Linearity property: This property is a combination of homogeneity and the superposition principle. If we multiply some constants in the time domain, their Laplace transforms will also be multiplied by the same constant.

For example, let us assume we have Laplace transform of the following three functions:

Unit step function: u(t)

Exponential function: e-3t

Sine function: sin(2t)

We can easily find out the Laplace transform of f(t) by using the linearity property.

Time scaling property: This property is given as:

1/mod a * F(s/a)

The Laplace transform of f(2t) is equal to 1/mod 2 (since the value of a here is 2) F(s/2).

We will discuss some more properties in the next lecture. I will end this lecture here. See you in the next one.

Review of Laplace Transform (Part 3)

In this presentation, we will discuss time shifting in two different ways - right shifting and left shifting. Using the time scaling property, we can determine that shifting in the time domain is equivalent to exponential multiplication in the frequency domain with the same sign. If we perform a right shift, the negative sign will remain unchanged in the exponential function. Thus, we have covered the Laplace transform property.

The frequency shifting property is also known as shifting in the s domain. Shifting a function to the right side by a factor of 2 in the time domain corresponds to an exponential multiplication with the same sign in the frequency domain if f(t) is a time domain function with a Laplace transform of f(s-s0).

The homework questions are based on the Laplace transform properties we have discussed so far. We still have two more properties to review - the differentiation property and the convolution property. Please pause this video and attempt these questions on your own.

Review of Laplace Transform (Part 4)

The fifth property is the time differentiation property, also known as differentiation in the time domain. This property states that when we differentiate a function in the time domain, its Laplace transform will be multiplied with s and its initial value will be subtracted. The initial value of the original function is the initial condition of the function f(t) when t is equal to 0 minus. If all the initial conditions are 0, we can calculate the Laplace transform of y(t) using the time differentiation property. By using Laplace transforms, we can convert a complicated differential equation into a simple algebraic equation.