Reduction of order

WARM-UP Consider y'ty=D. Suppose we know y==sin(x) is a solution.

Q: How many solus do we need for a Rund set of solus? A: 2.

Q: Given one sola, can we find the other?

-> Let u(x) be an arbitrary function, and set y= u(x) y, (x) = u(x) s, h(x) = us, h(x). Find y' and y' 1 y1 = w/5, w/x) + wcos(x) $A_{\parallel} = A_{\parallel}^{2} \times V(x) + V_{(co2(x) + Co2(x) - R2)} \times V(x)$ $= u'(s_1 w(x) + Zw'(0s(x) - ws(w(x)$ >> Plug y, y', y" into the DE [y" + y = 0 => " ("sin(x) + Zu cos(x) - useltx) + Usintx) = 0

 $| U^{ll} + 2\cos(x)u^{l} = 0$

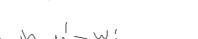
-> Make substitution of with w (i.e., w=u1);

 $W + \frac{2\cos(x)}{\cos(x)} w = 0$

 $= N_{sh} = \sin(x)$ $= \sin^{2}(x).$

Recall:
$$\frac{d}{dx}(\sin^2(x) w) = \frac{d}{dx}(0)$$

$$W = \frac{C}{\sin^2(x)}$$



Separation of variables:

$$\frac{du}{dx} = \frac{c}{\sin^2(x)} = \frac{c}{\sin^2(x)} dx$$

* Integrate:
$$\int \frac{c}{dx} dx = \int \frac{c}{\sin^2(x)} dx$$

(=) $u = c \int csc^2(x)dx = -ccot(x) + K$

 $= -c_1 \cot(x) + c_2 = c_1 \cot(x) + c_2.$

→ ?lug u into y=uy,: $Ty = (c_1 \cot(x) + c_2) \sin(x) = c_1 (\frac{\cos(x)}{\sin(x)} + c_2) \sin(x)$ L = C, (05(x) + C25 MCx) > Take different (1, cz to get 2 lin inder salus. [c1 = 0, c2 = 1 => 5, h(x)

~> Thus, two solve are y,=siNA, yz=ros(x).

| c1=1, cs=0 => (0) (x)

This is the Method of Treatment of order of the formula:

$$y = y_1(x) \int \frac{e^{-Sp(x)}dx}{(y_1(x))^2} dx$$

where P is from y"+P(x)y+Q(x)y=0.

REDUCTION OF ORDER + when to use: Given a Ind-order DE and only I soln. solu to form a find set of solus.

* why to we: Find the other lin indep * How to use: Two options. -> long route above (don't incharize)

-> the Sormula

a'(x) $\int \frac{(a'(x))_{\zeta}}{6-2b(x)\gamma} c/x$