1. 1. 1. range(A) = [ [1, 1, 0]T, [0, 1, -1]T ]

null(AT) = [ [1, -1, -1]T ]

* + 1. range(A) is 2-d and null(A^T) is 1-d
    2. Respectively, a plane and a line. They are orthogonal to each other.
    3. rank(A) = 2
  1. 1. Attempt to make into RREF (do R2 = R2 - R1 and R3 = R3 \* -1), R2 and R3 are the same variables but different answers => No solution
     2. ATA = [2, 1, 3 ATb = [5

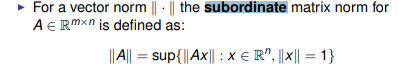
1, 2, 3 6

3, 3, 6] 11]

Solve for ATAx = ATb.

x = [13/4, 11/4, -11/12]T

* 1. 1. A does not have full rank (rank = no. +ve eigenvalues), and det(A) is also 0 (det gives the product of all eigenvalues) => A has eigenvalue 0
     2. det(ATA) is 0, as such 0 is an eigenvalue of ATA; for a matrix to be positive definite, all eigenvalues must be >0 => ATA is not positive definite
     3. Λ is a matrix with the same dimensions as A and with only its diagonal elements filled in with the eigenvalues of ATA that correspond to the eigenvector in Q (i.e. Λ11 = eigenvalue of v1)
     4. Something about Q having 3 eigenvectors of ATA, idk I said it had 0 in ii and now I'm not sure what to write for ii and iv
     5. Read off √Λ11 ????? Idk how to use iv for this

1. 1. 1. (see Abbas's slides)
      2. 
      3. κ(A) = 5 \* 2.5 = 12.5
   2. H = [-24x2, 2

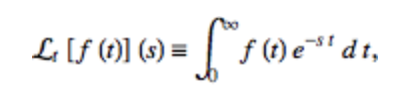
2, -2] => det(H) = 48x2 - 4

At (0,0) => saddle point

At (0.5, 0.5) => maximum

At (-0.5, -0.5) => maximum





Just do your standard Laplace

* + 1. Keep differentiating wrt s inside the integral and show it equal to the Laplace of (-t)n f(t) e.g.

...

L'[f(t)] = ∫ -t · e-st · f(t)·dx = L[ -t · f(t) ] = L[ (-t)1 · f(t) ]

L''[f(t)] = ∫ t2 · e-st · f(t)·dx = L[ t2 · f(t) ] = L[ (-t) 2 · f(t) ]

…

* + 1. Let L[y1(t)] = Y1 and L[y2(t)] = Y2

Let's get this bread 🍞🤙🏼📚

1. Rewrite the 2 equations in terms of ℒ (cross out 0's)

* sY1 ~~- y~~~~1~~~~(0)~~ = 25Y2 + 1/(s+1)2
* sY2 ~~- y~~~~2~~~~(0)~~ = Y1

1. Substitute one variable into another, so solve for one variable

Let's **yeet** in **Y1 = sY2** to line 1 so we get:

s(sY2) = 25Y2 + 1/(s+1)2

(s2 - 25)Y2 = 1/(s+1)2

(s+5)(s-5)Y2 = 1/(s+1)2

Y2 = 1/(s+1)2(s+5)(s-5)

1. Use partial fractions to get answer and convert back to t

Y2 = (1/360)(s-5)-1 - (1/160)(s+5)-1 + (1/288)(s+1)-1 - (1/24)(s+1)-2

= (1/360)e5t - (1/160)e-5t+ (1/288)e-t - (1/24)te-t