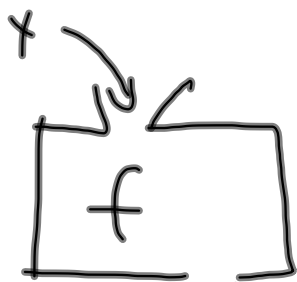


$$f(x) = x^2$$



$$y = f(x)$$

$$f(x+y) \neq f(x) + f(y)$$

$$(x+y)^2 \neq x^2 + y^2$$

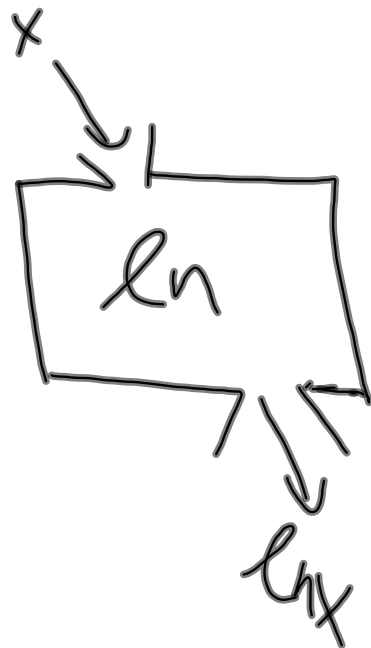
$$\sin(a+b) \neq \sin a + \sin b$$

Function

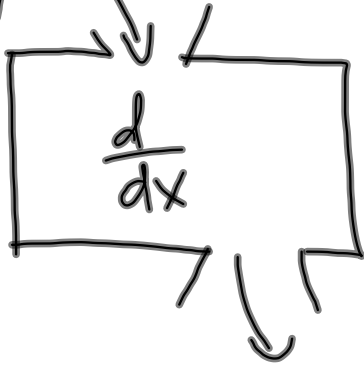
number in
number out

x	f(x)
1	1
2	4
3	9

x	lnx
1	0
2	.6...
3	1.09...



$y = f(x)$ Operator function in,
function out



$\frac{d}{dx}$ is a linear operator

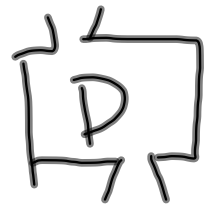
$$1) \frac{d}{dx}(f(x) + g(x)) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x)$$

$$2) \frac{d}{dx}(cf(x)) = c \frac{d}{dx}f(x)$$

$$\frac{d}{dx}(7x^2 + 3x + 5) = 7 \frac{d}{dx}(x^2) + 3 \frac{d}{dx}(x) + 5 \frac{d}{dx}(1)$$

$$= 7(2x) + 3(1) + 5(0)$$

$$= 14x + 3$$



$$D = \frac{d^2}{dx^2} + 5 \frac{d}{dx} + 6$$

$$Dy = \frac{d^2y}{dx^2} + 5 \frac{dy}{dx} + 6y$$

$f(x)$	$f'(x)$
1	0
x	1
x^2	$2x$
e^{ax}	ae^{ax}
$\sin ax$	$a \cos ax$

Operator

function in, function out

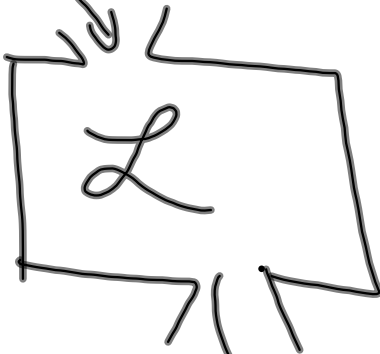
same independent variable

Transform

function in, function out

different independent variables

$f(t)$



Laplace Transform

$$\mathcal{L}[f(t)] = \underline{\underline{F(s)}}$$

Laplace transform of $f(t)$

$$\mathcal{L}[f(t) + g(t)] = \mathcal{L}[f(t)] + \mathcal{L}[g(t)] \\ = F(s) + G(s)$$

$$\mathcal{L}[cf(t)] = c \mathcal{L}[f(t)] = cF(s)$$

Laplace transform is a linear
transform

$f(t)$	$F(s)$
1	$\frac{1}{s}$
t	$\frac{1}{s^2}$
t^2	$\frac{2}{s^3}$
e^{at}	$\frac{1}{s-a}$
$\sin at$	$\frac{a}{s^2+a^2}$
$\cos at$	$\frac{s}{s^2+a^2}$

$$f(t) = 5t^2 \quad F(s) = \frac{10}{s^3}$$

$$f(t) = e^{-3t} = \frac{1}{s+3}$$

$$f(t) = \cos(2t) = \frac{s}{s^2+4}$$

$$\textcircled{1} f(t) = 3e^{-5t} + 7e^{2t}$$

$$F(s) = \frac{3}{s+5} + \frac{7}{s-2}$$

$$\textcircled{2} f(t) = 4t^2 - 6t + 3$$

$$F(s) = \frac{8}{s^3} - \frac{6}{s^2} + \frac{3}{s}$$

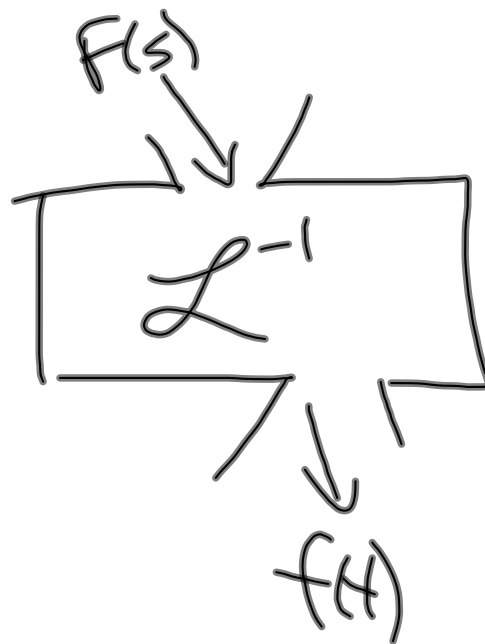
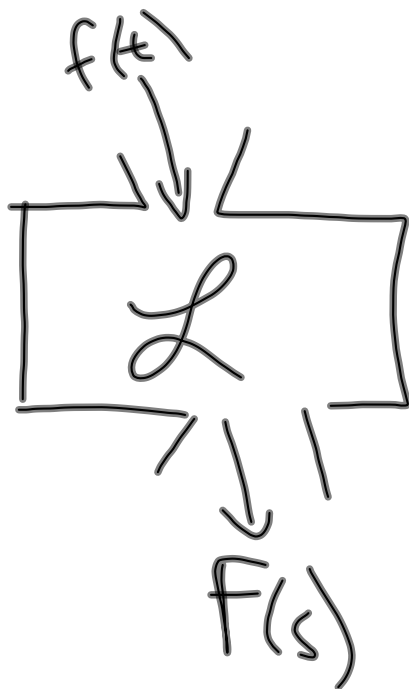
$$f(x) = x^2 - 3x$$

$$\textcircled{3} f(t) = 4\sin(3t) - 7e^{5t}$$

$$F(s) = \frac{12}{s^2+9} - \frac{7}{s-5}$$

$$f(-2)$$

Find all x
s.t. $f(x) = -2$



Assignment 2 Due Friday

Shaum 21.48, 52, 51, 62, 63
65, 66, 67

see next
page

Watch 2 videos \rightarrow Look on schedule
under 4/4

Click on the links
under "watch"

$$21.48 \quad f(t) = 5e^{-\frac{t}{3}}$$

$$21.63 \quad f(t) = 5e^{2t} + 7e^{-t}$$

$$21.51 \quad f(t) = 3\sin\frac{t}{2}$$

$$21.65 \quad f(t) = 3 - 4t^2$$

$$21.52 \quad f(t) = -\cos\sqrt{19}t$$

$$21.66 \quad f(t) = 2t + 5\sin 3t$$

21.62

$$f(t) = t^3 + 3\cos 2t$$

transform of t^n is $\frac{n!}{s^{n+1}}$

$$21.67 \quad f(t) = 2\cos 3t - \sin 3t$$