Differential Equations Review Sheet 1, Spring 2024

I. First-order DEs

(a) Separable

Form: $\frac{dy}{dx} = f(x)g(y)$

To solve: arrange it like so: $\frac{dy}{g(y)} = f(x)\,dx$, integrate both sides!

Don't forget the lost solutions $y = c$, where $g(c) = 0$.

(b) Linear

General Form: $a(x)y' + b(x)y = c(x)$

Standard form: $y' + p(x)y = f(x)$

To solve:

- Put in standard form (by dividing by $a(x)$ if necessary).
- Compute the homogeneous solution: $y_h(x) = e^{-\int p(x)dx}$.
- Use the variation of parameters formula: $y(x) = y_h(x)(\int \frac{q(x)}{y_h(x)}\,dx + C)$.
- There is also the definite integral solution: $y(x) = y_h(x)(\int_a^x \frac{q(u)}{y_h(u)}\,du + C)$, where $C = y(a)/y_h(a)$.

End of review sheet 1

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