Queens College, CUNY,   Department of Computer Science
Numerical Methods
CSCI 361 / 761
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25   Homework lecture 25

- **As experience has demonstrated, if you do not understand the above expressions/questions, THEN ASK.**

- **If you do not understand the words/sentences in the lectures, THEN ASK.**

- **Send me an email, explain what you do not understand.**

- **Do not just keep quiet and produce nonsense in exams.**

25.1 Complex numbers

- **Calculate the real and imaginary parts and $|z|^2$ of the complex number z.**

- In all cases, the values of x, y, r and θ are real and $(\dots)^*$ denotes a complex conjugate.

$$z = (x + iy)^2 \,. \tag{25.1.1}$$

$$z = \frac{1}{2 + 3i} \,. \tag{25.1.2}$$

$$z = \left(\frac{1 - i}{2 + 3i} \right)^* \,. \tag{25.1.3}$$

$$z = \frac{1}{re^{i\theta}} \qquad\qquad (r \neq 0) \,. \tag{25.1.4}$$

$$z = \frac{1}{1 + re^{i\theta}} \qquad\qquad (1 + re^{i\theta} \neq 0) \,. \tag{25.1.5}$$

25.2   Graph 1

- You are given that a and θ are real and

$$z = x + iy = \frac{1}{1 + ae^{-i\theta}} . \qquad (25.2.1)$$

- **Calculate the expressions for x and y as functions of a and θ.**

- **Set $a = \frac{1}{2}$.**

- **Fill in the following table for the values of x and y.**

θ	x	y
$0°$		
$90°$		
$180°$		
$270°$		

- **Plot a graph in the (x, y) plane, for 201 values $\theta = j\pi/100$, where $j = 0, 1, \ldots, 200$.**

- *If you have done your work correctly, the graph will be a closed curve.*

- **Set $a = 2$.**

- **Fill in the following table for the values of x and y.**

θ	x	y
$0°$		
$90°$		
$180°$		
$270°$		

- **Plot a graph in the (x, y) plane, for 201 values $\theta = j\pi/100$, where $j = 0, 1, \ldots, 200$.**

- *If you have done your work correctly, the graph will be a closed curve.*

- **(Optional)** *Do you recognize the shapes of the curves?*

25.3   Graph 2

- You are given that a and θ are real and

$$z = x + iy = \exp\{ia\sin(\theta)\}. \tag{25.3.1}$$

- **Calculate the expressions for x and y as functions of a and θ.**

- **Set $a = 3$ below.**

- **Plot graphs of**
  (i) x as a function of θ,
  (ii) y as a function of θ.
  Use 201 values $\theta = j\pi/100$, where $j = 0, 1, \ldots, 200$.
  Plot both curves in the same graph.
  On the horizontal axis, plot the value of θ/π, so $0 \le \theta/\pi \le 2$.

- *If you have done your work correctly, the curves should display the following symmetries:*

$$\begin{aligned} x(\theta + \pi) &= -x(\theta)\,, \\ y(\theta + \pi) &= y(\theta) \end{aligned} \qquad (0 \le \theta < \pi)\,. \tag{25.3.2}$$

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