Week 9 - 1st Order Differential Equations

Review:

> Integrate[function, variable]
> Integrate [function {variable, min, max}]
> Same form as Plot which was Plot[function, {variable, min, max}]

Introduction:

```
DSolve[differential equation, y[x], x]
```

```
DSolve[{differential equation, initial condition}, y[x], x]
```

Example:

Solve $y'(x) = \frac{y(x)}{x}$ which can also be written as $\frac{dy}{dx} = \frac{y}{x}$

```
DSolve[y'[x] == y[x] / x, y[x], x]
```

```
{{y[x] → x C[1]}}
```

note the C[1] just stands for a constant.

Difference between '=' and '==':

a single equals - assigning value

```
a = 3
```

```
a * x^2
```

Double equals

```
Command[if the left hand side == the right hand side, some other conditions]
```

```
double equals contracts when we press space e.g. == == ==
```

Including initial conditions:

```
DSolve[{y'[x] == y[x] / x, y[1] == 1}, y[x], x]
```

```
{{y[x] → x}}
```

```
sol1[x_] := x
```

Common Problem:

Using = instead of ==.

```
DSolve[y'[x] = y[x] / x, y[x], x]
```

DSolve::deqn : Equation or list of equations expected instead of $\frac{y[x]}{x}$ in the first argument $\frac{y[x]}{x}$. ≫

$$\text{DSolve}\left[\frac{y[x]}{x}, y[x], x\right]$$

```
DSolve[y'[x] == y[x] / x, y[x], x]
```

DSolve::deqn : Equation or list of equations expected instead of True in the first argument True. ≫

$$\text{DSolve}[\text{True}, y[x], x]$$

Summary:

> DSolve[{function, initial conditions}, y[x], x] (be careful to include two capital letters at beginning of this function)

> Single equals assigns a value to a variable e.g. a=3

> Double equals asks *if* the LHS were equal to the RHS what would be our solution

> Remove[ ]