

EE461 Midterm:

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Date: Wednesday, October 17, 2007

Time = 2 hours

Two 8.5 by 11 formula sheets (writing both sides)

(i.e. no Text Books or Notes)

Absolutely no worked examples or solved problems

NB: Draw a box around your final answer.

1. 2 (2)
 2. 4 (4)
 3. 3 (3)
 4. 4 (4)
 5. 5 (6)
 6. 5 (5)
 7. 3 (3)
 8. 3 (3)
- TOTAL 29

- (2) 1. Find the steady state output (call it $y(n)$) of a system that has frequency response

$$H(e^{j\omega}) = 1 - \frac{|\omega - 0.5|}{\pi} + j \sin(\pi\omega),$$

if the input to the system is

$$x(n) = 3\cos(0.5n) \quad \omega = 0.5$$

$$H(e^{j0.5}) = 1 - \frac{|0.5 - 0.5|}{\pi} + j \sin(\pi \cdot 0.5)$$
$$= 1 - 0 + j1 = 1 + j1 = 1.41421 \angle \pi/4$$

$$y(n) = 3 \cdot 1.41421 \cos(0.5n + \pi/4)$$

$$y(n) = 4.2426 \cos(0.5n + \pi/4)$$



2. A single pole low-pass filter has its pole at $z = 0.8 + j0.0$. The pole location is shown in Figure 1.

- (2) (a) Find the approximate bandwidth of the filter (i.e. the 3 dB down frequency) using a tangential approximation. Answer in the space provided below and give your answer in units of radians/sample.

$BW \approx 1 - r = 1 - 0.8 \quad BW \approx 0.2 \frac{\text{rad}}{\text{Sample}}$ 2

- (2) (b) Find the actual bandwidth (to the accuracy possible) of the filter graphically using Figure 1. Show the construction lines and clearly mark the point on the unit circle where the filter response is 3 dB down. Give your answer in units of radians/sample.

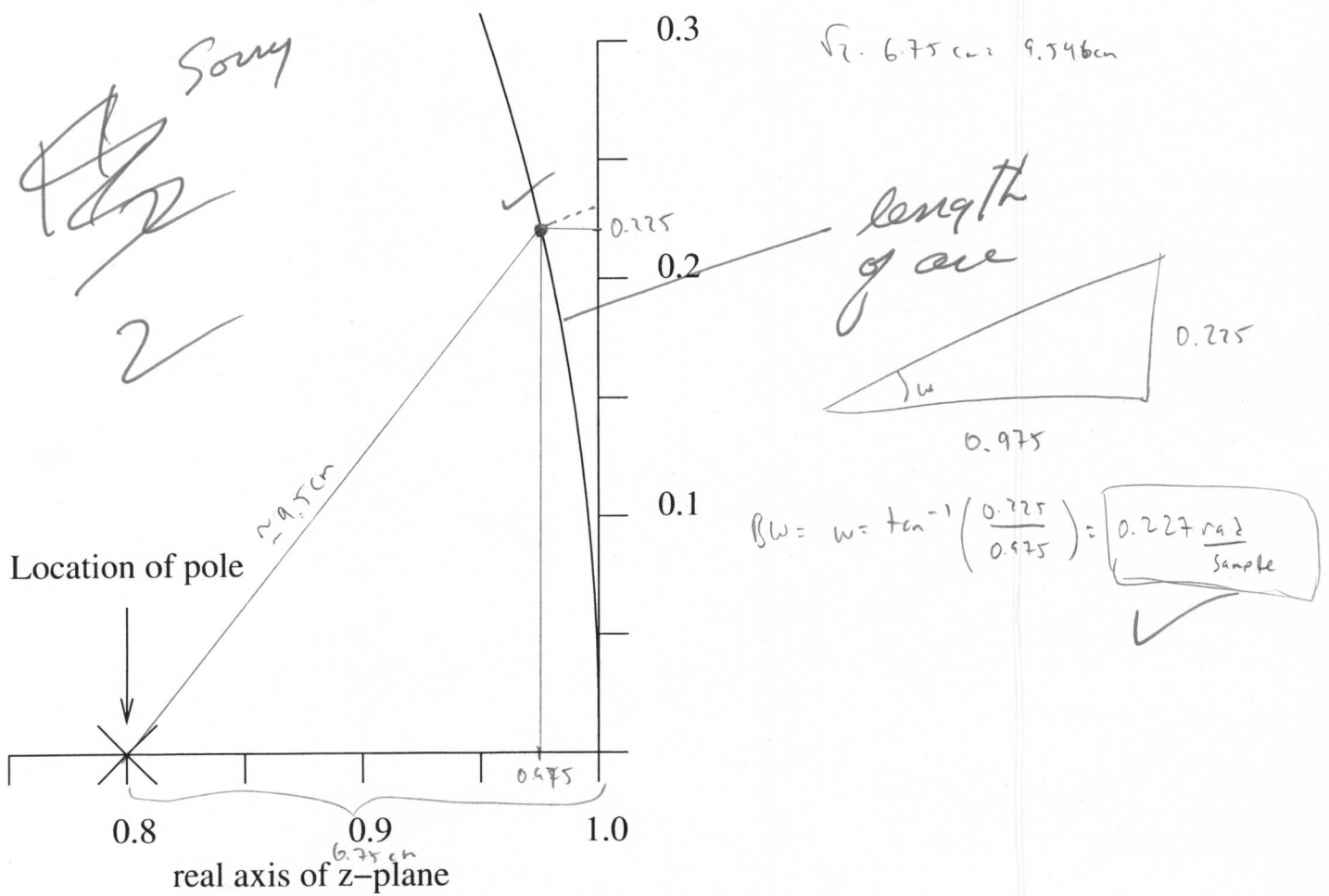


Figure 1: z -plane near $z=1+j0$

