from given ones.

## *Maple Essentials*

- Important Maple commands introduced in this lab are:

| Command | Description | Example |
|---|---|---|
| `x->formula` | define a function in x | `f:=x->2*x^2*(1-x^2);` |
| `expand` | expand an expression | expand(f(x));expand((x-2)^18); |
| `simplify` | simplify an expression | simplify(f(x)+2);simplify(x-(x-2)^18); |

- The *Shift* maplet is available from

  http://www.math.sc.edu/calclab/MapletsForCalculus/Maplets/Shift.maplet

## *Related course material*

§1.3 New Functions From Old (Pages 27-39) of the textbook.

## *Activities*

- Login and start a Maple session.
- Use the command $->$ to define functions. *While the command := alone can assign formulas, it does not really define functions in terms of the input variable that can be easily called for. (One could use the command* `subs`*, but that is another story). A better way is to use* `:=` *together with* $->$.
  - The general maple call sequence to define a function `f` in an input variable `x` with a formula `F` is `f:=x->`$F$.
  - Try the following examples:
    `f:=x->(x+1)^2;f(x);f(t);f(3);f(whatever); g:=x->2*abs(x); h:=x->f(x)+g(x); h:=x->f(x)*g(x)+f(g(x)); plot([f(x), 2*f(x)-3 ], x=-5..5, color=[red,blue], style=[point,line]); plot([f(x), -f(x), f(-x) ], x=-4..4, color=[red,blue,green]);`
  - Work through Exercises 15-18, 29, 31, 33, 36, 40, and 53 of §1.3 (pages 36-38). You may want to simplify or expand your results using the Maple commands `simplify` and `expand`.
  - A more advanced way to define functions is to use the command `unapply`. Check `unapply` in the help menu if you are interested.
- Start the *Shift* maplet. Follow the directions in the box below the graphics box in this interface. Work with this tool until you become proficient at identifying seven basic functions and their shifts.
- If you have time left, see if the Maple can help you to do some homework problems.
- Save anything you want to save and remember to logout.

## *Assignment*

Use maple to work out Exercises 15-18, 30, 32, 34, 40, and 56 in §1.3 (pages 36-38).