1-1 nnouncements

1) Office hours change; no office hours Tuesday, office hours Thursday 9-11 AM

2) Practice problems for Exam 1 available under "Assignments" on Canvas. The Wronskian and Linear Independence

then f and g are linearly dependent Dn I.

Complex Numbers and Linear, homogeneous, second order equations or What if the roots arent real? (Section 4.3) (Not on Exam 1)

The Heat Equation lemperature u(x,t) at position X and time t in a thin rod given by

 $\frac{\partial U}{\partial t} (x,t) = k \frac{\partial^2 U}{\partial x^2} (x,t)$

where K 20 is the "thermal conductivity" of the material

Wishful Thinking: I wish that U(x,t) = f(x)g(t)for some real-valued Functions f and g. Rewrite the heat equation.

 $\frac{\partial U}{\partial t} = \frac{\partial}{\partial t} \left(f(x)g(t) \right)$ = f(x) g'(t) $\frac{\partial^2 U}{\partial x^2} = \frac{\partial^2}{\partial x^2} \left(F(x)g(t) \right)$ = f''(x)g(t)

(t is a constant with respect to X) X is a constant with respect to t)

The heat equation becomes f(x)g'(t) = kf''(x)g(t)Dividing both sides by kf(x)g(t) ur get $\frac{\int g'(t)}{k} = \frac{f''(x)}{f(x)}$

Since x and tare independent variables, the only way a function of X can equal a function of t is if they are both constant! So there is a number of with $\frac{1}{4} \frac{g(t)}{g(t)} = \frac{f'(x)}{f(x)} = \alpha$ $K = \frac{g(t)}{f(x)} = \frac{f'(x)}{f(x)}$

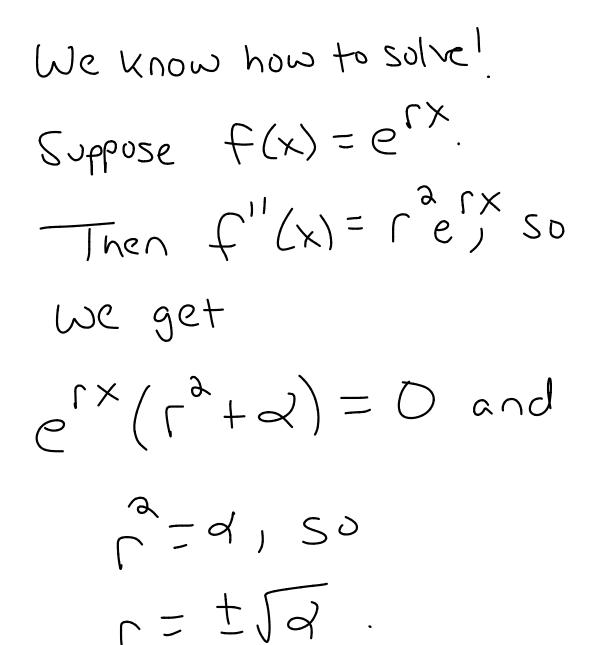
2 equations to solve: $\frac{1}{4} \frac{g'(t)}{g(t)} = d$ $\left|\right\rangle$ Multiply by k to get $\frac{g'(t)}{g(t)} = \alpha K$, integrate with respect to t. We get $\ln g(t) = xkt + C, SO$

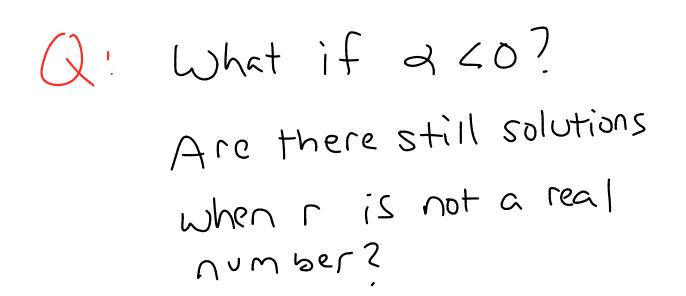
Exponentiating, $q(t) = e^{-\frac{1}{2}}$

 $2) \quad \frac{f''(x)}{f'(x)} = 2,50$ f(x)

 $f'(x) = \mathcal{L}f(x)$ and

 $f''(x) - \forall f(x) = D$





If 2(D, then -2)0. If we let $f(x) = Sin(\sqrt{-3}x)$ $f''(x) = - \left(- \operatorname{sin}(\overline{1-2} \times 1), \operatorname{so} \right)$

 $\int''(x) - \alpha f(x)$

 \bigcirc

 $= - \alpha \left(- \sin(\sqrt{-\alpha} x) + \sin(\sqrt{-\alpha} x) \right)$

So there are still solutions IF X < O!

Could also find a solution in cosines: f(x) = (DS(J-d x))

Since our original solutions were supposed to be Cr× where r=+ J7, there should be a connection between Crx, cos(J-2 x), and sin (v-a x). QCD gives rimaginary!

$$TF \quad i = \sqrt{-1},$$

$$\Gamma = \pm \sqrt{2}, 2<0,$$

$$\Gamma = \pm i\sqrt{-2},$$

$$Connection: MacLaurin Series!
$$e^{X} = \sum_{n=0}^{\infty} \frac{x^{n}}{n!}, cos(x) = \sum_{n=0}^{\infty} \frac{(-1)^{n} x^{2n}}{(2n)!}$$

$$Sin(x) = \sum_{n=0}^{\infty} \frac{(-1)^{n} x^{2n+1}}{(2n+1)!}$$$$

