Some Useful Maple Commands

`diff`: Compute symbolic derivatives

> `ex1 := exp( sin(4*x) ) + ln( x^2 + sqrt(x) );`

$$ex1 := e^{\sin(4x)} + \ln(x^2 + \sqrt{x})$$

> `diff( ex1, x );`

$$4 \cos(4x) e^{\sin(4x)} + \frac{2x + \dfrac{1}{2\sqrt{x}}}{x^2 + \sqrt{x}}$$

> `diff( ex1, x$2 );`

$$-16 \sin(4x) e^{\sin(4x)} + 16 \cos(4x)^2 e^{\sin(4x)} + \frac{2 - \dfrac{1}{4 x^{(3/2)}}}{x^2 + \sqrt{x}} - \frac{\left(2x + \dfrac{1}{2\sqrt{x}}\right)^2}{(x^2 + \sqrt{x})^2}$$

> `diff( diff( cos(x/y) , x ) , y );`

$$\frac{\cos\left(\dfrac{x}{y}\right) x}{y^3} + \frac{\sin\left(\dfrac{x}{y}\right)}{y^2}$$

`int`: Compute symbolic integrals (anti-derivatives and definite integrals)

> `ex2 := 1 / sqrt( x^2 - a^2 );`

$$ex2 := \frac{1}{\sqrt{x^2 - a^2}}$$

> `int( ex2, x );`

$$\ln(x + \sqrt{x^2 - a^2})$$

A definite integral

> `int( x^2 , x = 0 .. 2);`

$$\frac{8}{3}$$

Don't expect miracles!!

```
> int( ex1, x );
```

$$\int e^{\sin(4\,x)} + \ln(x^2 + \sqrt{x}\,)\,dx$$

Multi-dimensional integrals are often straightforward:

```
> ex3 := (x^3+ y^3) / (x^2- y^2);
```

$$ex3 := \frac{x^3 + y^3}{x^2 - y^2}$$

```
> int(int(ex3,x),y);
```

$$\frac{x^2\,y}{6} - \frac{1}{3}(x-y)^3\ln(x-y) - \frac{x\,y^2}{6} + \frac{11\,x^3}{18} - \frac{y^3}{9} + x\,y^2\ln(x-y) - \ln(x-y)\,y\,x^2$$

`series` and `taylor`: Compute power series expansions

```
> series(exp(x),x=0);
```

$$1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4 + \frac{1}{120}x^5 + \mathrm{O}(x^6)$$

```
> series(exp(x),x=0,11);
```

$$1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4 + \frac{1}{120}x^5 + \frac{1}{720}x^6 + \frac{1}{5040}x^7 + \frac{1}{40320}x^8 + \frac{1}{362880}x^9 + \frac{1}{3628800}x^{10} + $$
$$\mathrm{O}(x^{11})$$

```
> taylor(exp(x),x=0);
```

$$1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4 + \frac{1}{120}x^5 + \mathrm{O}(x^6)$$

The special Maple variable `Order` controls the default expansion order

```
> Order := 8;
```

$$Order := 8$$

```
> taylor(exp(x),x=0);
```

$$1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4 + \frac{1}{120}x^5 + \frac{1}{720}x^6 + \frac{1}{5040}x^7 + \mathrm{O}(x^8)$$

```
> Order := 6:
```

```
> taylor((1 + x)^(-1),x=0,7);
```
$$1 - x + x^2 - x^3 + x^4 - x^5 + x^6 + O(x^7)$$

Convert the Taylor series to a polynomial (useful in Homework 2!)

```
> convert(%,'polynom');
```
$$1 - x + x^2 - x^3 + x^4 - x^5 + x^6$$

solve: Solve equations, including linear systems

```
> eq1 := x + y + z = 6;   eq2 := 2*x + y + z = 2;
  eq3 := x + y + 3 *z = 3;
```
$$eq1 := x + y + z = 6$$
$$eq2 := 2\,x + y + z = 2$$
$$eq3 := x + y + 3\,z = 3$$

```
> solve( {eq1,eq2,eq3} );
```
$$\{x = -4, y = \frac{23}{2}, z = \frac{-3}{2}\}$$

```
> solve( {eq1,eq2,eq3} , {x,y,z} );
```
$$\{x = -4, y = \frac{23}{2}, z = \frac{-3}{2}\}$$

```
> eq[1] := c[1] + c[2] + c[3] = 6:
> eq[2] := 2*c[1] + c[2] + c[3] = 2:
> eq[3]:= c[1] + c[2] + 3*c[3] = 3:
> eq[1]; eq[2]; eq[3];
```
$$c_1 + c_2 + c_3 = 6$$
$$2\,c_1 + c_2 + c_3 = 2$$
$$c_1 + c_2 + 3\,c_3 = 3$$

```
> solve( {eq[1],eq[2],eq[3]},
>        { c[1], c[2], c[3]} );
```
$$\{c_1 = -4, c_2 = \frac{23}{2}, c_3 = \frac{-3}{2}\}$$

```
> solve( {eq[1],eq[2],eq[3]} );
```

$$\{\, c_1 = \text{-}4,\ c_2 = \frac{23}{2},\ c_3 = \frac{\text{-}3}{2}\, \}$$

Common Mistakes

(1) Not terminating statement with ';' or ':'

```
> a := int(x^2,x=0..1)
> ;
```

$$a := \frac{1}{3}$$

(2) Using '=' rather than ':=' for assignment

```
> a = 2;
```

$$\frac{1}{3} = 2$$

```
> a;
```

$$\frac{1}{3}$$

```
> a := 2;
```

$$a := 2$$

```
> a;
```

$$2$$

(3) Using quotes (') rather than double quotes (") to delimit strings

```
> string1 := "This is a Maple string";
```

$$string1 := \text{"This is a Maple string"}$$

```
> string2 := 'This is not a Maple string';
Error, missing operator or `;`
```