1.3
(a) Periodic with period $T_p = \frac{2\pi}{5}$.
(b) $f = \frac{5}{T_p} \Rightarrow$ non-periodic.
(c) $f = \frac{1}{T_p} \Rightarrow$ non-periodic.
(d) $\cos\left(\frac{2\pi}{5}\right)$ is non-periodic; $\cos\left(\frac{4\pi}{5}\right)$ is periodic; Their product is non-periodic.
(e) $\cos\left(\frac{2\pi}{5}\right)$ is periodic with period $N_p=4$
$\sin\left(\frac{2\pi}{5}\right)$ is periodic with period $N_p=16$
$\cos\left(\frac{2\pi}{5} + \frac{\pi}{4}\right)$ is periodic with period $N_p=8$
Therefore, $x(n)$ is periodic with period $N_p=16$. (16 is the least common multiple of 4,8,16).

1.7
(a) $F_{\text{max}} = 10 \text{kHz} \Rightarrow F_s \geq 2F_{\text{max}} = 20 \text{kHz}$.
(b) For $F_s = 8 \text{kHz}, F'_{\text{fold}} = F_s/2 = 4 \text{kHz} \Rightarrow 5 \text{kHz}$ will alias to 3kHz.
(c) $F=9\text{kHz}$ will alias to 1kHz.

1.11
$$x(n) = x_a(nT)$$
$$= 3\cos\left(\frac{100\pi n}{200}\right) + 2\sin\left(\frac{250\pi n}{200}\right)$$
$$= 3\cos\left(\frac{\pi n}{2}\right) - 2\sin\left(\frac{3\pi n}{4}\right)$$
$$T' = \frac{1}{1000} \Rightarrow y_a(t) = x(t/T')$$
$$= 3\cos\left(\frac{\pi 1000t}{2}\right) - 2\sin\left(\frac{3\pi 1000t}{4}\right)$$
$$y_a(t) = 3\cos(500\pi t) - 2\sin(750\pi t)$$
(a) Refer to fig 1.15.1. With a sampling frequency of 5kHz, the maximum frequency that can be represented is 2.5kHz. Therefore, a frequency of 4.5kHz is aliased to 500Hz and the frequency of 3kHz is aliased to 2kHz.

Figure 1.15.1:
(b) Refer to fig 1.15-2. $y(n)$ is a sinusoidal signal. By taking the even numbered samples, the sampling frequency is reduced to half i.e., 25kHz which is still greater than the nyquist rate. The frequency of the downsampled signal is 2kHz.

Figure 1.15-2:
Matlab Question:

t = 0:0.01:2;
f = 0.2*sin(2*pi*3*t + 1/2*pi);
plot(t,f)
xlabel('time (sec)')
ylabel('f')
title('Matlab Question Homework 1')