Solution to ECE Test #4 S08

A continuous-time signal $x(t) = 3\sin(32\pi t) - 4\cos(24\pi t)$ is impulse-sampled at a rate $f_s = 20$ samples/second to form the impulse-sampled signal $x_\delta(t)$. Fill in the table below with the 10 lowest positive frequencies at which $X_\delta(f)$ has an impulse and the corresponding strengths of those impulses.

$$x_\delta(t) = \left[3\sin(32\pi t) - 4\cos(24\pi t)\right]\delta_{1/20}(t)$$

$$X_\delta(f) = \left\{j3/2\left[\delta(f+16) - \delta(f-16)\right] - 2\left[\delta(f-12) + \delta(f+12)\right]\right\} * 20\delta_{20}(f)$$

$$X_\delta(f) = j30\left[\delta_{20}(f+16) - \delta_{20}(f-16)\right] - 40\left[\delta_{20}(f-12) + \delta_{20}(f+12)\right]$$

Impulses of strength $-j30$ at $16 + 20k$, k any integer   ...,-64,-44,-24,-4,16,36,56,...
Impulses of strength $j30$ at $-16 + 20k$, k any integer   ...,-56,-36,-16,4,24,44,64,...
Impulses of strength -40 at $12 + 20k$, k any integer   ...,-68,-48,-28,-8,12,32,52,...
Impulses of strength -40 at $-12 + 20k$, k any integer   ...,-52,-32,-12,8,28,48,68,...

Frequency, f	4	8	12	16	24	28	32	36	44	48
Impulse Strength	$j30$	-40	-40	$-j30$	$j30$	-40	-40	$-j30$	$j30$	-40

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A continuous-time signal $\mathrm{x}(t) = 5\sin(28\pi t) - 3\cos(18\pi t)$ is impulse-sampled at a rate $f_s = 20$ samples/second to form the impulse-sampled signal $\mathrm{x}_\delta(t)$. Fill in the table below with the 10 lowest positive frequencies at which $\mathrm{X}_\delta(f)$ has an impulse and the corresponding strengths of those impulses.

$$\mathrm{x}_\delta(t) = \left[5\sin(28\pi t) - 3\cos(18\pi t)\right]\delta_{1/20}(t)$$

$$\mathrm{X}_\delta(f) = \left\{j5/2\left[\delta(f+14) - \delta(f-14)\right] - (3/2)\left[\delta(f-9) + \delta(f+9)\right]\right\} * 20\delta_{20}(f)$$

$$\mathrm{X}_\delta(f) = j50\left[\delta_{20}(f+14) - \delta_{20}(f-14)\right] - 30\left[\delta_{20}(f-9) + \delta_{20}(f+9)\right]$$

Impulses of strength $-j50$ at $14 + 20k$, k any integer   ...,-66,-46,-26,-6,14,34,54,...
Impulses of strength $j50$ at $-14 + 20k$, k any integer   ...,-54,-34,-14,6,26,46,66,...
Impulses of strength -30 at $9 + 20k$, k any integer   ...,-51,-31,-11,9,29,49,69,...
Impulses of strength -30 at $-9 + 20k$, k any integer   ...,-49,-29,-9,11,31,51,71,...

Frequency, f	6	9	11	14	26	29	31	34	46	49
Impulse Strength	$j50$	-30	-30	$-j50$	$j50$	-30	-30	$-j50$	$j50$	-30

Solution to ECE Test #4 S08

A continuous-time signal $x(t) = -7\sin(34\pi t) - 9\cos(16\pi t)$ is impulse-sampled at a rate $f_s = 20$ samples/second to form the impulse-sampled signal $x_\delta(t)$. Fill in the table below with the 10 lowest positive frequencies at which $X_\delta(f)$ has an impulse and the corresponding strengths of those impulses.

$$x_\delta(t) = \left[-7\sin(34\pi t) - 9\cos(16\pi t)\right]\delta_{1/20}(t)$$

$$X_\delta(f) = \left\{(-j7/2)\left[\delta(f+17) - \delta(f-17)\right] - (9/2)\left[\delta(f-8) + \delta(f+8)\right]\right\} * 20\delta_{20}(f)$$

$$X_\delta(f) = -j70\left[\delta_{20}(f+17) - \delta_{20}(f-17)\right] - 90\left[\delta_{20}(f-8) + \delta_{20}(f+8)\right]$$

Impulses of strength $j70$ at $17 + 20k$, k any integer   ...,-63,-43,-23,-3,17,37,57,...
Impulses of strength $-j70$ at $-17 + 20k$, k any integer   ...,-57,-37,-17,3,23,43,63,...
Impulses of strength -90 at $8 + 20k$, k any integer   ...,-52,-32,-12,8,28,48,68,...
Impulses of strength -90 at $-8 + 20k$, k any integer   ...,-68,-48,-28,-8,12,32,52,...

Frequency, f	3	8	12	17	23	28	32	37	43	48
Impulse Strength	$-j70$	-90	-90	$j70$	$-j70$	-90	-90	$j70$	$-j70$	-90