2) one dimensional, multi-channel, discrete time, digital
3) multi-dimensional, single channel, continuous time, analog.
2) one dimensional, single channel, continuous time, analog.
3) one dimensional, multi-channel, discrete time, digital.

1.3 (b)

2) \( \cos(0.01 \pi n) \) 
   \[ f = \frac{0.01 \pi}{2\pi} = \frac{1}{200} \Rightarrow \text{Periodic with } N_p = 200 

3) \( f = \frac{0.01 \pi}{2\pi} \times \frac{1}{2\pi} = \frac{1}{7} \Rightarrow \text{Periodic with } N_p = 7 

4) \( f = \frac{0.01 \pi}{2\pi} = \frac{3}{2} \Rightarrow \text{Periodic with } N_p = 2 
   \] (since \( \frac{3}{2} \times 2 = 3 \), integer)

5) \( f = \frac{0.01 \pi}{2\pi} + \text{ratio of integers} \Rightarrow \text{non-periodic} 

6) \( f = \frac{0.01 \pi}{2\pi} \times \frac{1}{2\pi} = \frac{31}{10} \Rightarrow \text{Periodic with } N_p = 10 

(Credit for solutions to Saroja Srinidhi, Northeastern University)
\[ \text{Analyze} \] \[ x(t) = 3 \sin(100 \pi t) \] 

Period is given by \[ 100 \pi T_a = 2\pi \] 
\[ T_a = \frac{2\pi}{100 \pi} = \frac{1}{50} = 0.02 \text{ ms} \]

\[ x[n] = x[nT_a] = x[n/(100\pi)] = 3 \sin\left(\frac{\pi n}{3}\right) \]

\[ f = \frac{\pi}{3} \times \frac{1}{2\pi} = \frac{1}{6}, \text{ so } N_p = 6 \]

\[ x[n] = \{0.2, -0.3, 0.2, -0.3, 0.2\} \]

see sketch above

\[ N_p = 6 \text{ technically should not refer to period in ms.} \]

\[ \text{Yes, clearly } \geq 4 \ \text{ samples/cycle} \]
\[ \text{if } F_s = 4 \times (\frac{1}{T_a}) = 200 \text{ samples/sec} \]

\[ x(n) = A \cos\left(2\pi F_0 n/f_s + \theta\right) \]
\[ = A \cos\left(2\pi \left(\frac{1}{0.02}\right) n + \theta\right) \]

But \[ T/f_p = f \Rightarrow x[n] \text{ is periodic if } f \]

\( \text{is rational.} \)
* (Note, in parts b and c of Tp should have been Td)

\[ \frac{106.5}{\pi} \text{ of } x(n) \text{ is periodic, then } f = \frac{\alpha}{N} \]

\[ n = \frac{\pi}{f} \]

Thus \( T_d = N T = \frac{\pi}{f} T = \pi T_p \)

Thus period of discrete signal \( T_d = A \) periods of analog signal.

(If \( \frac{f}{T_p} \) is integer, \( \alpha = 1 \)

\( T_d = \alpha T_p \Rightarrow N T = \pi T_p \Rightarrow f = \frac{\pi}{N} \Rightarrow f \text{ rational, } x[n] \text{ periodic} \)