MATH 2204 - FORMULA SHEET

- **1st Order Linear ODE:** $\frac{dy}{dt} + p(t)y = g(t)$
  - Integrating Factor: $\mu(t) = e^{\int p(t)dt}$
  - Then $y(t) = \frac{1}{\mu(t)} \left[\int \mu(t)g(t)dt + C \right]$
- **1st Order homogeneous:** $\frac{dy}{dx} = F\left(\frac{y}{x}\right)$
  - Then use substitution $v = \frac{y}{x}$ and $\frac{dy}{dx} = x\frac{dv}{dx} + v$
- **(Existence and Uniqueness Theorem for 1st Order Linear ODE):** If the function p and g are continuous on an open interval $I = (a, b)$ containing the point $t = t_0$, then there **exists** a **unique** function $y = \phi(t)$ that satisties the IVP

  $$y' + p(t)y = g(t), \quad y(t_0) = y_0$$

  for each t in I and where y_0 is an arbitrary initial value.
- **Euler's Method:** $\frac{dy}{dt} = f(t, y)$, $y(t_0) = y_0$.
  - Given step size h,
  - $t_{k+1} = t_k + h$
  - $y_{k+1} = y_k + f(t_k, y_k)\, h$