

# Sums in Maple

## 1 Introduction

This handout is meant to supplement "An Introduction to Using Maple in Math 23." It assumes that you have read the previous handout and are familiar with some of the basics of Maple that were introduced there.

## 2 sum

Suppose you want to use Maple to compute the following sum:

$$\sum_{k=1}^{20} \frac{k^2 + 3}{e^k}.$$

One (very inefficient) way to do this would be to type all 20 of the terms in this sum

$(1^2 + 3)/\exp(1) + (2^2 + 3)/\exp(2) + (3^2 + 3)/\exp(3) + (4^2 + 3)/\exp(4) + \text{etc.}$

and hit enter. This, naturally, would take forever, and should there be a typo in your input it would be very difficult to spot. Fortunately Maple provides the command `sum` to get around this problem. As usual, we proceed by example. The sum considered above would be entered as

```
sum((k^2 + 3)/exp(k), k=1..20)
```

The sum

$$\sum_{n=1}^{1000} \frac{1}{n^2}$$

would be entered as

```
sum(1/n^2, n=1..1000)
```

As is clear from these two examples, the first quantity that comes after the word `sum` is the formula for the general term of the series. Next we indicate the indexing variable and its range. In the first example `k=1..20` tells Maple the indexing variable is  $k$  and that it should add the terms from  $k = 1$  to  $k = 20$ . In the second example `n=1..1000` tells Maple the indexing variable is  $n$  and that

it should add the terms from  $n = 1$  to  $n = 1000$ . You are, of course, free to use any indexing variable you like, and the range need not start with 1 every time.

Since you explicitly tell Maple which variable is the indexing variable for the summation, you can use any other variables in the expression for the general term that you like. This is very useful for plotting functions given by series. For example, the 20<sup>th</sup> partial sum of the series

$$\sum_{n=1}^{\infty} \frac{1}{x^2 + n^2}$$

you would be entered into Maple as

```
sum(1/(x^2 + n^2), n=1..20)
```

This expression is perfectly valid as an argument to the `plot` command. Thus, if we wanted to plot the function given by the 20<sup>th</sup> partial sum of the series above, on the interval  $-5 \leq x \leq 5$ , we would type

```
plot(sum(1/(x^2 + n^2), n=1..20), x=-5..5);
```

and hit enter.