$$\begin{bmatrix} S \longleftarrow H \\ L \longleftarrow B \\ E \longleftarrow NE \end{bmatrix}$$

1. **Separable** $\frac{dy}{dx} = f(x)g(y)$
   (a) Move all x's to one side of the equation and all y's to the other.
   (b) Integrate.
2. **Linear** $\frac{dy}{dx} + P(x)y = Q(x)$
   (a) Identify the integrating factor: $e^{\int P(x)dx}$.
   (b) Multiply both sides of the equation by the integrating factor.
   (c) Reverse product rule.
   (d) Integrate.
   (e) Solve for y.
3. **Exact** $M(x,y)dx + N(x,y)dy = 0$, where $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$
   (a) Identify $f_1(x,y) = \int M(x,y)\ dx$ (think "partial integral")
   (b) Identify $f_2(x,y) = \int N(x,y)\ dy$ ("partial integral")
   (c) Reconcile $f(x,y) = f_1(x,y) = f_2(x,y)$.
   (d) Write out your solution $f(x,y) = c$.
4. **Homogeneous** $M(x,y)dx + N(x,y)dy = 0$, where M and N are homogeneous of degree α.
   (a) Choose one:
      i. $u = \frac{x}{y}$, if M is simpler.
      ii. $u = \frac{y}{x}$, if N is simpler.
   (b) Calculate du and rewrite the equation in terms of u and x.
   (c) The equation is now separable. See method 1, above.
5. **Bernoulli** $\frac{dy}{dx} + P(x)y = Q(x)y^n$
   (a) Let $v = y^{1-n}$.
   (b) Compute dv.
   (c) Rewrite the equation in terms of v and x.
   (d) The equation is now linear. See method 2, above.
6. **Near-Exact** $M(x,y)dx + N(x,y)dy = 0$
   (a) Try one (if the first fails, try the second):
      i. If $\frac{M_y - N_x}{N}$ is a function of x, let $\mu = e^{\int \frac{M_y - N_x}{N} dx}$
      ii. If $\frac{N_x - M_y}{M}$ is a function of y, let $\mu = e^{\int \frac{N_x - M_y}{M} dy}$
   (b) Multiply both sides of the equation by μ.
   (c) The equation is now exact. See mthod 3, above.
7. **u-Substitution** $\frac{dy}{dx} = f(Ax + By + C)$
   (a) Let $u = Ax + By + C$.
   (b) Calculate du.
   (c) Rewrite the equation in terms of x and u.
   (d) Reexamine which of the other methods applies to the new equation.