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EECE 200

Homework 1

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Problem 1 :

1. The amplitude of x is 0.5 v

The amplitude of y is 3 V

The amplitude of z is 2 V

1. For graph of x :
* Frequency : F = 1/1.25 = 0.8Hz
* Period : T= 1.25 s
* Angular Frequency : W = 2 π f = 2\*π\*0.8 = 5.02 rad/s

For graph of y :

* Frequency : F = 1/6.25 = 0.16 Hz
* Period : T= 6.25 s
* Angular Frequency : W = 2 π f = 2\*π\*0.16 = 1rad/s

For graph of z :

* Frequency : F =1/2.5 = 0.4 Hz
* Period : T= 2.5 s
* Angular Frequency : W = 2 π f = 2\*π\*0.4 = 2.51 rad/s
1. The signal that has the highest frequency, is the one that has the lowest period: 1.25s <2.5s <6.25s

So the graph x has the highest frequency: 0. 8 Hz

1. y(t)= A sin ( w t + Ѳ )

For the first graph of x :

* The graph x is ¼ a period off set of time:

2 $π$ rad 🡪 1 period

π/2 rad 🡨 ¼ period

Ѳ1 = π/2 rad = 90$°$

* The graph y is not off of time:

Ѳ2 = 0 : there is no phase shift

* The graph of z:

2 π rad 🡪 1 period

π/5 🡨 1/10 period

* Validation :
1. For the graph x =

We have that at t=0 :

 y = V = 0.5 V

* Replacing in the equation: y(0) = A sin(w(0) + Ѳ 1)
* We have that A: the amplitude of the graph x, is the maximum value : A = 0.5 V
* The angular frequency for the graph of x : w = 5.02 rad/s

Replacing in the original equation:

 y(0)=0.5sin(Ѳ 1)

0.5=0.5 sin (Ѳ 1)

Sin (Ѳ 1) = 1

Ѳ 1 = 90°= $\frac{π}{2}$ rad

X: Y (t) = 0.5 sin (2.76 t + $\frac{π}{2}$)

1. For the graph of y:
* We have that at t=0 :

 y = V = 0V

* Replacing in the equation: y(0) = A sin(w(0) + Ѳ 2)
* We have that A: the amplitude of the graph y, is the maximum value : A = 3 V
* The angular frequency for the graph of y : w = 1.00 rad/s

Replacing in the original equation:

 y(0)=3 sin(Ѳ 2)

0=3 sin(Ѳ 2)

Sin(Ѳ 2) = 0

Ѳ 2 = 0° = $0$ rad

Y : Y(t) = 3 sin (1t) = 3 sin (t)

1. For the graph of z:
* We have that at t=0 :

 y = V = 1.5V

* Replacing in the equation: y(0) = A sin(w(0) + Ѳ 3)
* We have that A: the amplitude of the graph y, is the maximum value : A = 2 V
* The angular frequency for the graph of y : w = 2.51 rad/s

Replacing in the original equation:

 y(0)=2 sin(Ѳ 3)

1.5=2 sin(Ѳ 3)

Sin(Ѳ 3) = 3/4

Ѳ 3 = 48.59°= $0.84$ rad



Problem 2:

1. Virgin Radio Station. Frequency 89.5 FM. We can say that it fits within range , because it change with in 200 kHz of its value.
2. The bandwidth of AM station is 10 kHz.

In fact, the number of AM stations that could fit inside this whole range (530 kHz 🡪 1700 kHz) is: 1700-530 = 1170 / 10 = 117 stations.

One station that uses AM is *Sawt el Ghad*.

1. Yes there is an operating system using DVB in Lebanon: OSN.
2. In fact, such technology doesn’t require anything other than a TV tuner that can be connected directly to TVs. At this rate, the TV sets can stay the same.

**Problem 3:**

1. The dimensions of this image are 4\*4 = 16 pixels.
2. One pixel requires 2 bits : 2^1 = 2 bits. In fact, We need two bits , because we have here 4 different shades of gray : 2 ^ 4 = 16 pixels.

We define each level of gray :

* Black 00
* Dark Gray 01
* Light Gray 10
* White 11

$$\left[\begin{array}{c}00 10 01 10\\01 11 01 01 \\11 10 11 10\\00 11 10 01\end{array}\right]$$

1. $\left[\begin{array}{c}0 2 1 2 \\1 3 1 1\\3 2 3 2 \\0 3 2 1\end{array}\right]$
2. The movie is at a rate of 40 frames/s. Time : 3 min = 3\*60 = 180 s

40 frames/s \* 180 = 7200 frames/s

Each frame is 16 pixels : 7200 \* 16 = 115200 pixels

Each pixel is represented by 2 bits : 115200\*2 = 230400 bits

At a rate of 8 bits / 1 byte : 230400/8 = 28800 bytes = 0.02746 mega bytes

Problem 4:

1. 11001.010 2

1\*2^4 + 1\*2^3 + 0 + 0 + 1\*2^0 + 1\*2^-2 = 25.25 10

1. 364.125 10

|  |  |  |
| --- | --- | --- |
|  |  | rem |
| 364/2 | 182 | 0 |
| 182/2 | 91 | 0 |
|  91/2 | 45 | 1 |
| 45/2 | 22 | 1 |
| 22/2 | 11 | 0 |
| 11/2 | 5 | 1 |
| 5/2 | 2 | 1 |
| 2/2 | 1 | 0 |
| ½ | 0 | 1 |
| 101101100 |

|  |  |
| --- | --- |
| 0.125\*2 | **0**.25 |
| 0.25\*2 | **0**.5 |
| 0.5\*2 | **1** |
|  | 001 |

101101100.001 2

1. 261 8

= 2\*8^2 + 6\*8^1 + 1\*8^0 = 173 10

173 10

|  |  |  |
| --- | --- | --- |
| 173/2 | 86 | 1 |
| 86/2 | 43 | 0 |
| 43/2 | 21 | 1 |
| 21/2 | 10 | 1 |
| 10/2 | 5 | 0 |
| 5/2 | 2 | 1 |
| 2/2 | 1 | 0 |
| ½ | 0 | 1 |
| 10101101 |

1. 1001011 2

We take each 4 alone :

0100 1011

* 0100 = 0\*2^3 + 1\*2^2 + 0 +0 = 4
* 1011 = 1\*2^3 + 0 + 1\*2^1 + 1\*2^0 = A

4A 16

1. 2AB 16

= 2\*16^2 + 11\*16^1 + 12\*16^0 = 700 10