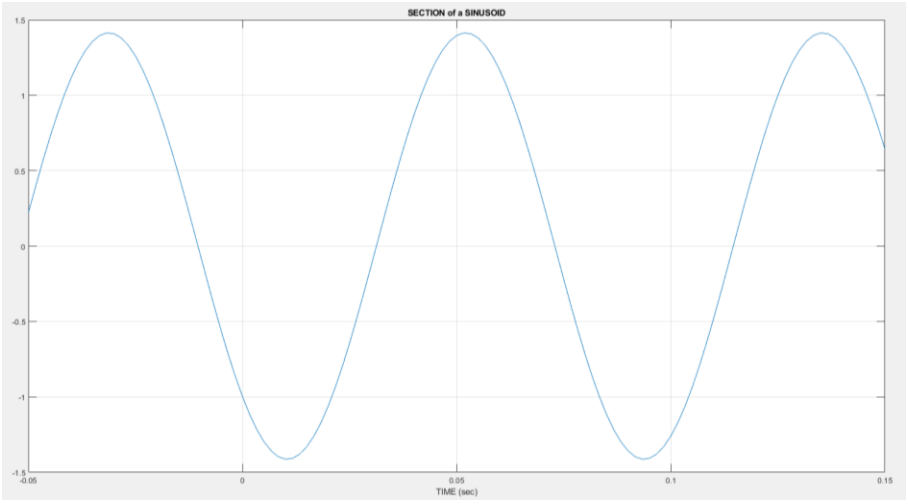
Yonatan Carver
ECES 352

HW 2
1.22.2019

Problem 1



A = 1.1435

$\phi = -\omega * t_d = \frac{2\pi}{T} * t_d = \frac{2\pi}{0.0834} * -0.0317 = -2.3882$

T = 0.0834

Problem 2

(a)

A = 2

$\omega_0 = -\frac{\phi}{t_d} = -\frac{\pi}{5}$

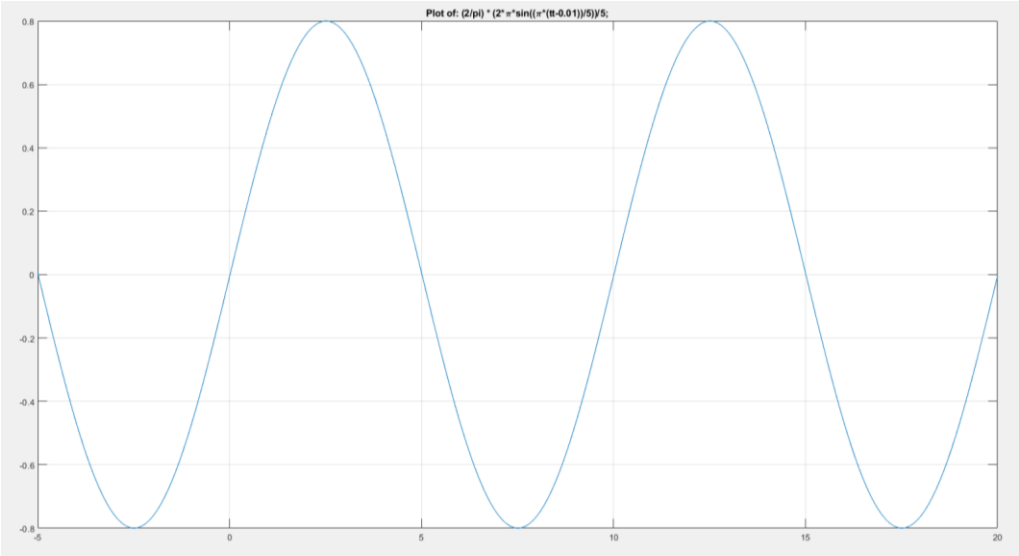
$\phi = \frac{2\pi}{T} * t_d = \frac{2\pi}{10} * 5 = \pi$

$x(t) = 2\cos\left(-\frac{\pi}{5}t + \pi\right)$

(b) $z(t) = Ze^{(j\omega_o t)}$

$= 2 * \left(e^{-j\frac{\pi}{5}t} e^{j\pi}\right)$

(c)



Problem 3

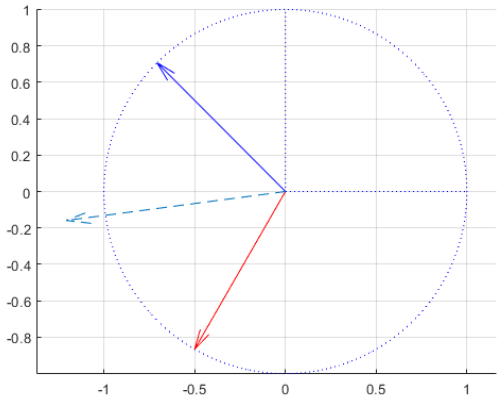
(a) $x_a(t)$

```
xa = 2 * cos(27 * pi * tt - (2*pi)/3) - cos(27 * pi * tt + (3*pi)/4);
xxa = real( 2 * (exp(1j * 27 * pi * tt)*(exp(-1j * (2 * pi)/3))) - (exp(1j * 27 * pi
* tt)*exp(1j * (3 * pi)/4)) );
xa1 = 2 * (exp(-1j * (2 * pi)/3));
xa2 = -1 * exp(1j * (3 * pi)/4);
```

```
xa1 Z =      X     +      jY      Magnitude     Phase     Ph/pi    Ph(deg)
             -0.5       -0.866            1    -2.094    -0.667   -120.00

xa2 Z =      X     +      jY      Magnitude     Phase     Ph/pi    Ph(deg)
         -0.7071       0.7071            1     2.356     0.750    135.00

xa1 + xa2 Z =      X     +      jY      Magnitude     Phase     Ph/pi    Ph(deg)
                -1.207      -0.1589         1.218    -3.011    -0.958   -172.50
```



(b) $x_b(t)$

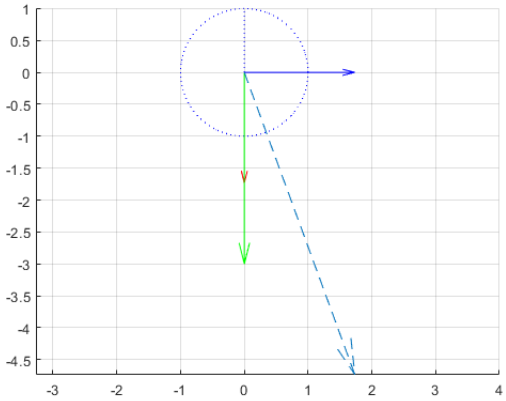
```
xb = sqrt(3) * cos(18.776 * pi * tt + 15.5 * pi) + 3 * cos(18.776 * pi * tt - 12.5 *
pi) + sqrt(3) * cos(18.776 * pi * tt + 18 * pi);
xxb = real( sqrt(3) * (exp(1j * 18.776 * pi * tt)*exp(1j * 15.5 * pi)) + 3 * (exp(1j
* 18.776 * pi * tt) * exp(-1j * 12.5 * pi)) + sqrt(3) * (exp(1j * 18.776 * pi * tt) *
exp(1j * 18 * pi)) );
xb1 = sqrt(3) * exp(1j * 15.5 * pi);
xb2 = 3 * exp(-1j * 12.5 * pi);
xb3 = sqrt(3) * exp(1j * 18 * pi);
```

```
xb1 Z =      X     +      jY      Magnitude     Phase     Ph/pi    Ph(deg)
     -6.365e-15       -1.732        1.732    -1.571    -0.500    -90.00

xb2 Z =      X     +      jY      Magnitude     Phase     Ph/pi    Ph(deg)
     -7.366e-16            -3            3    -1.571    -0.500    -90.00

xb3 Z =      X     +      jY      Magnitude     Phase     Ph/pi    Ph(deg)
         1.732   -3.818e-15        1.732    -0.000    -0.000     -0.00

xb1 + xb2 + xb3 Z =      X     +      jY      Magnitude     Phase     Ph/pi    Ph(deg)
                     1.732       -4.732        5.039    -1.220    -0.388    -69.90
```



(c) $x_c(t)$

```
xc = cos(120 * pi * tt + (3*pi)/4) + cos(120 * pi * tt + (5*pi)/4) + (2 * sin(120 *
pi * tt - pi/4)) + (2 * sin(120 * pi * tt + pi/4));
xxc = -real( ...
    ( exp(1j * 120 * pi * tt) * exp(1j * 3*pi/4) ) + ...
    ( exp(1j * 120 * pi * tt) * exp(1j * 5*pi/4 ) ) + ...
    ( 2 * (-exp(1j * 120 * pi * tt) * exp( -1j * 3*pi/4 ) ) ) + ...
    ( 2 * (exp(-1j * 120 * pi * tt) * exp( 1j * -pi/4 ) ) ) ...
    );

xc1 = exp(1j * 3*pi/4);
xc2 = exp(1j * 5*pi/4);
xc3 = 2 * exp( -1j * 3*pi/4 );
xc4 = 2 * exp( 1j * -pi/4 );
```

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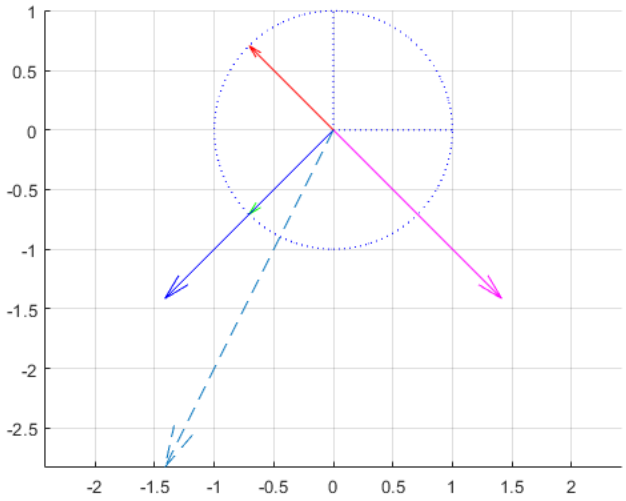
```
xc1 Z =     X     +     jY     Magnitude     Phase     Ph/pi    Ph(deg)
          -0.7071       0.7071           1     2.356     0.750    135.00

xc2 Z =     X     +     jY     Magnitude     Phase     Ph/pi    Ph(deg)
          -0.7071      -0.7071           1    -2.356    -0.750   -135.00

xc3 Z =     X     +     jY     Magnitude     Phase     Ph/pi    Ph(deg)
           -1.414       -1.414           2    -2.356    -0.750   -135.00

xc4 Z =     X     +     jY     Magnitude     Phase     Ph/pi    Ph(deg)
            1.414       -1.414           2   -0.785    -0.250    -45.00

xc1 + xc2 + xc3 + xc4 Z =     X     +     jY     Magnitude     Phase     Ph/pi    Ph(deg)
                           -1.414       -2.828        3.162    -2.034    -0.648   -116.57
```



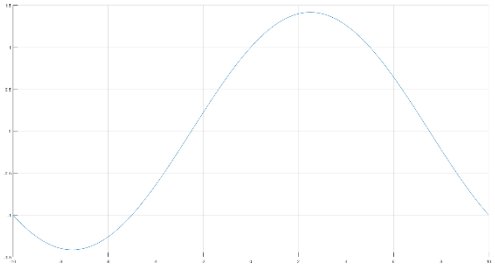
Problem 4

(a)

$$x(t) = \sqrt{3}\cos\left(\omega_0 t + \frac{\pi}{3}\right) + \sin\left(\omega_0 t + \frac{\pi}{2}\right)$$
$$x(t) = \sqrt{3}\left(e^{j\omega_0 t} * e^{j\frac{\pi}{3}}\right) + \left(e^{j\omega_0 t - \frac{\pi}{2}} * e^{j\frac{\pi}{2} - \frac{\pi}{2}}\right)$$
$$x(t) = \sqrt{3}\left(e^{j\omega_0 t} * e^{j\frac{\pi}{3}}\right) + \left(e^{j\omega_0 t} * e^{-j\frac{\pi}{2}} * 1\right)$$
$$x(t) = \sqrt{3}e^{j\omega_0 t} * \sqrt{3}e^{j\frac{\pi}{3}} + e^{j\omega_0 t} * e^{-j\frac{\pi}{2}}$$
$$x(t) = e^{j\omega_0 t}\left(3e^{j\frac{\pi}{3}} + e^{-j\frac{\pi}{2}}\right)$$

(b) $\omega_0 = 0.1\pi$

1 period included in -10 < t < 10



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Problem 5

(a) $x(t) = 1 + \cos\left(300\pi t + \frac{\pi}{2}\right) + 0.6\cos\left(2(300\pi)t + \frac{\pi}{5}\right)$

(b) $y(t) = 2x(t) + 10\cos\left(250\pi(t - 0.002)\right)$

Problem 6

(a) Dc component: -2.5
ω = π

(b) $x(t) = -2.5 + 7.5\sin(\pi t)$
$x(t) = -2.5 + 7.5\cos\left(\pi t - \frac{\pi}{2}\right)$

(c) $@ -\pi, 3.75\, e^{-j\frac{\pi}{2}}$
$@\ 0, -2.5$
$@\pi, 3.75e^{j\frac{\pi}{2}}$

(d) @ frequency 4 Hz, peak @ 2251.8
@ frequency 600 Hz, peak @ 2251.8