```
exercise11
=====
       x =   1  -2   4   6  -5   8  10
       n =  -4  -3  -2  -1   0   1   2

exercise11a
=====
   x1(n) =   3  -6  10  22 -23  12  41 -18 -16   6  -5   8  10
       n =  -6  -5  -4  -3  -2  -1   0   1   2   3   4   5   6

exercise11b
=====
   x2(n) =   5  -6  12  46  -1  23  76  52  18 -15  24  30
       n =  -9  -8  -7  -6  -5  -4  -3  -2  -1   0   1   2

exercise11c
=====
   x3(n) =   0   0   0   0  10  -8 -40  36 -20 -16  10   0
       n =  -8  -7  -6  -5  -4  -3  -2  -1   0   1   2   3

exercise11d
=====
   x4(n) =   0   0   0   0  -0  -0   2   3  -1  15   0  26  54   0   0   0   0
0   0   0   0
       n = -10  -9  -8  -7  -6  -5  -4  -3  -2  -1   0   1   2   3   4   5   6
7   8   9  10

exercise11e
=====
   x5(n) =   0   1   0   3  12  16  22  55  54  37  80  50
       n =  -4  -3  -2  -1   0   1   2   3   4   5   6   7
```

1.2.1

$$T_1[x(n)] = \sum_0^n x(k)$$

a) Stable : $|x(n)| \leq M$

$$\Downarrow$$

$$T_1[x(n)] \leq |n| \cdot M$$

As $n \to \infty$, $T_1 \to \infty$. Therefore NOT stable.

b) Causal : $T_1[x(n)]$ depends on future values of x, when $n < 0$.

Therefore NOT causal

c) Linear : $T_1[a x_1(n) + b x_2(n)]$

$$= \sum_0^n a x_1(k) + b x_2(k)$$

$$= a T_1[x_1(n)] + b T_1[x_2(n)]$$

i.e. the system is linear.

d) TI : let $x_1(n) = x(n - n_0)$

$$y_1(n) = y(n - n_0)$$

$$y(n) = T_1[x(n)]$$

$$T_1[x_1(n)] = \sum_0^n x_1(k) = \sum_0^n x(k - n_0)$$

$$\neq y_1(n) = y(n - n_0) = \sum_0^{n-n_0} x(k)$$

i.e. NOT TI

1.2.2 $\quad T_2[x(n)] = \sum_{n-10}^{n+10} x(k)$

Stable: $|x(n)| \leq M \Rightarrow T_2 \leq 20M$, i.e. stable

Causal: T_2 refers to future values of x, therefore NOT causal.

Linear: As in 1.2.1, i.e. linear

TI: $\quad T_2[x_1(n)] = \sum_{n-10}^{n+10} x_1(k)$

$$= \sum_{n-10}^{n+10} x(k-n_0)$$

$$y_1(n) = \sum_{n-n_0-10}^{n-n_0+10} x(k)$$

$$= \sum_{n-10}^{n+10} x(k-n_0) = T_2[x_1(n)]$$

i.e. TI.

1.2.3 $\quad T_3[x(n)] = x(-n)$

Stable: if $|x(n)| \leq M$ then also $|x(-n)| \leq M$, i.e. stable.

Causal: for $n<0$ T_3 depends on future x; i.e. NOT causal.

Linear: $T_3[a x_1(n) + b x_2(n)]$

$= a x_1(-n) + b x_2(-n)$

$= a T_3[x_1(n)] + b T_3[x_2(n)]$

i.e. linear.

Ti: $T_3[x_1(n)] = x(-n-n_0)$.

$y_1(n) = y(n-n_0) = x(-n+n_0)$

$\neq T_3[x_1(n)]$, i.e. NOT Ti.