Calculus II Name: _____

Maple Lab #5: Infinite Series

In this Maple Lab you will be working evaluating the sums of some convergent series.

In Maple, we can use the sum function to find the value of a finite sum, say:

```
sum(k^2 – 3*k + 2, k = 1 .. 10000);
```

$$\sum_{k=1}^{10000} k^2 - 3k + 2$$

That sum is _____.

If the upper limit of the summation is a variable, then we have an indefinite sum. Sometimes, Maple can come up with an explicit formula for the indefinite sum.

```
sum(k, k=1 .. n);
simplify(%);
```

This is the formula: $1 + 2 + \ldots + n = \frac{n(n+1)}{2}$

```
power := proc(r) sum(k^r, k=1 .. n) end;
```

Now we will look at series in the form of $\sum_{k=1}^{n} k^r$

```
power(4);
power(10);
```

So, what does this series evaluate to when r = 4?

_____

When r = 10?

_____

```
power(-1)
```

When r = -1?

_____

That last command gives the answer in terms of the built-in function **psi**, and the constant gamma. For a specific value of n, you can find the approximate value of the sum.

```
evalf(subs(n = 200,%))
```

Write the first five terms of the sum to show that it is harmonic series.

_____

Now let look at the series $\sum_{k=1}^{\infty} \frac{1}{k^{\frac{1}{2}}}$

Maple evaluates this sum to

_____.

```
sum(1/k^(1/2), k = 1 .. infinity);
```

Now let look at the series $\sum_{k=1}^{\infty} \frac{1}{k^{\frac{1}{2}}}$

sum(1/k^(2), k = 1 .. infinity);

You can show that the series $\sum_{k=1}^{\infty} \frac{1}{k^2}$ converges using the integral test, however, does not actually give you the sum of the series, which is: _____

What does $\sum_{k=1}^{\infty} \frac{1}{k^{1.1}}$ converge to?

_____

What does $\sum_{k=1}^{\infty} \frac{1}{k^{1.01}}$ converge to?

_____

What does $\sum_{k=1}^{\infty} \frac{1}{k^{1.00001}}$ converge to?

What does the harmonic series $\sum_{k=1}^{\infty} \frac{1}{k^1}$ converge to?

(trick question)

_____

Which test for convergence does this example bring to mind?

_____

Now lets consider alternating series.

sum((-1)^k/k^2, k=1..n);

$$\sum_{k=1}^{\infty} \frac{(-1)^k}{k^2}$$

What is that sum? _____

Now, use Maple to figure out what the alternating harmonic series $\sum_{k=1}^{\infty} \frac{(-1)^k}{k^1}$ converges to.

_____

This lab is complete and correct.
(or, I did this lab at . . .)

_____ _____
lab aide date

I want your opinion.

	Strongly agree				strongly disagree
The labs have helped me learn the material for the course.	5	4	3	2	1

comments:

How long did it take you to complete this lab? _____

Other comments: