GEORGIA INSTITUTE OF TECHNOLOGY

SCHOOL of ELECTRICAL & COMPUTER ENGINEERING

QUIZ #1

DATE: 1-Feb-10 COURSE: ECE-2025

NAME: ______________________________ GT username: ____________

LAST, FIRST (ex: bdodd1)

3 points 3 points 3 points

Recitation Section: Circle the date & time when your **Recitation Section** meets (not Lab):

	L05:Tues-Noon (Michaels)	L06:Thur-Noon (Bhatti)
	L07:Tues-1:30pm (Michaels)	L08:Thur-1:30pm (Bhatti)
L01:M-3pm (Lee)	L09:Tues-3pm (Fekri)	
L03:M-4:30pm (Lee)	L11:Tues-4:30pm (Fekri)	

- Write your name on the front page ONLY. **DO NOT** unstaple the test.
- Closed book, but a calculator is permitted.
- One page ($8\frac{1}{2}'' \times 11''$) of **HAND-WRITTEN** notes permitted. OK to write on both sides.
- **JUSTIFY** your reasoning clearly to receive partial credit.
  Explanations are also REQUIRED to receive **FULL** credit for any answer.
- You must write your answer in the space provided on the exam paper itself.
  Only these answers will be graded. Circle your answers, or write them in the boxes provided.
  If space is needed for scratch work, use the backs of previous pages.

Problem	*Value*	*Score*
1	50	
2	30	
3	20	
No/Wrong Rec	−3	

PROBLEM Spring-10-Q.1.1:

Evaluate the expressions below, where angles are given in radians and frequencies in rad/s. In the answers, the magnitudes, r, or amplitudes, A, ***must be nonnegative***; and the angles, θ or φ, ***must be in radians***, and lie between $-\pi$ and $+\pi$. Use a calculator; only the answers will be graded—no explanations necessary.

(a) Determine r and θ, such that $re^{j\theta} = 21e^{-j2} + 87e^{j3}$.

$r =$	$\theta =$

(b) Determine r and θ, such that $re^{j\theta} = -77$.

$r =$	$\theta =$

(c) Determine r and θ, such that $re^{j\theta} = (-0.4 + j0.1)e^{j2}$.

$r =$	$\theta =$

(d) Determine r and θ, such that $re^{j\theta} = 30j$.

$r =$	$\theta =$

(e) Express this signal, $\Re\{31e^{j2.5}e^{j20t}\}$, as a sinusoid in standard form, i.e., $A\cos(\omega_0 t + \varphi)$.

$A =$	$\varphi =$

(f) Express this signal, $\Re\{(-30 + j25)e^{j44t}\}$, as a sinusoid in standard form, i.e., $A\cos(\omega_0 t + \varphi)$.

$A =$	$\varphi =$

(g) Express this signal, $\Re\{-150je^{j20t}\}$, as a sinusoid in standard form, i.e., $A\cos(\omega_0 t + \varphi)$.

$A =$	$\varphi =$

(h) Express this signal, $0.5\cos(9t - 1.5) + 0.6\cos(9t - 1.8)$, as a sinusoid in standard form, i.e., $A\cos(\omega_0 t + \varphi)$.

$A =$	$\varphi =$	$\omega_0 =$

PROBLEM Spring-10-Q.1.2:

(a) Evaluate this definite integral, and express the answer in polar form: $\displaystyle\int_0^{0.02} e^{-j25\pi t}\,dt = re^{j\theta}$

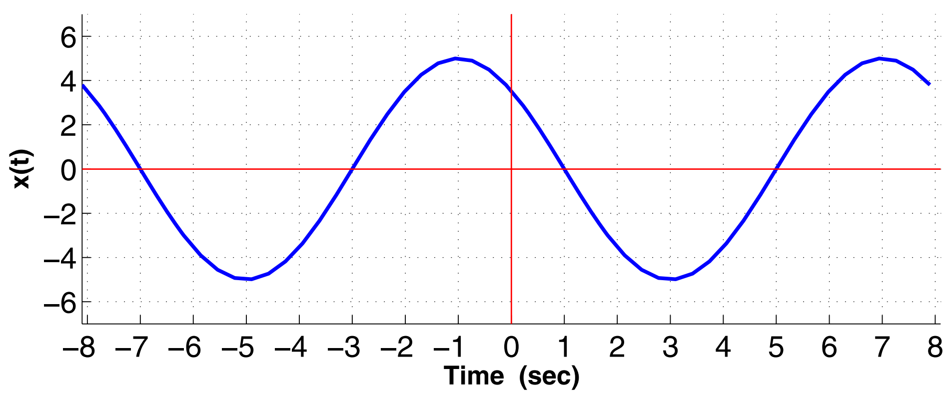
$r =$	$\theta =$

(b) Find the *real* numbers p and q such that the following equation is true: $\dfrac{p}{q + j0.3} = 90e^{-j4\pi/5}$

$p =$	$q =$

(c) Values of the sinusoid shown below can be generated via the following MATLAB statements:

```
tt = -8:0.01:8;  XX = ??;  ww = ??;  xt = real( XX * exp(j*ww*tt) );
```



Write the appropriate MATLAB statements needed to define `XX` and `ww`.

`XX=` ______________________________

`ww=` ______________________________

PROBLEM Spring-10-Q.1.3:

(a) Recall that the following sum: $\sum_{k=1}^{L} e^{j2\pi k/N}$ is equal to 0 when $L = N$.

The MATLAB code below adds many sinusoids whose phases differ by $2\pi/N$.

```
tt = 0:0.001:1;
xx = 0*tt;
for kk=4:14
   xx = xx + 43*cos(55*pi*tt + 0.2*pi*kk);
end
plot(tt,xx), title('SECTION of a SINUSOID'), xlabel('TIME (sec)')
```

The plot made from the vector xx is a single sinusoid, which can be written as $A\cos(\omega_0 t + \varphi)$. Determine the parameters for the sinusoid in the vector xx. Also, identify the value of N.

$N =$	$A =$	$\varphi =$	$\omega_0 =$

(b) The simultaneous sinusoidal equations below can be converted into simultaneous linear equations involving complex variables and complex numbers.

$$\begin{aligned} 0.2\cos(\omega_0 t + 0.1\pi) &= 0.77A_1\cos(\omega_0 t + \varphi_1) + 0.9A_2\cos(\omega_0 t - \pi/3 + \varphi_2) \\ 0.5\cos(\omega_0 t - 0.2\pi) &= 0.3A_1\cos(\omega_0 t + \varphi_1) + 1.1A_2\cos(\omega_0 t + \varphi_2) \end{aligned}$$

Then MATLAB can obtain the solution for $\{A_1, \varphi_1, A_2, \varphi_2\}$ via its backslash operator, or inv:

```
AA = [ ?, ?; ?, ? ];
bb = [ ?; ? ];
zz = AA \ bb;
amps = abs(zz), angles = angle(zz)
```

Determine the correct MATLAB statements for the matrix AA, and the vector bb.
Note: it is not necessary to solve the equations; just set up the MATLAB code.

AA = ______________________________

bb = ______________________