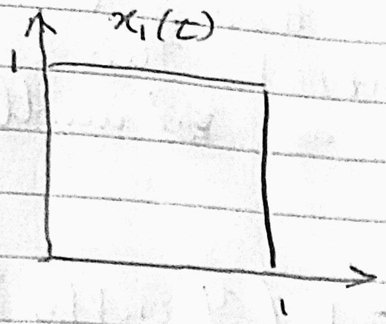
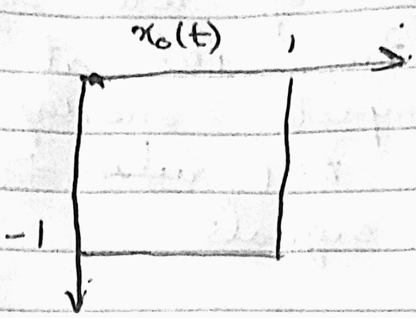
Pre Lab

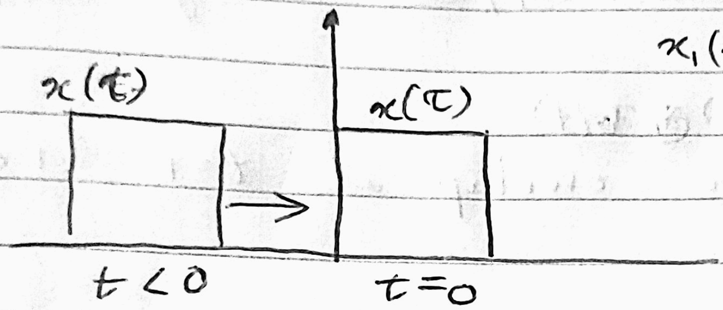
1. a)

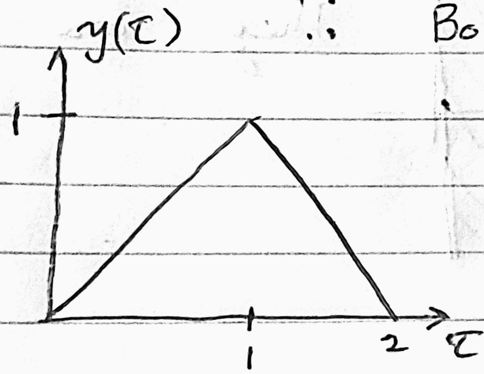




b)

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





Boundaries :

$t<0$, $y(t)=0$

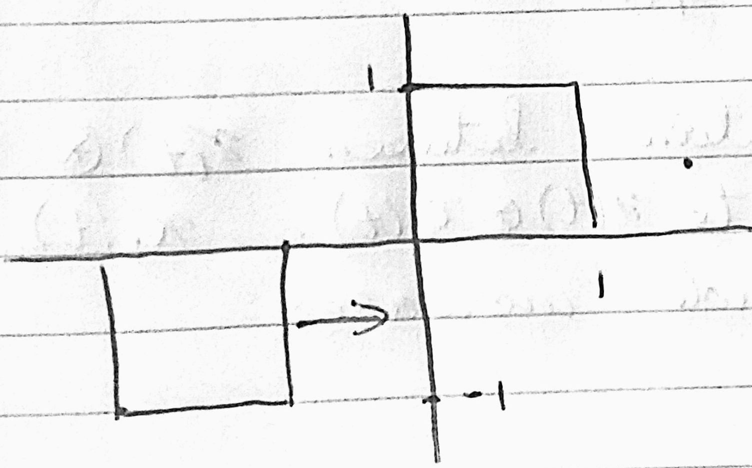
$0<t\leq 1$, $y(t)=t$

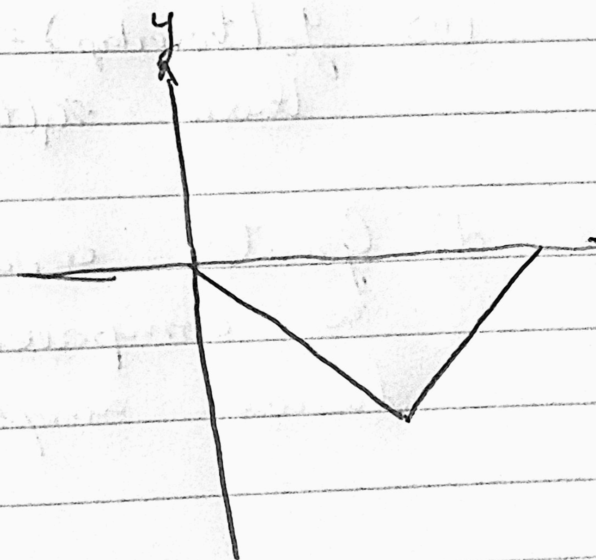
$1<t\leq 2$, $y(t)=-t+2$

$t>2$, $y(t)=0$

Hence A is correct

c) $x_1(t) \circledast x_0(t)$





Hence B is correct

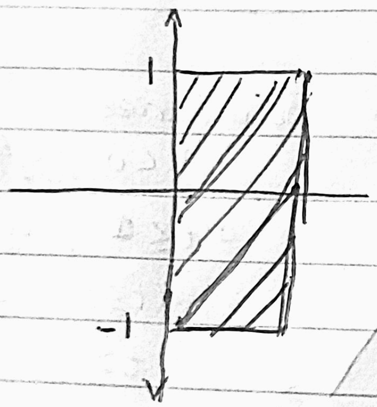
2.a) width of both signals $w_i = 1$

b) (i) From 1b), at $t=1$ there is a complete overlap $\Rightarrow y(t) = 1$. This occurs at $t=1$ ~~value~~ $\Rightarrow$ same as width of signals

(ii) correlation $(x_1, x_1) = 1$ ($y(\text{overlap}) = 1$)

c) $y_0(t) = x_1(t) \circledast x_0(t)$

(i) complete overlap at $t=1$ (1.c)



They are equals.

width = 1.

(ii) $y_0(t_{overlap}) = -1$ at $t=1$. This is lower than $x_1(t) \circledast x_1(t)$

d) Greater correlation between $x(t) \circledast x_1(t)$ as compared to $x(t) \circledast x_0(t)$. $x_1(t)$ is positive hence amplitude increases

3. a)

```
def decode(x, d, fs, x0, x1):
    high = numpy.convolve(x, x1) / fs
    low  = numpy.convolve(x, x0) / fs
    s = numpy.zeros(int(fs * d))
```

b)

```
for i in s:
    if low[0] > high[i]:
        s[i] = 1

    return s
```

4. a)

```
rm_rows = rm.shape[0]
```

b)

```
message_bits = np.zeros(rm_rows, 8000)
```

c)

```
for i in rm_rows:
    for j in message_bits[i]:
        message_bits[j][i] = rm[j][i]
```