2 a) Given $f_s = 8KHz$

for $f_0 = 1KHz$ $\quad x[n] = A\cos(2\pi \cdot \frac{1}{8} \cdot n) = A\cos(\frac{\pi n}{4})$

for $f_0 = 2KHz$ $\quad x[n] = A\cos(2\pi \cdot \frac{2}{8} \cdot n) = A\cos(\frac{\pi n}{2})$

for $f_0 = 3KHz$ $\quad x[n] = A\cos(2\pi \cdot \frac{3}{8} \cdot n) = A\cos(\frac{3\pi n}{4})$

for $f_0 = 3.5KHz$ $\quad x[n] = A\cos(2\pi \cdot \frac{3.5}{8} \cdot n) = A\cos(\frac{7\pi n}{8})$

for $f_0 = 4KHz$ $\quad x[n] = A\cos(2\pi \cdot \frac{4}{8} n) = A\cos(\pi n)$

for $f_0 = 5KHz$ $\quad x[n] = A\cos(2\pi \cdot \frac{5}{8} n) = A\cos(\frac{5\pi n}{4})$

for $f_0 = 6KHz$ $\quad x[n] = A\cos(2\pi \cdot \frac{6}{8} n) = A\cos(\frac{3\pi n}{2})$

for $f_0 = 7KHz$ $\quad x[n] = A\cos(2\pi \cdot \frac{7}{8} n) = A\cos(\frac{7\pi n}{4})$

Now consider $f_0 = 7KHz$

$$x[n] = A\cos\left(\frac{7\pi n}{4}\right) = A\cos\left(\left(\frac{8\pi - \pi}{4}\right)n\right)$$

$$= A\cos\left(2\pi n - \left(\frac{\pi n}{4}\right)\right)$$

As $n \in \mathbb{Z}$ $\quad \cos(2\pi n - \theta) = \cos\theta$.

$$x[n] = A\cos\left(\frac{\pi n}{4}\right)$$

$$= x[n] \text{ for } f_0 = 1KHz$$

similarly graph for $f_0 = 6KHz \approx f_0 = 2KHz$

$f_0 = 5KHz \approx f_0 = 3KHz$

So the similarity of plots is due to cos difference identity [i.e $\cos(2\pi - \theta) = \cos\theta$]

The frequency of analog sinusoids $= f_0$

But the frequency of sampled sinusoids $= \frac{f_0}{f_s} \neq f_0$

So the sampled sinusoids do not reflect the true frequency.