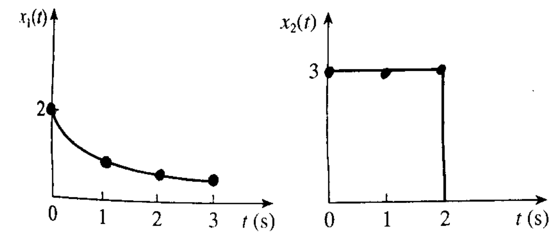
42-381 50 SHEETS EYE-EASE 5 SQUARE
42-382 100 SHEETS EYE-EASE 5 SQUARE
42-389 200 SHEETS EYE-EASE 5 SQUARE
National Brand

5.13 (1) Figure 5.41 shows two functions $x_1(t)$ and $x_2(t)$. Evaluate

(a) their convolution, $x_3(t)$, numerically, taking sampled values at $t = 0, 1, 2, 3, 4, 5$ s, and

(b) $x_3(t)$ analytically.

(2) Sketch the functions $x_3(t)$ and give reasons for any differences between them.



$x_1(t) = 2e^{-2t}$ for $0 \leq t \leq 3$
$= 0$ elsewhere

Figure 5.41 The functions $x_1(t)$ and $x_2(t)$ for Problem 5.13.

Discrete Linear Convolution

$x_1(t) \circledast x_2(t)$

$\{2.0 \quad 0.2707 \quad 0.0366 \quad 0.0050\} \circledast \{3 \quad 3 \quad 3\}$

		2.0	0.2707	0.0366	0.0050	
3	3	3				$\Rightarrow x_3(0) = 6.0$
	3	3	3			$\Rightarrow x_3(1) = 6.8120$
		3	3	3		$\Rightarrow x_3(2) = 6.9219$
			3	3	3	$\Rightarrow x_3(3) = 0.9368$
				3	3	$\Rightarrow x_3(4) = 0.1248$
					3	$\Rightarrow x_3(5) = 0.0149$

Check in Matlab

```
>> x1 = [2 2*exp(-2) 2*exp(-4) 2*exp(-6)]

x1 =

    2.0000    0.2707    0.0366    0.0050

>> x2 = [3 3 3]

x2 =

     3     3     3

>> y1 = conv(x1, x2)

y1 =

    6.0000    6.8120    6.9219    0.9368    0.1248    0.0149
```

5.17 Determine the output of an electrical system of impulse response function {0, 0.899, 0.990, 0.991, 1} when the input {0, 2.5, 5.0, 0} (volts) is applied

(1) by direct convolution, and

(2) by applying the convolution theorem. ← FFT Method. See Mitra Figure 3.14 or example 3.20

You can manually crank this out yourself.

Here is a MATLAB check...

```
>> x2 = [0 0.899 0.990 0.991 1]

x2 =

        0    0.8990    0.9900    0.9910    1.0000

>> x1 = [0 2.5 5.0 0]

x1 =

        0    2.5000    5.0000         0

>> y1 = conv(x1, x2)

y1 =

        0         0    2.2475    6.9700    7.4275    7.4550    5.0000         0

>> L = length(x1) + length(x2) - 1

L =

     8

>> y2 = abs(ifft(fft(x1,L).*fft(x2,L)))

y2 =

    0.0000    0.0000    2.2475    6.9700    7.4275    7.4550    5.0000    0.0000
```