

Solution of ECE 315 Test 2 F07

1. A discrete-time signal has the following values:

n	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13
$x[n]$	4	-2	5	-4	-10	-6	-9	-9	1	9	6	2	-2	2	0	-2	-9	-5	3

For all other n $x[n]$ is zero. Let $y[n] = x[2n-1]$. Fill in the values below.

n	-2	-1	4	7	12
$y[n]$	_____	_____	_____	_____	_____

n	-2	-1	4	7	12
$y[n]$	4	5	-2	3	0

In discrete time any period must be an integer.

2. What is the fundamental period of $x[n] = -3\sin(3\pi n / 11)$? $N_0 =$ _____

In the form $\sin(2q\pi n / N_0)$, if all common factors in q and N_0 have already been cancelled the fundamental period is N_0 .

$$x[n] = -3\sin(2 \times 3\pi n / 22) \Rightarrow N_0 = 22$$

3. Exactly one period of a discrete-time periodic signal is described by $x[n] = n^2$, $0 \leq n < 5$. What is the average signal power E_x ? $E_x =$ _____

$$E_x = \frac{1}{N} \sum_{x \in \langle N \rangle} |x[n]|^2 = \frac{1}{5} \sum_{n=0}^4 n^4 = \frac{0+1+16+81+256}{5} = \frac{354}{5} = 70.8$$

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1. A discrete-time signal has the following values:

n	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13
$x[n]$	4	-2	5	-4	-10	-6	-9	-9	1	9	6	2	-2	2	0	-2	-9	-5	3

Let $y[n] = x[2n-1]$. Fill in the values below.

n	-1	0	5	6	11
$y[n]$	_____	_____	_____	_____	_____

n	-1	0	5	6	11
$y[n]$	5	-10	0	-9	0

2. What is the fundamental period of $x[n] = -3\sin(3\pi n / 13)$? $N_0 =$ _____

In the form $\sin(2q\pi n / N_0)$, if all common factors in q and N_0 have already been cancelled the fundamental period is N_0 .

$$x[n] = -3\sin(2 \times 3\pi n / 26) \Rightarrow N_0 = 26$$

In discrete time any period must be an integer.

3. Exactly one period of a discrete-time periodic signal is described by $x[n] = n^2$, $-1 \leq n < 4$. What is the average signal power E_x ? $E_x =$ _____

$$E_x = \frac{1}{N} \sum_{x \in \langle N \rangle} |x[n]|^2 = \frac{1}{5} \sum_{n=-1}^3 n^4 = \frac{1+0+1+16+81}{5} = \frac{99}{5} = 19.8$$

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1. A discrete-time signal has the following values:

n	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13
$x[n]$	4	-2	5	-4	-10	-6	-9	-9	1	9	6	2	-2	2	0	-2	-9	-5	3

For all other n $x[n]$ is zero. Let $y[n] = x[2n-1]$. Fill in the values below.

n	-4	-2	1	3	8
$y[n]$	_____	_____	_____	_____	_____

n	-4	-2	1	3	8
$y[n]$	0	4	-9	6	0

2. What is the fundamental period of $x[n] = -3\sin(3\pi n / 7)$? $N_0 =$ _____

In the form $\sin(2q\pi n / N_0)$, if all common factors in q and N_0 have already been cancelled the fundamental period is N_0 .

$$x[n] = -3\sin(2 \times 3\pi n / 14) \Rightarrow N_0 = 14$$

In discrete time any period must be an integer.

3. Exactly one period of a discrete-time periodic signal is described by $x[n] = n^2$, $-2 \leq n < 3$. What is the average signal power E_x ? $E_x =$ _____

$$E_x = \frac{1}{N} \sum_{x=\langle N \rangle} |x[n]|^2 = \frac{1}{5} \sum_{n=-2}^2 n^4 = \frac{16+1+0+1+16}{5} = \frac{34}{5} = 6.8$$