Signal Notation and Properties
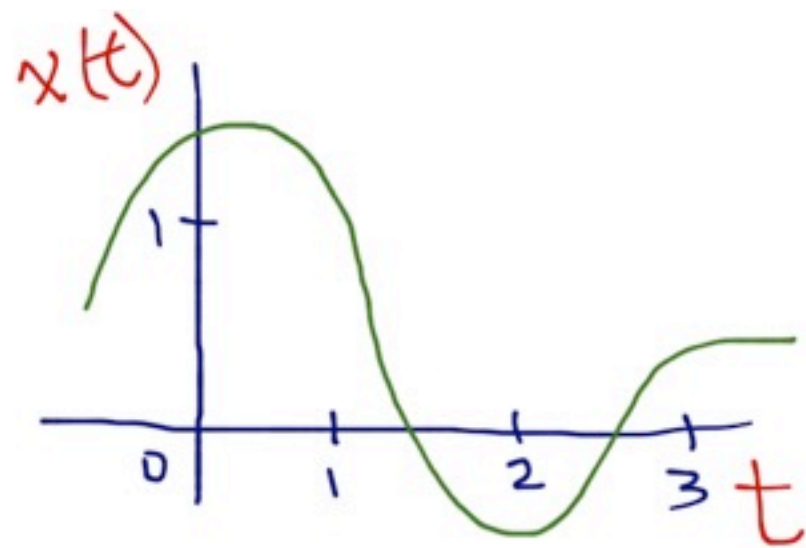
Contents

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1. Signals as functions

2. Continuous- and discrete-time signals
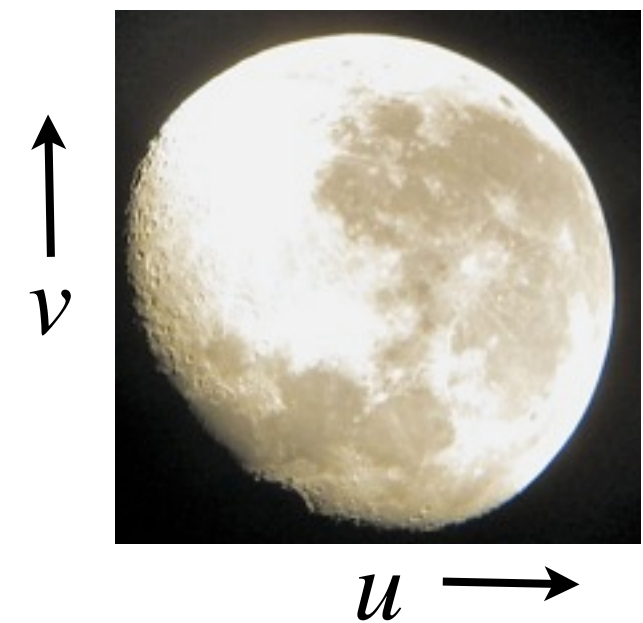
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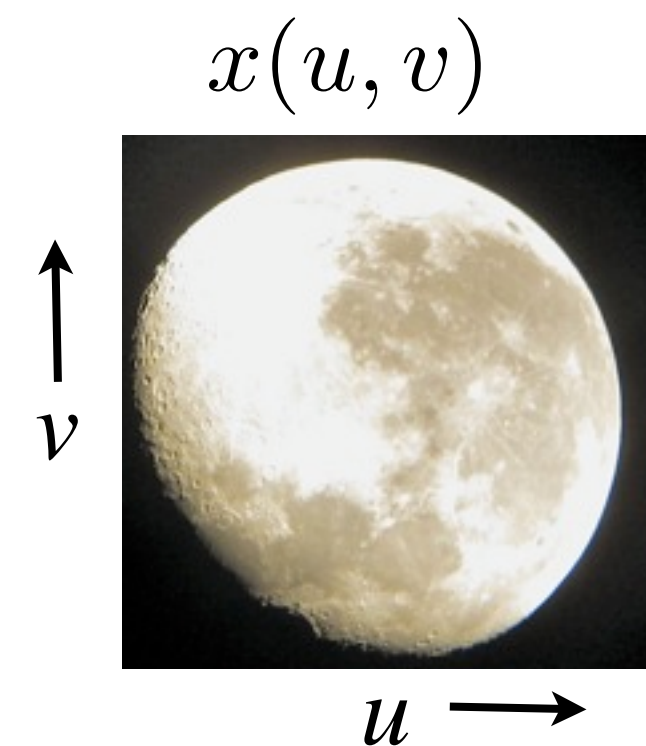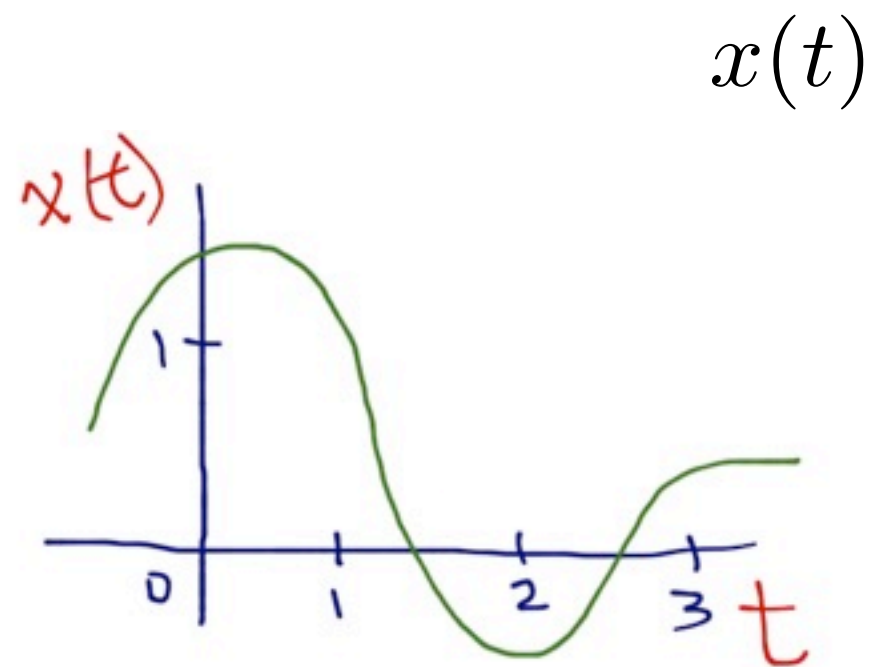
3. Periodic signals

Signals

$$x(t)$$

$$x(u, v)$$

Signals

- A "signal" describes how some physical quantity varies over time and/or space

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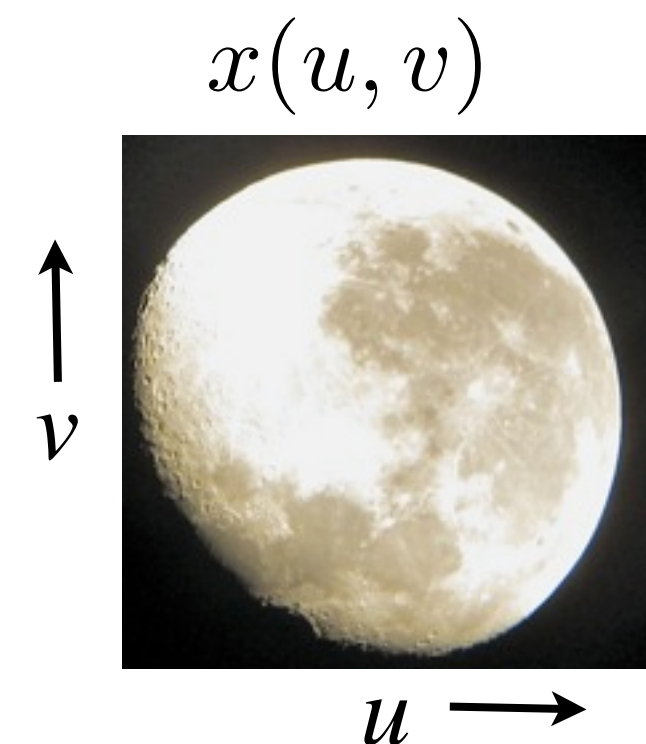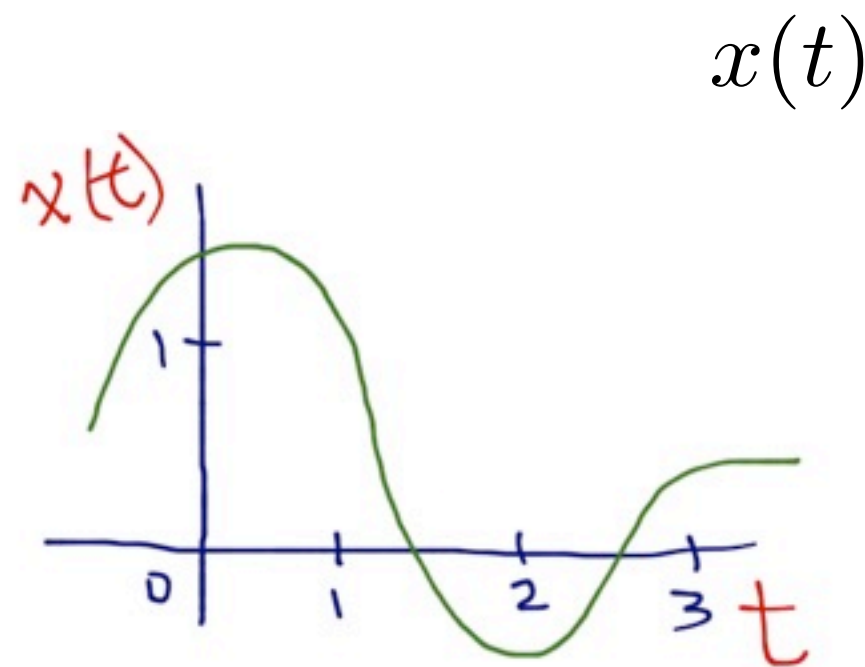
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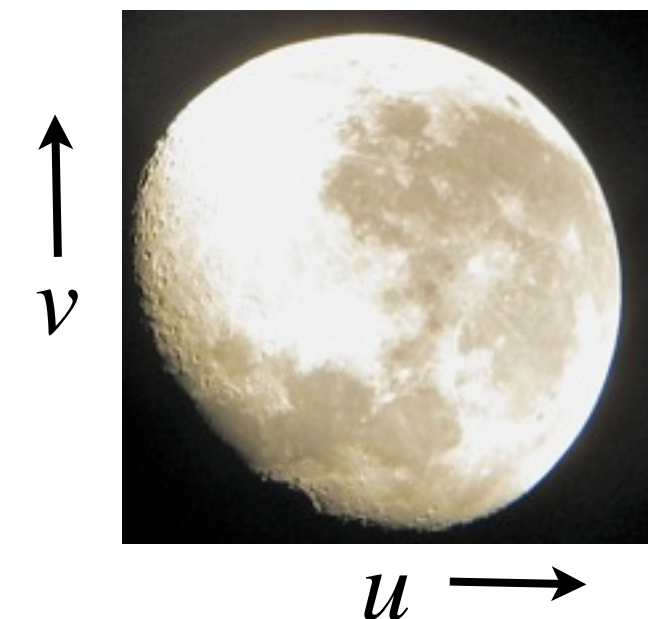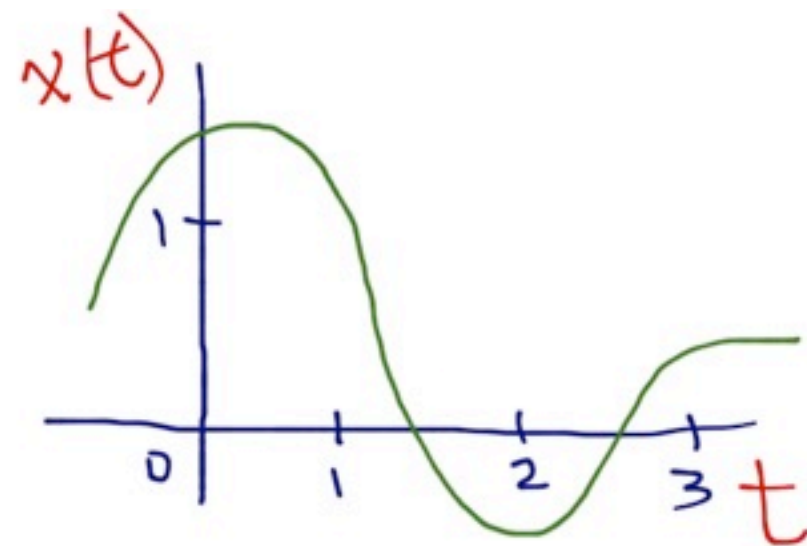
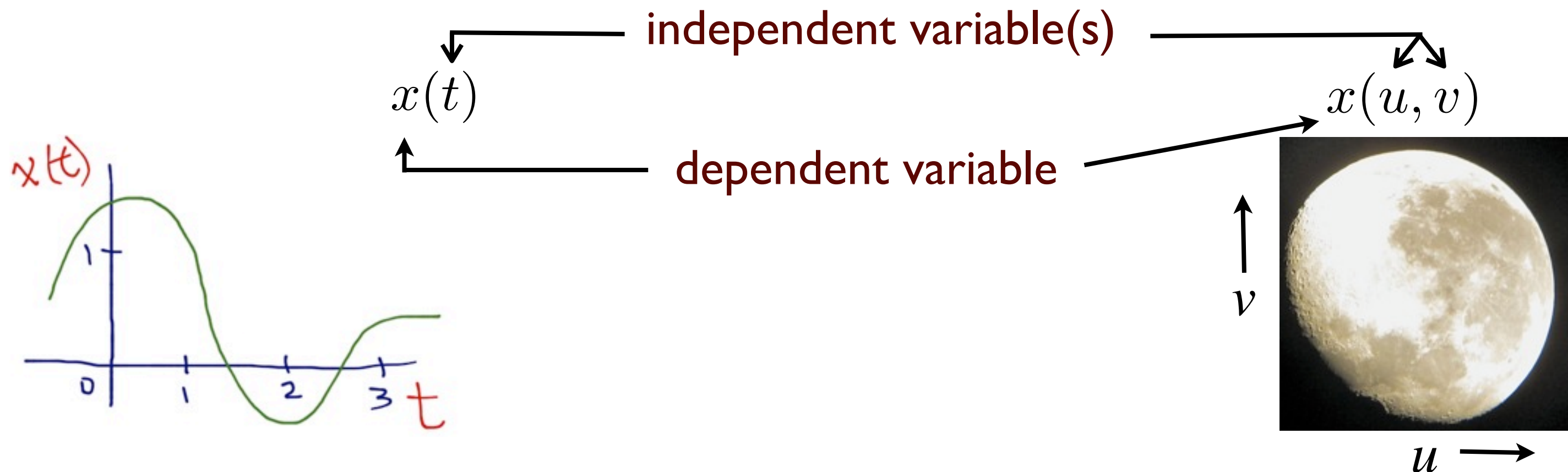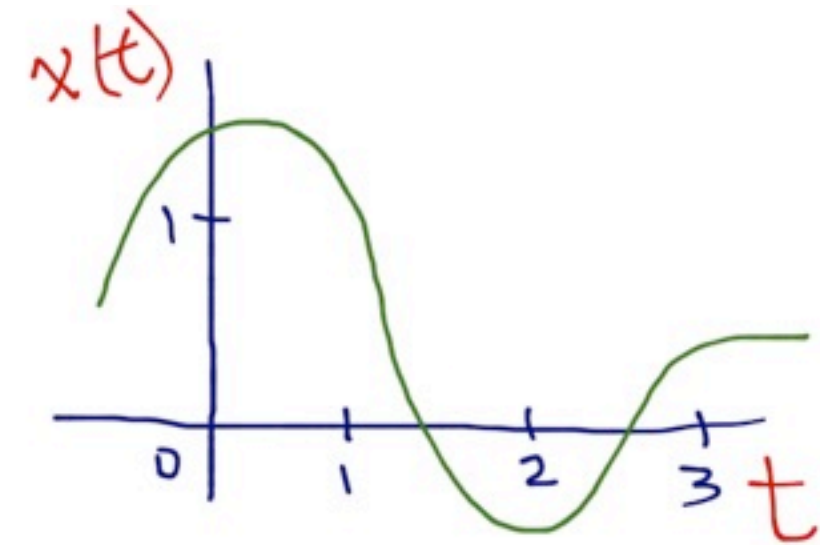independent variable(s)

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dependent variable

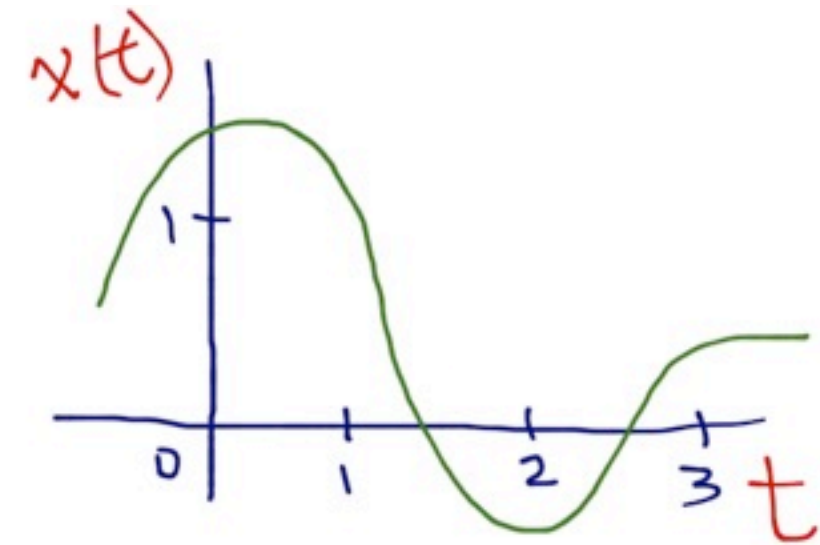# Continuous- and Discrete Indep Vbls

$x(t)$

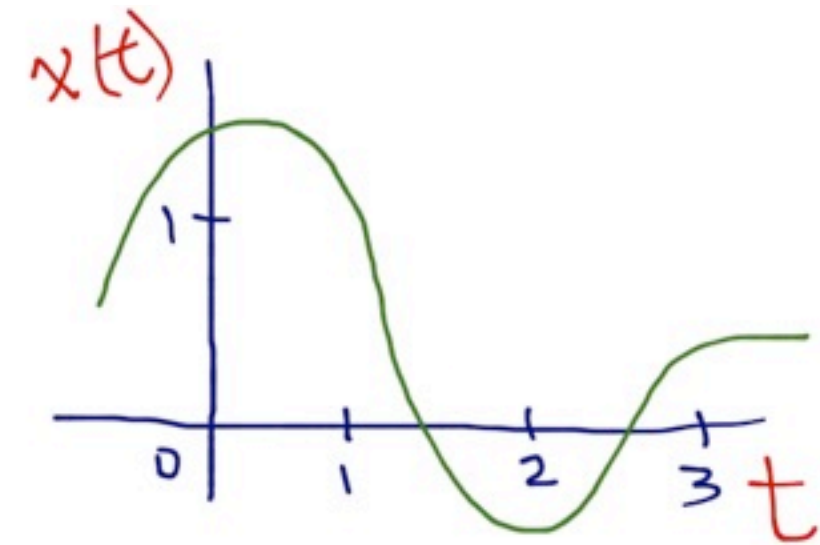# Continuous- and Discrete Indep Vbls

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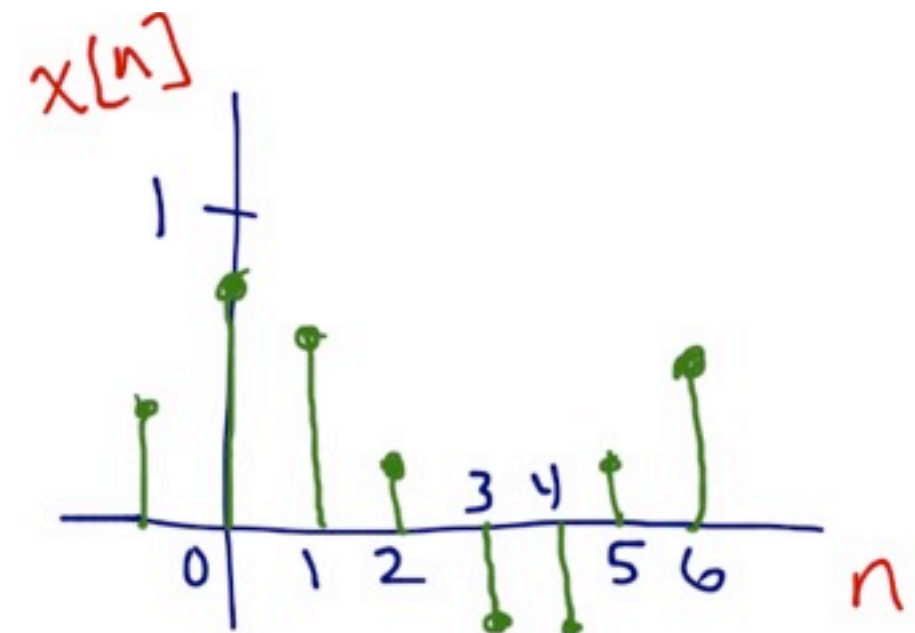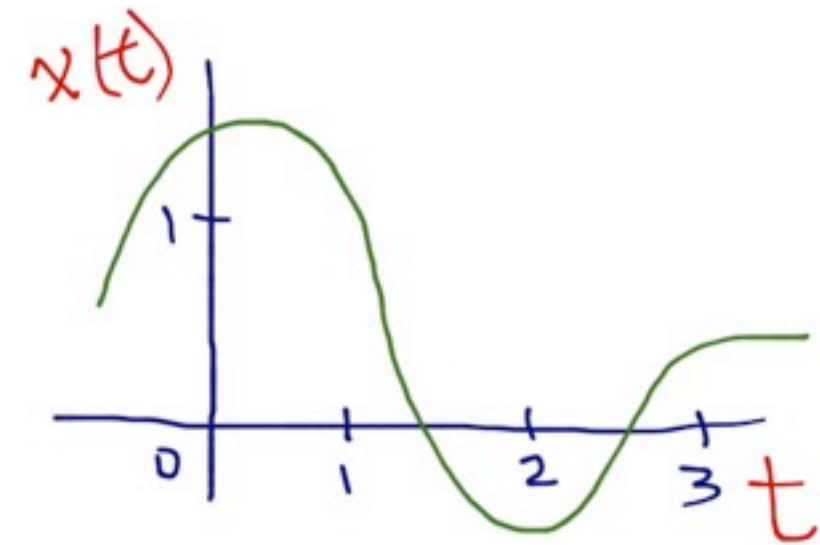 (typically integers) $\quad x[n]$

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Continuous- and Discrete Indep Vbls

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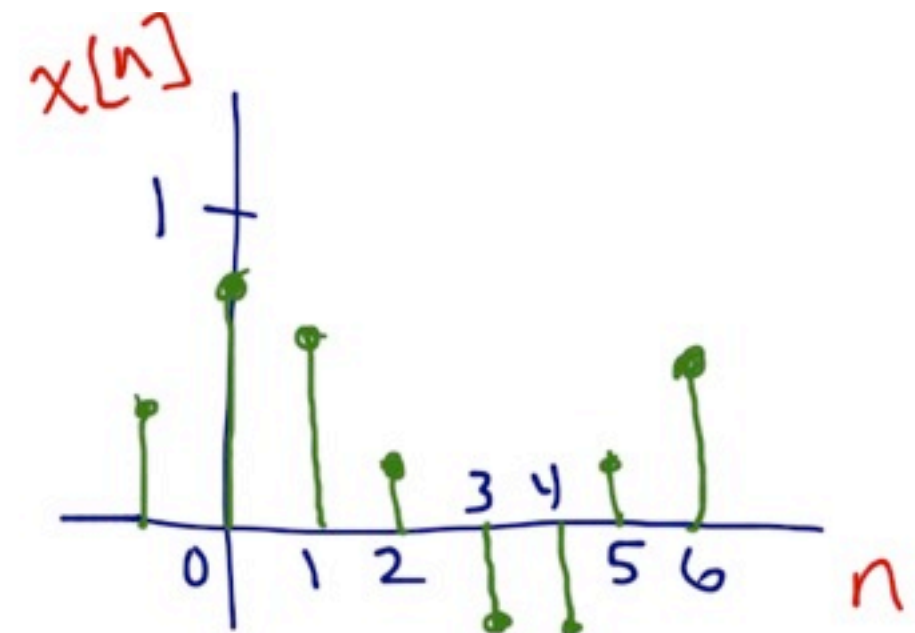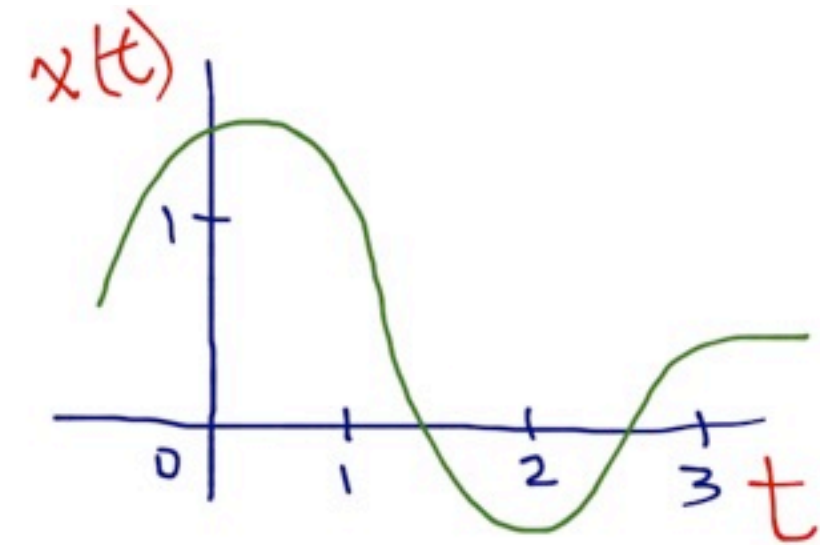- Discrete: n limited set of values
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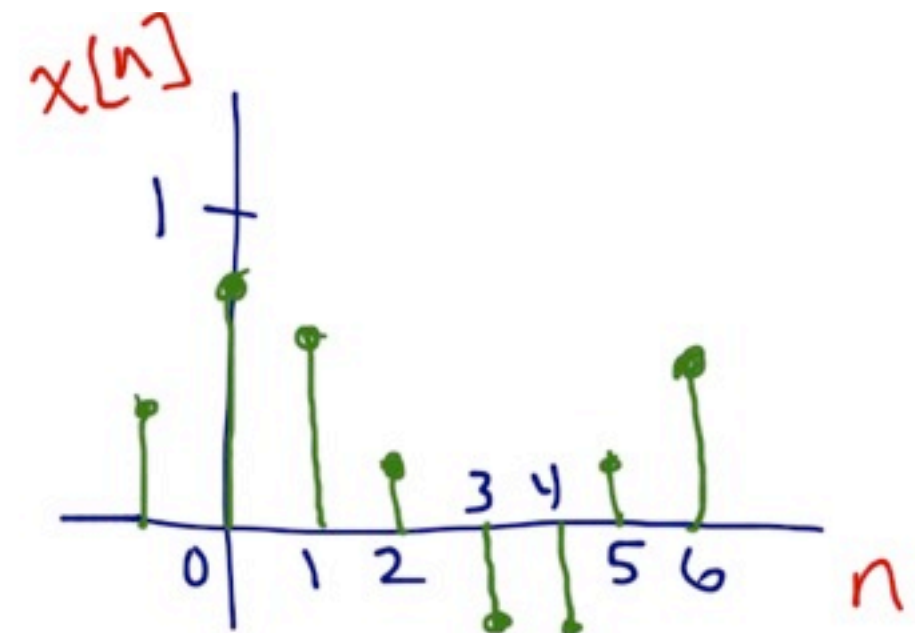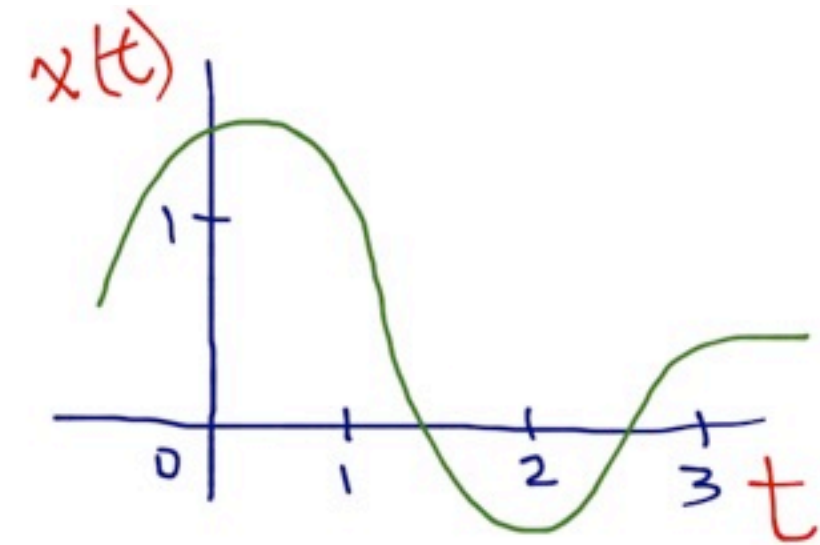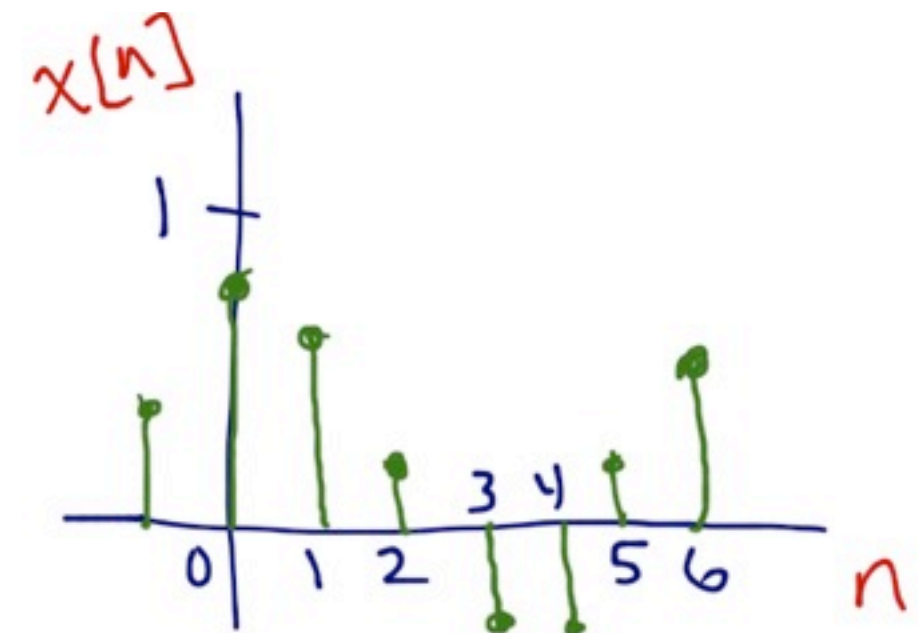
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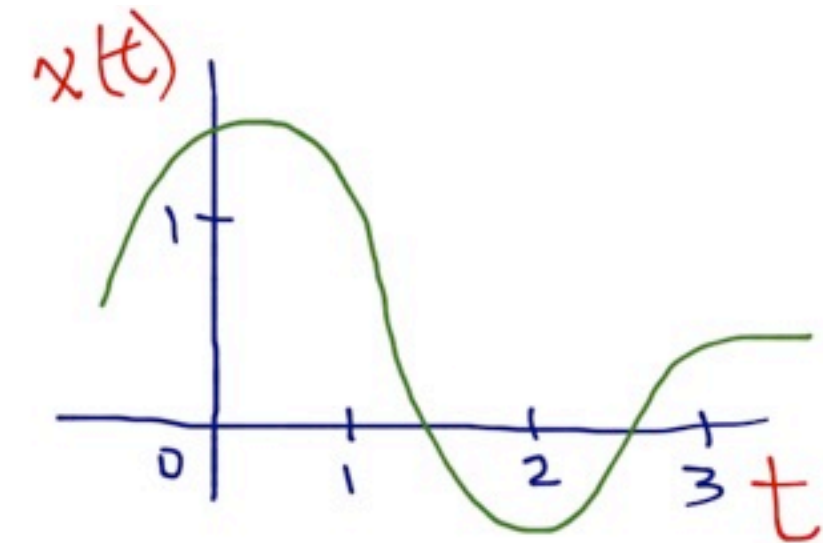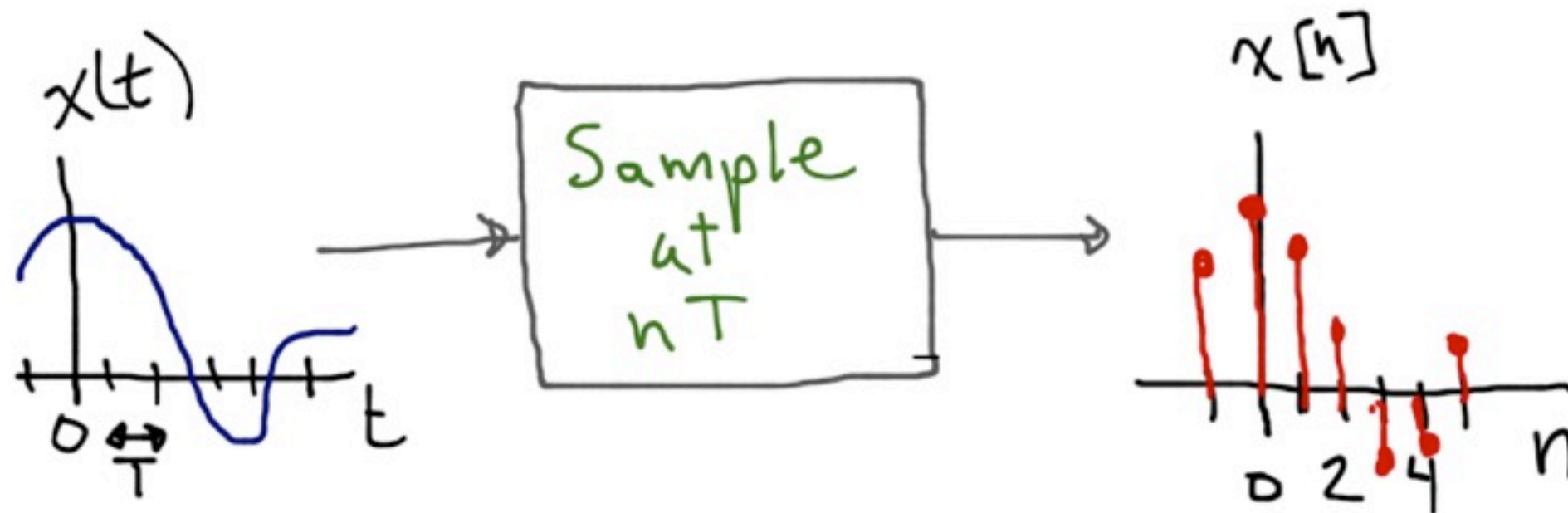
Sampling

$$x[n] = x(t)|_{t=nT} = x(nT)$$

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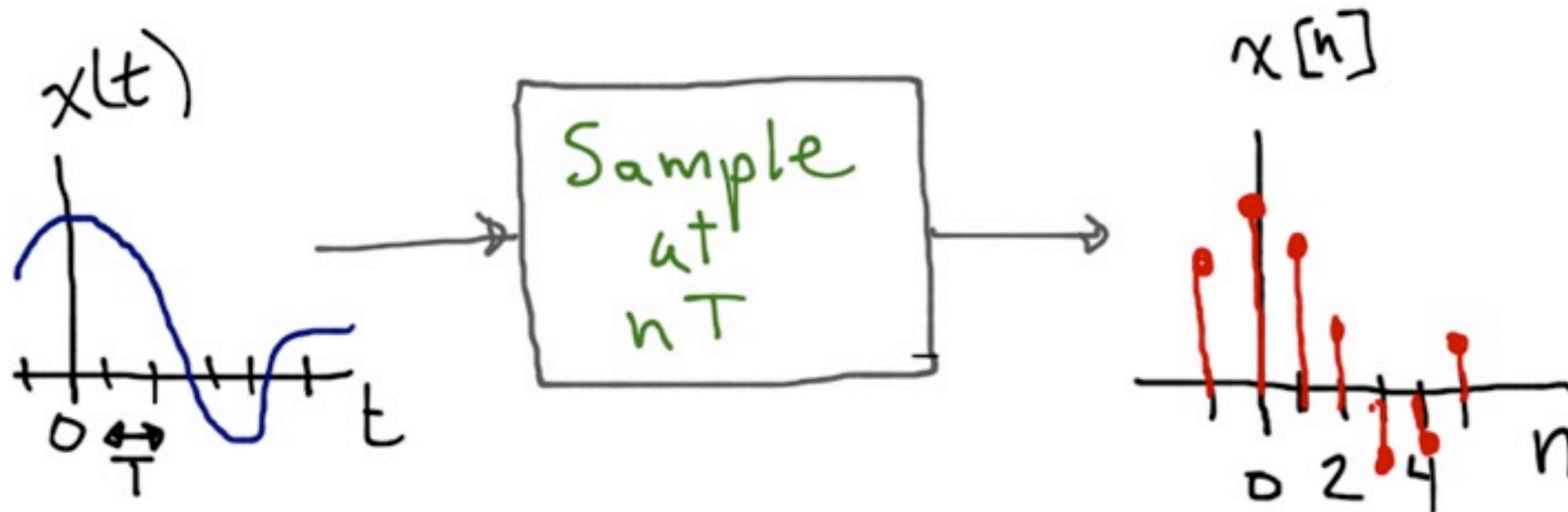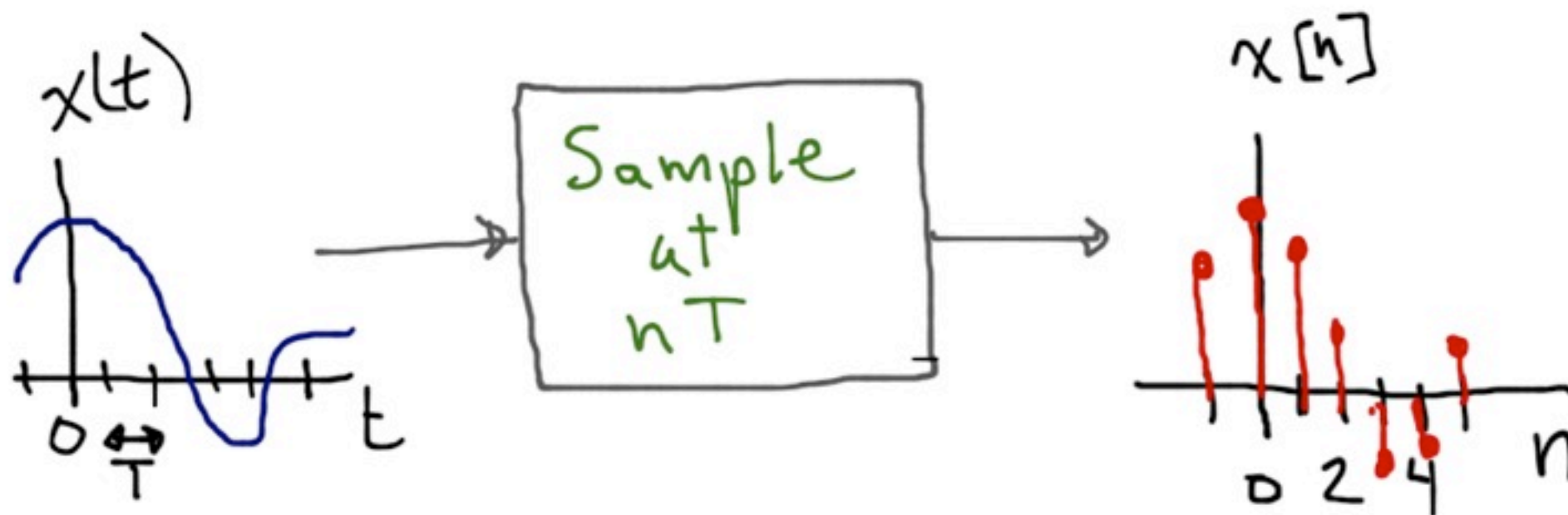

Examples

- Analog to digital converter

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Sampling

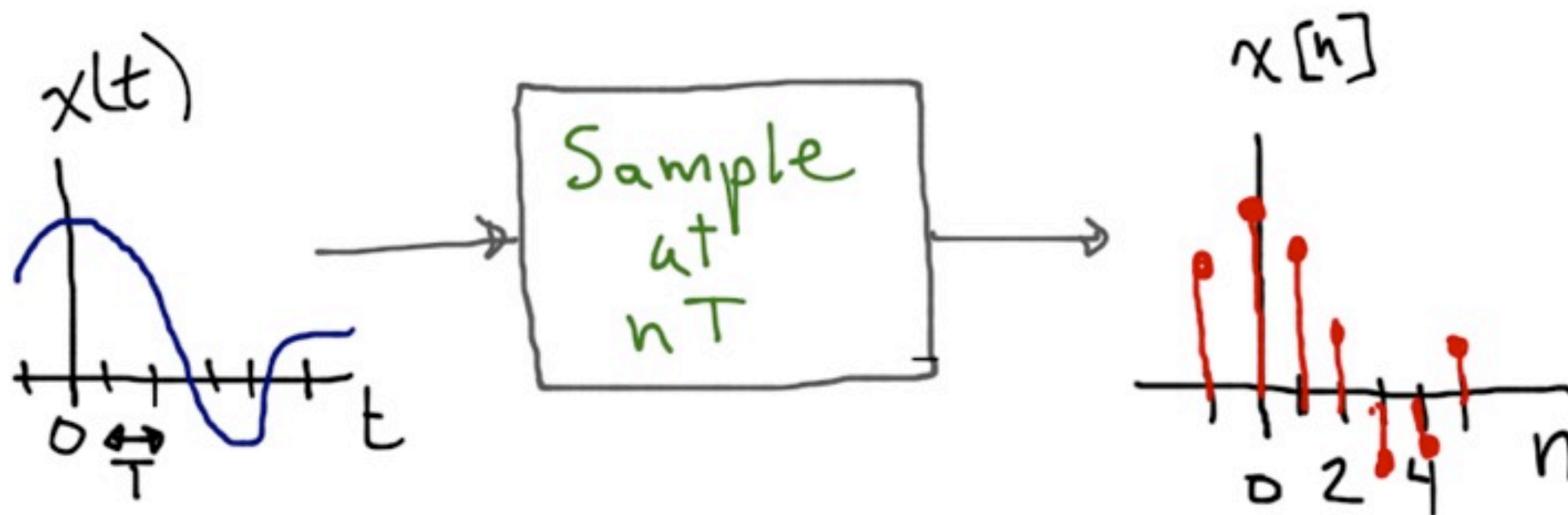- Often we obtain a discrete-time signal $x[n]$ by sampling a continuous-time signal $x(t)$

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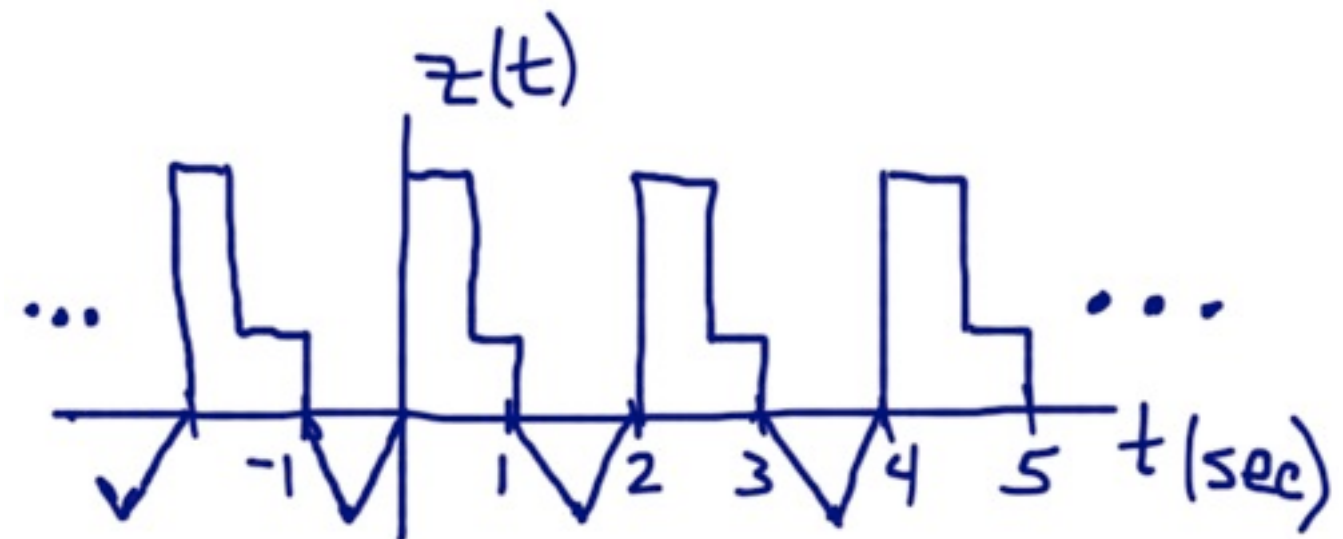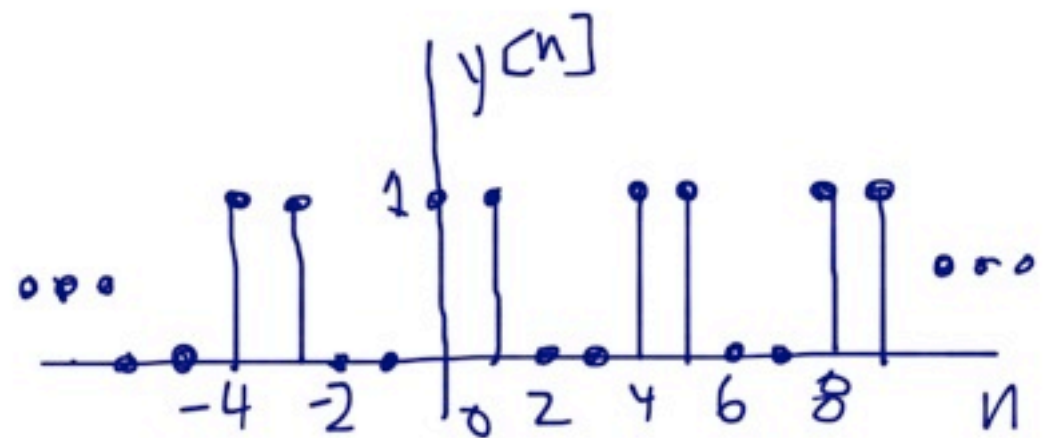
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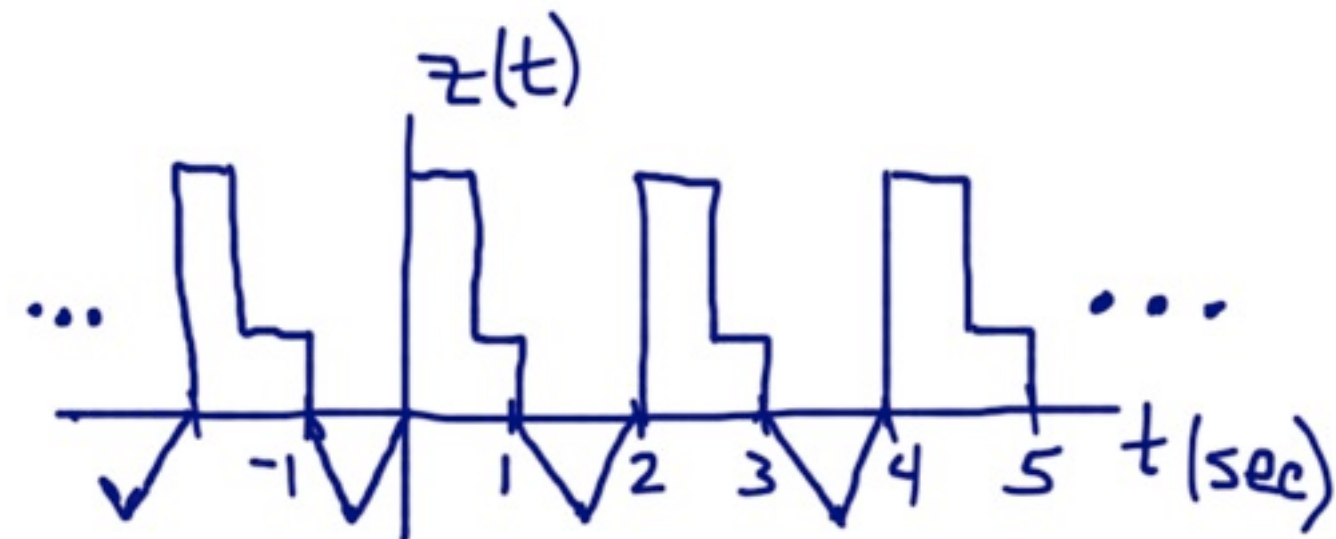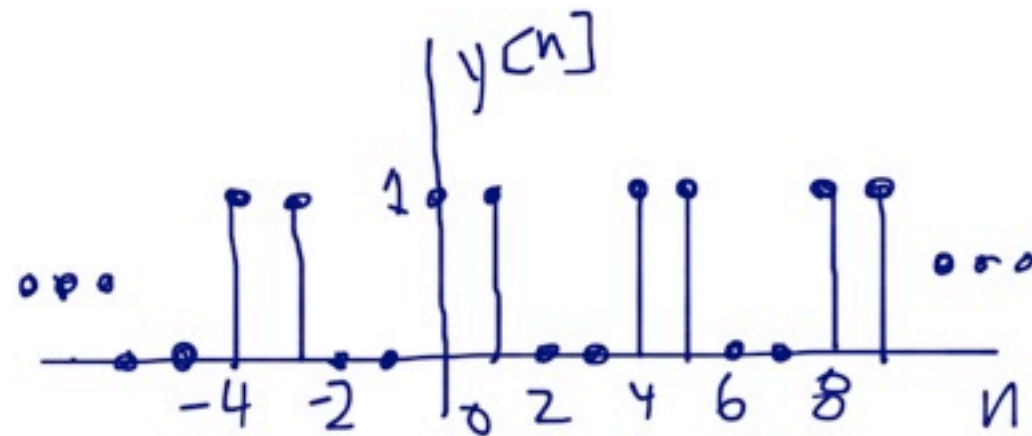 - Use continuous time axis labels to visualize as continuous-time signal

Periodicity

$$T_o = 2, 4, 6, \ldots \text{sec}$$
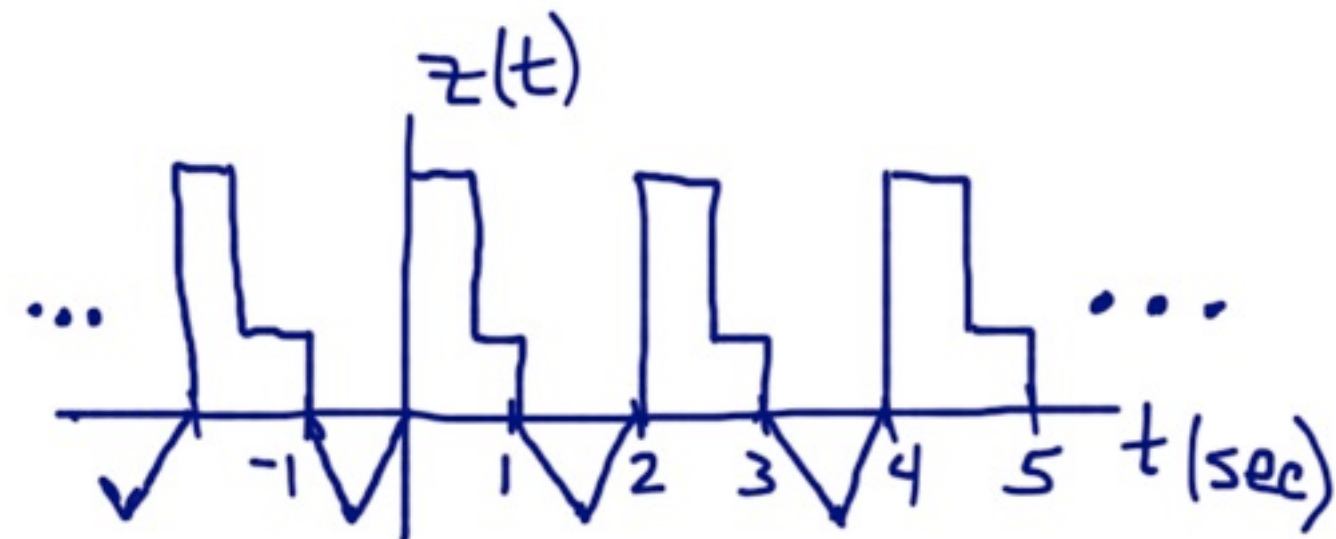
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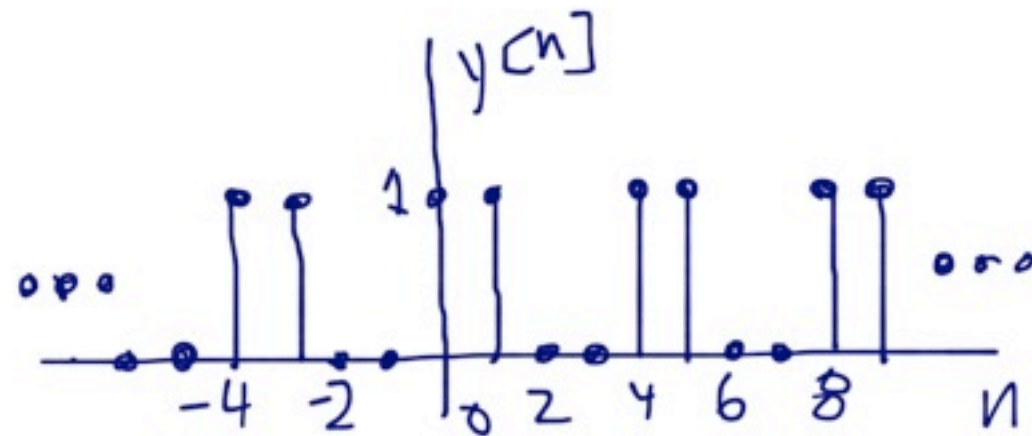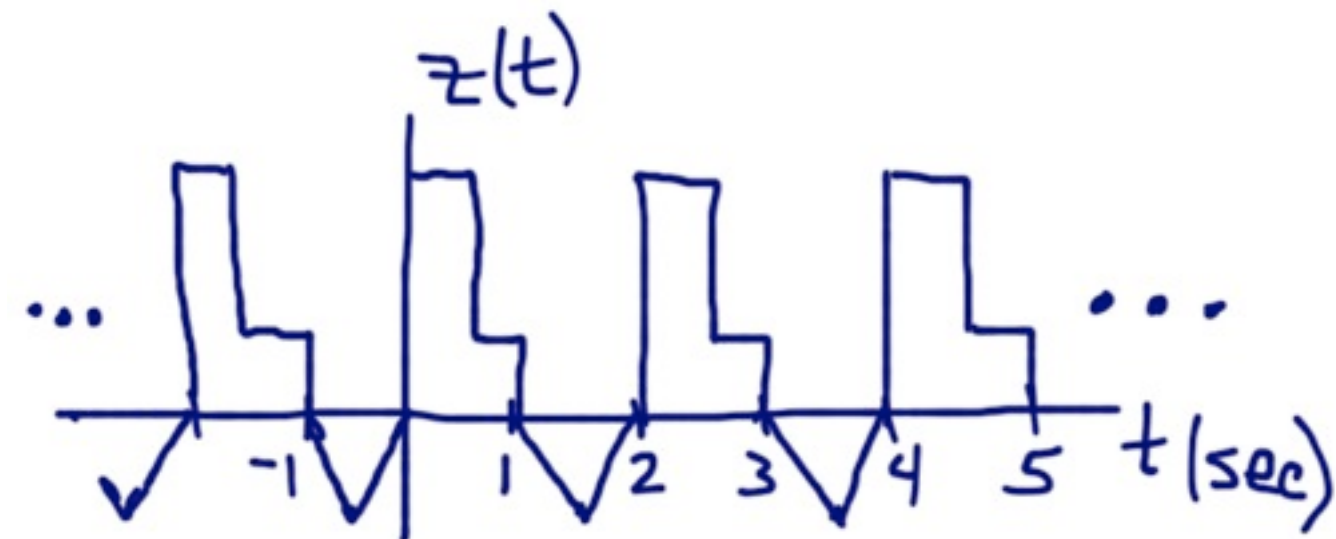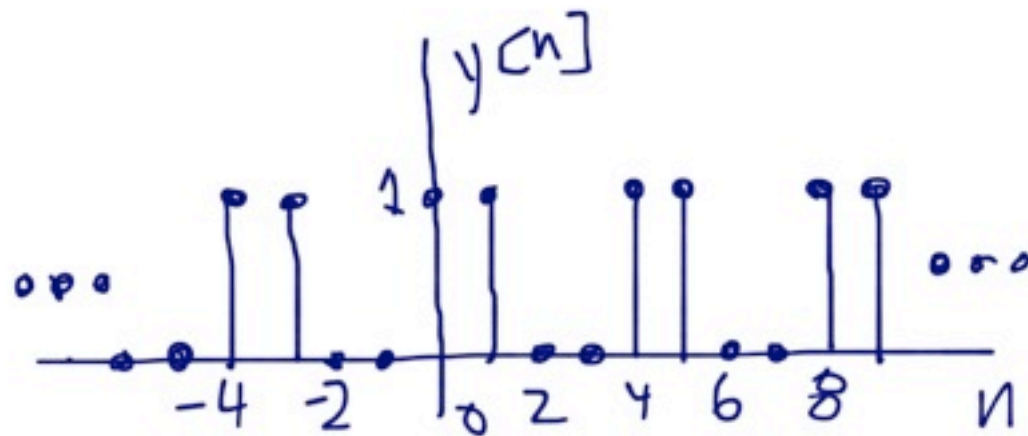
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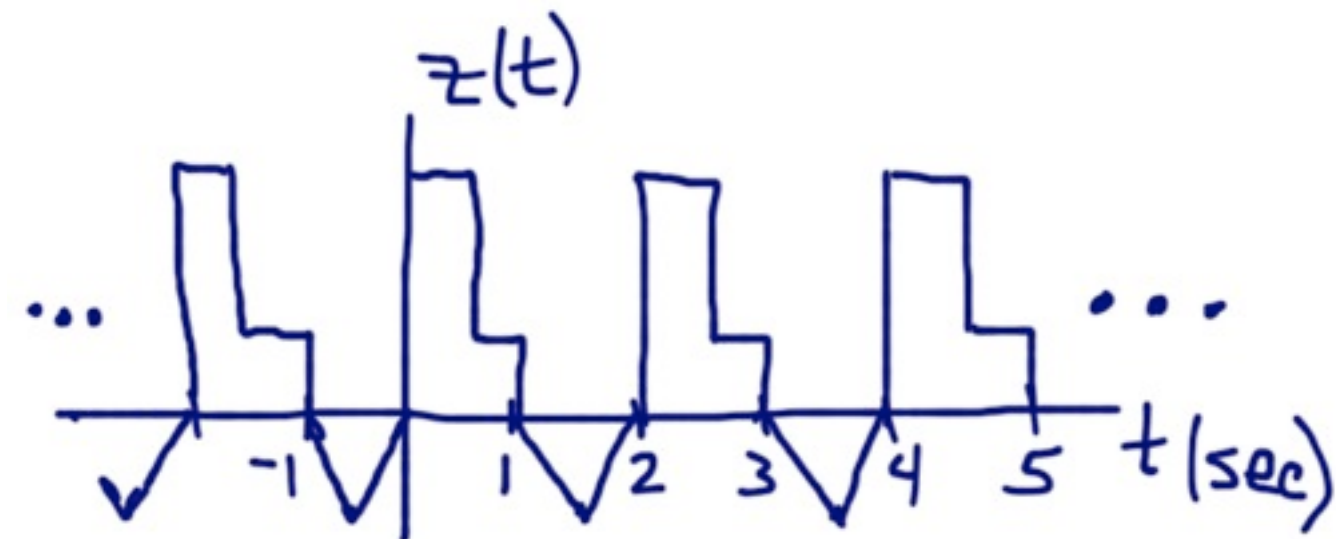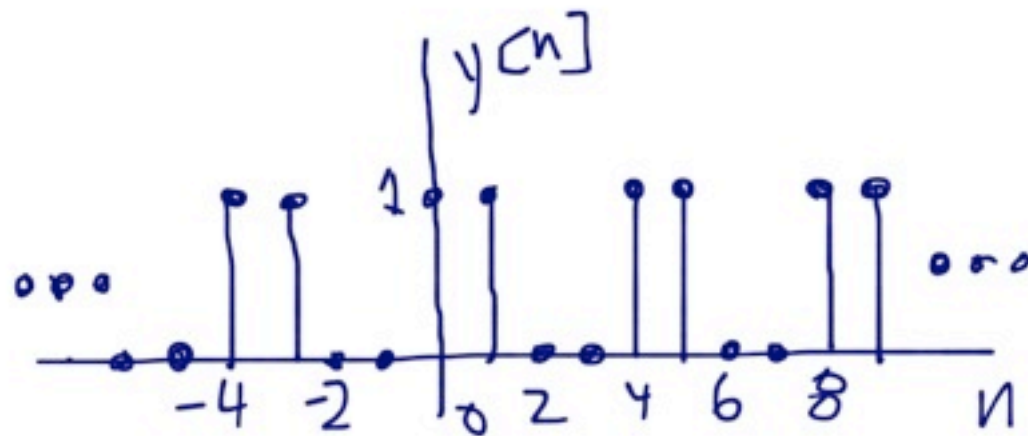
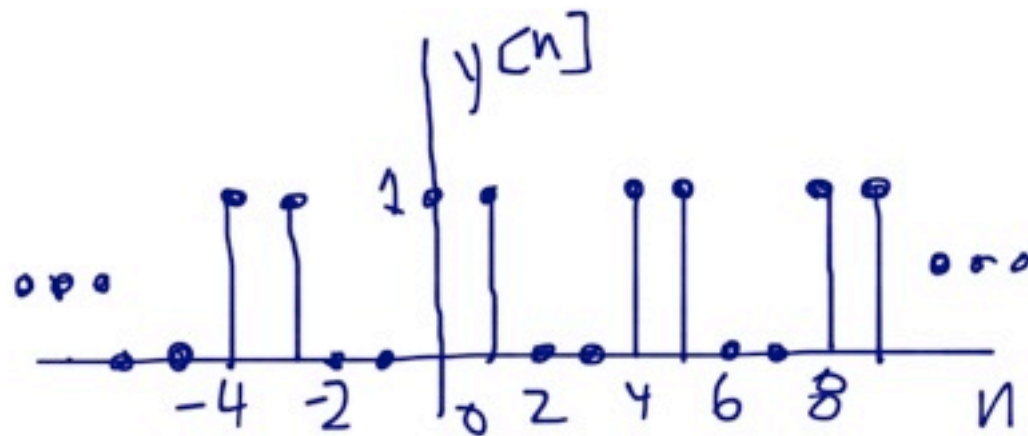$$T_o = 2, 4, 6, \ldots \text{sec}$$

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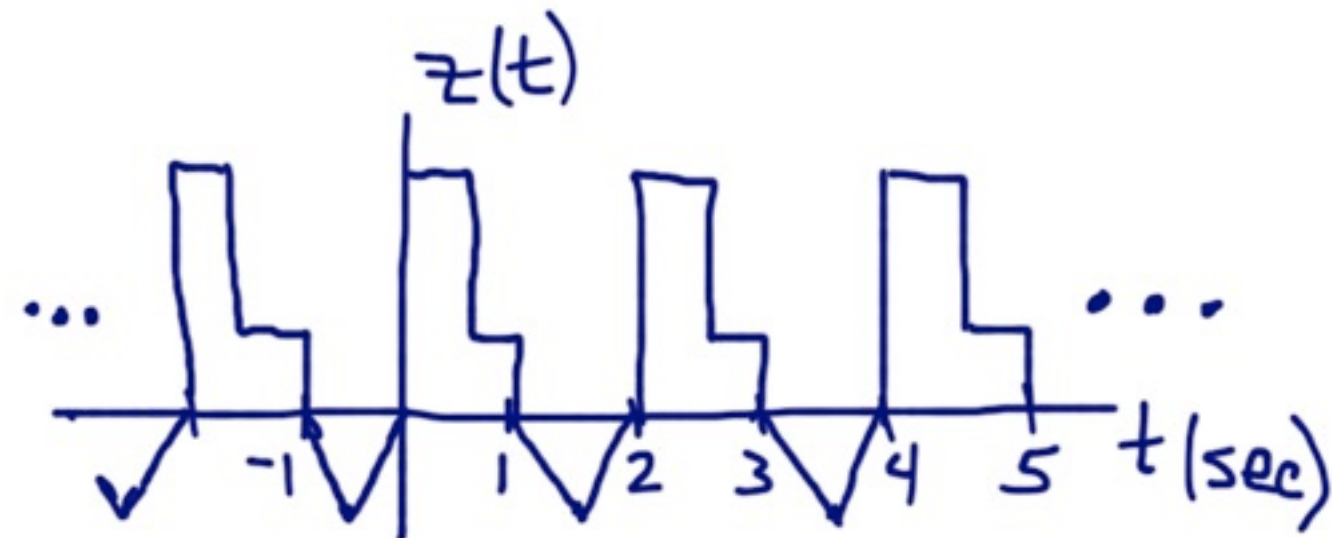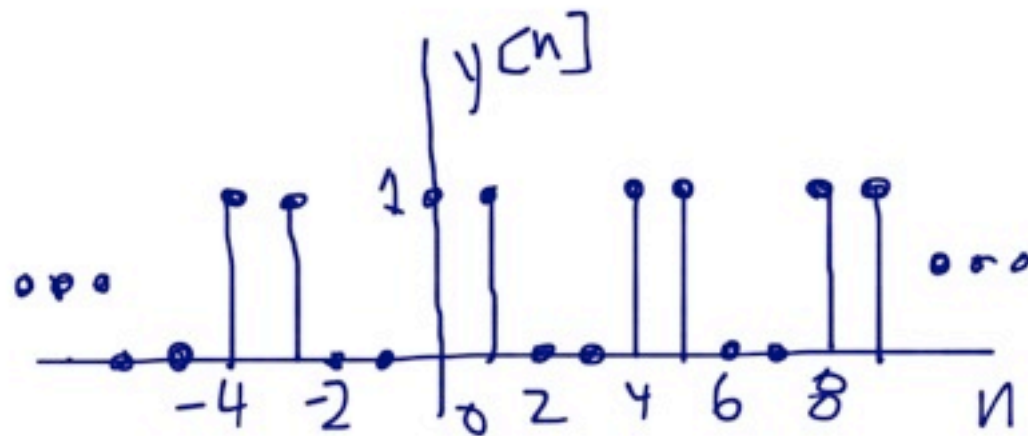
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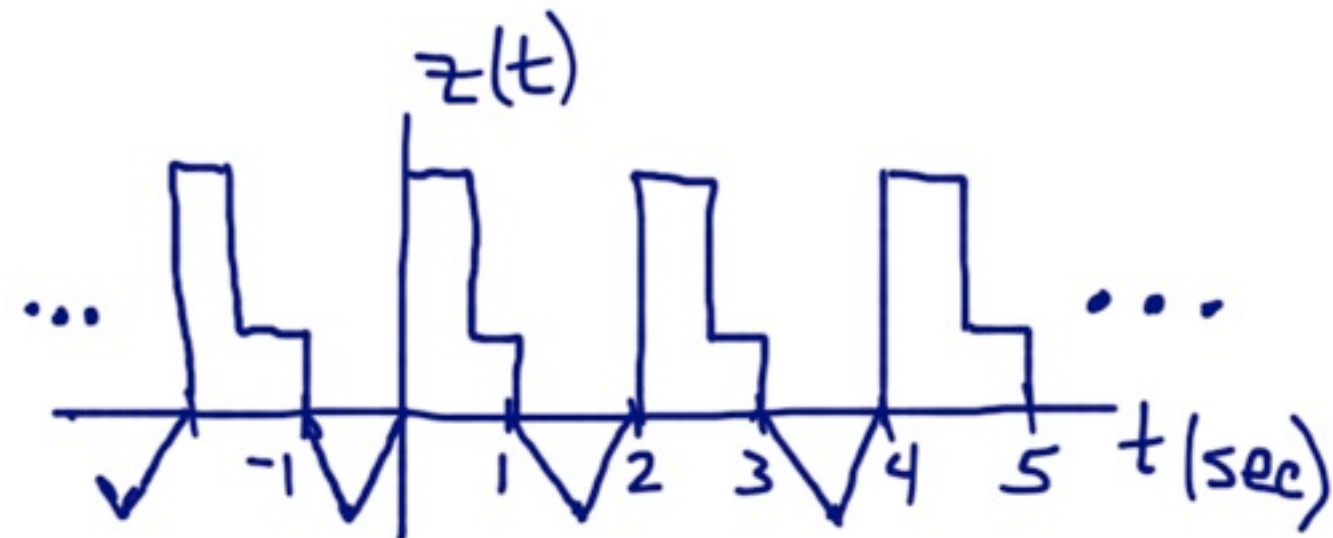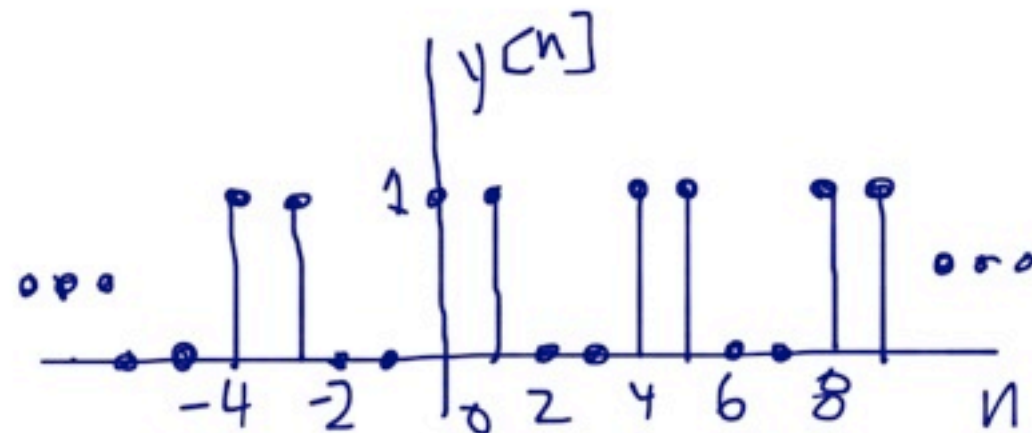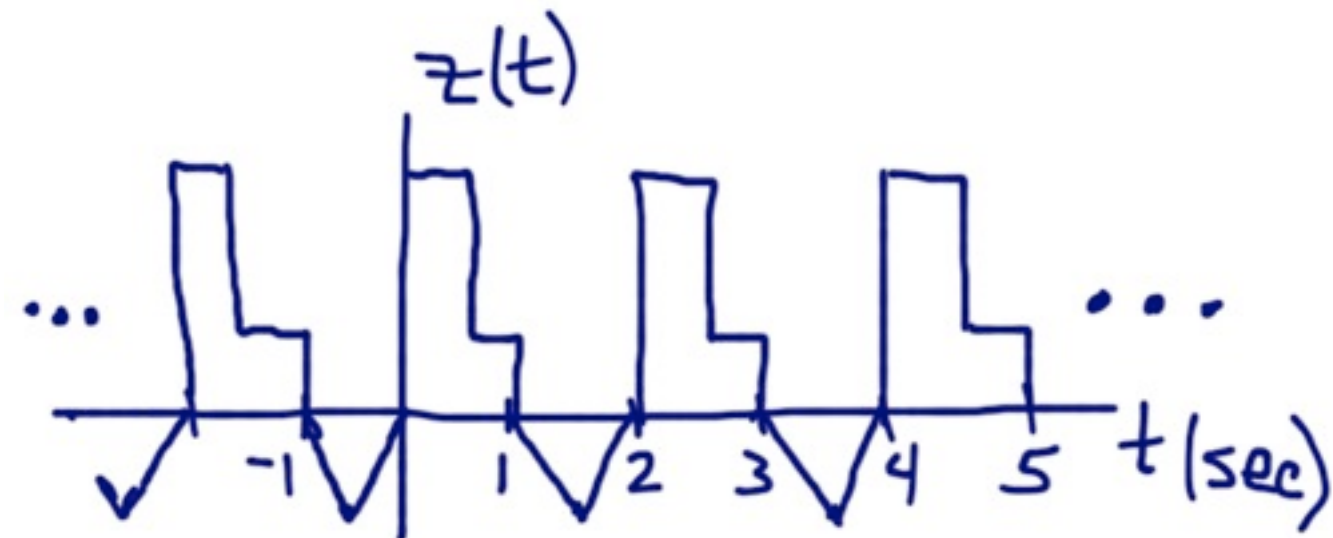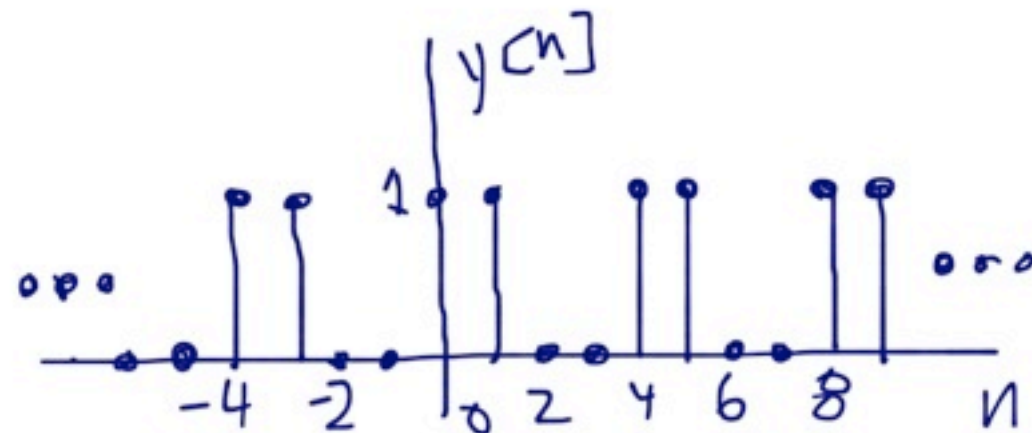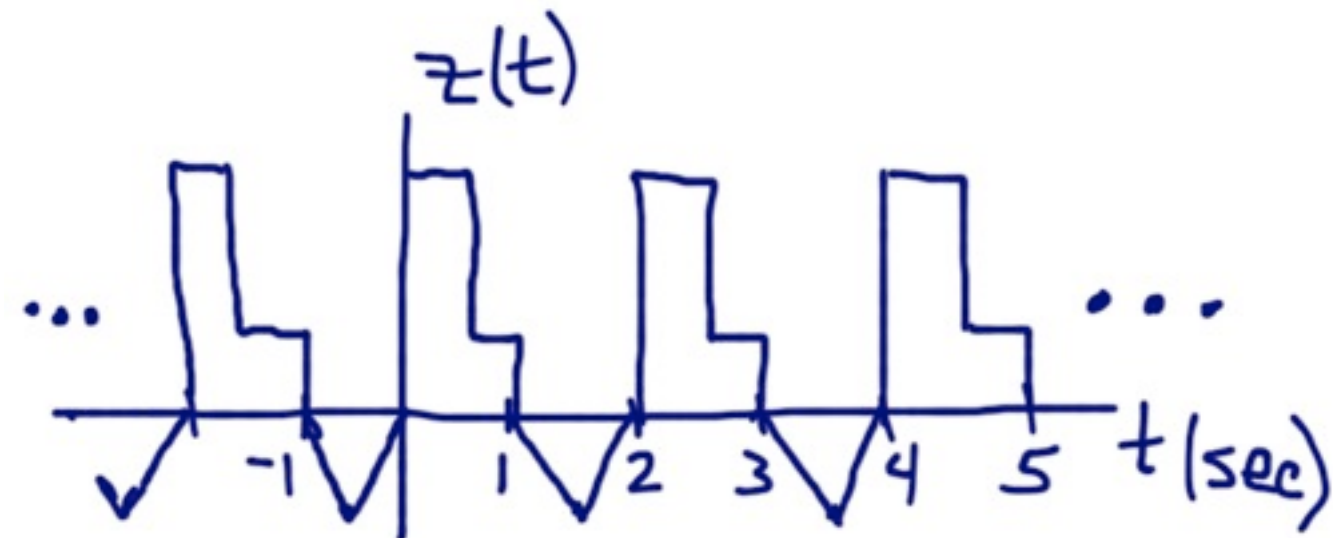- Period is the repetition interval

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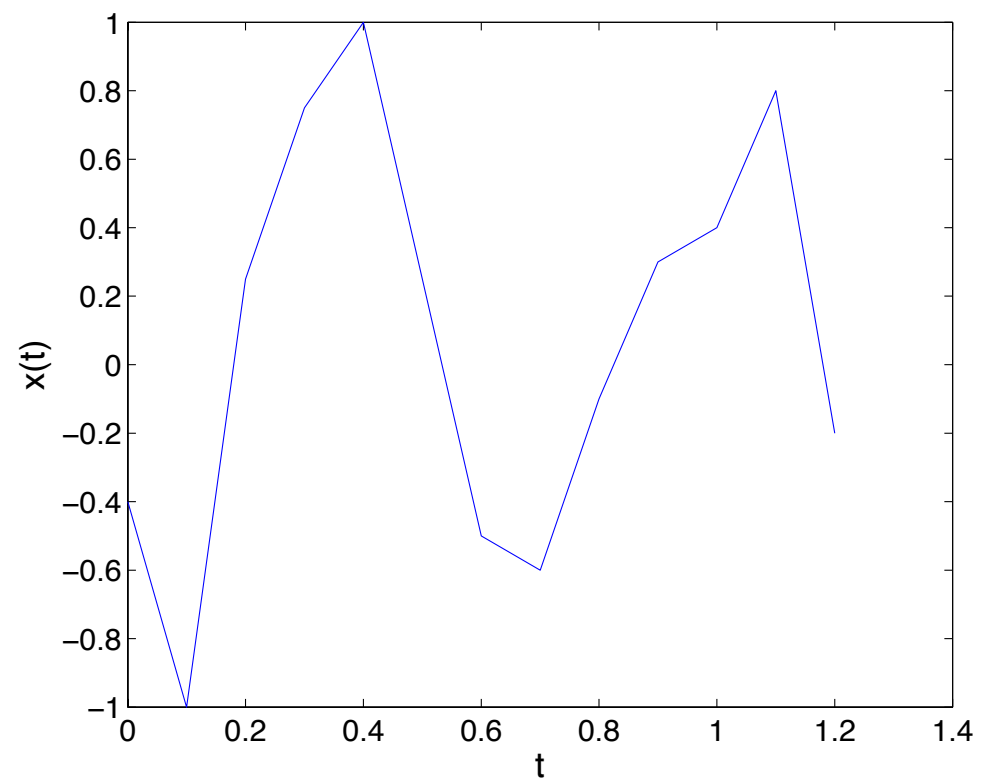- Brain electrical activity: "normal" vs seizure

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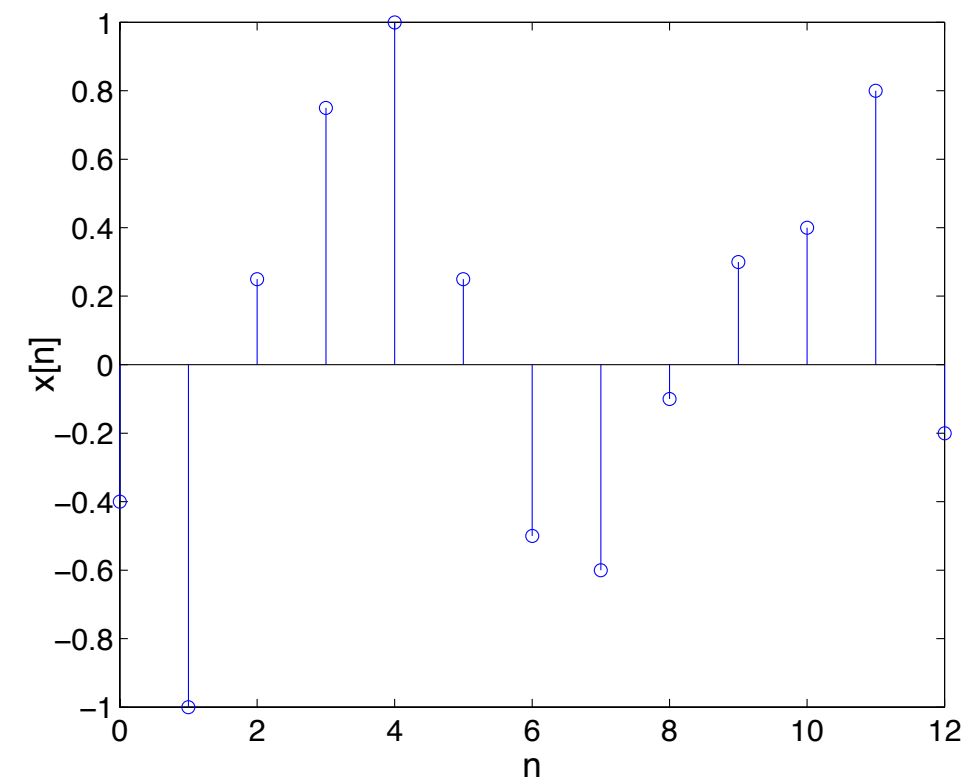- Brain electrical activity: "normal" vs seizure

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- Saxophone

Displaying Signals in MATLAB

```
x = [-0.4,-1,0.25,0.75,1,0.25,-0.5,-0.6,-0.1,0.3,0.4,0.8,-0.2];
t = [0:12]*0.1;
n = 0:12;
```

```
plot(t,x)
xlabel('t')
ylabel('x(t)')
```

```
stem(n,x)
xlabel('n')
ylabel('x[n]')
```

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- Practical definitions