

Solution of ECE 316 Test #1 S03 1/22/03 #1

1. (2 pts each) For each signal find the Nyquist rate. If a signal is not bandlimited write "infinite".

(a) $x(t) = -4 \operatorname{sinc}\left(\frac{t}{8}\right)$ Nyquist rate = 1/8 Hz
 $X(f) = -32 \operatorname{rect}(8f)$

(b) $x(t) = 25 \operatorname{tri}\left(\frac{t-4}{2}\right)$ Nyquist rate = Infinite
 $X(f) = 50 \operatorname{sinc}^2(2f) e^{-j8\pi f}$

(c) $x(t) = 3 \cos(100\pi t) \sin(10,000\pi t)$ Nyquist rate = 10,100 Hz

$$X(f) = \frac{3}{2} [\delta(f-50) + \delta(f+50)] * \frac{j}{2} [\delta(f+5000) - \delta(f-5000)]$$

$$X(f) = j \frac{3}{4} [\delta(f+4950) + \delta(f+5050) - \delta(f-5050) - \delta(f-4950)]$$

(d) $x(t) = -50 \operatorname{sinc}(20t) \cos(80\pi t)$ Nyquist rate = 100 Hz

$$X(f) = -\frac{5}{2} \operatorname{rect}\left(\frac{f}{20}\right) * \frac{1}{2} [\delta(f-40) + \delta(f+40)] = -\frac{5}{4} \left[\operatorname{rect}\left(\frac{f-40}{20}\right) + \operatorname{rect}\left(\frac{f+40}{20}\right) \right]$$

2. (2 pts) If the signal, $x(t) = 10 \sin(20\pi t) \cos(50\pi t)$, is sampled at 200 Hz and sample #1 occurs at time, $t = 0$, what are the numerical values of samples #2 and #392?

Sample #2 Value = 2.1851 , Sample #392 Value = -2.1851

