

1/6 - sheets
~~1/6~~

Student: RUS-S3

Sheet: E-001

Side: A



Задача 1.

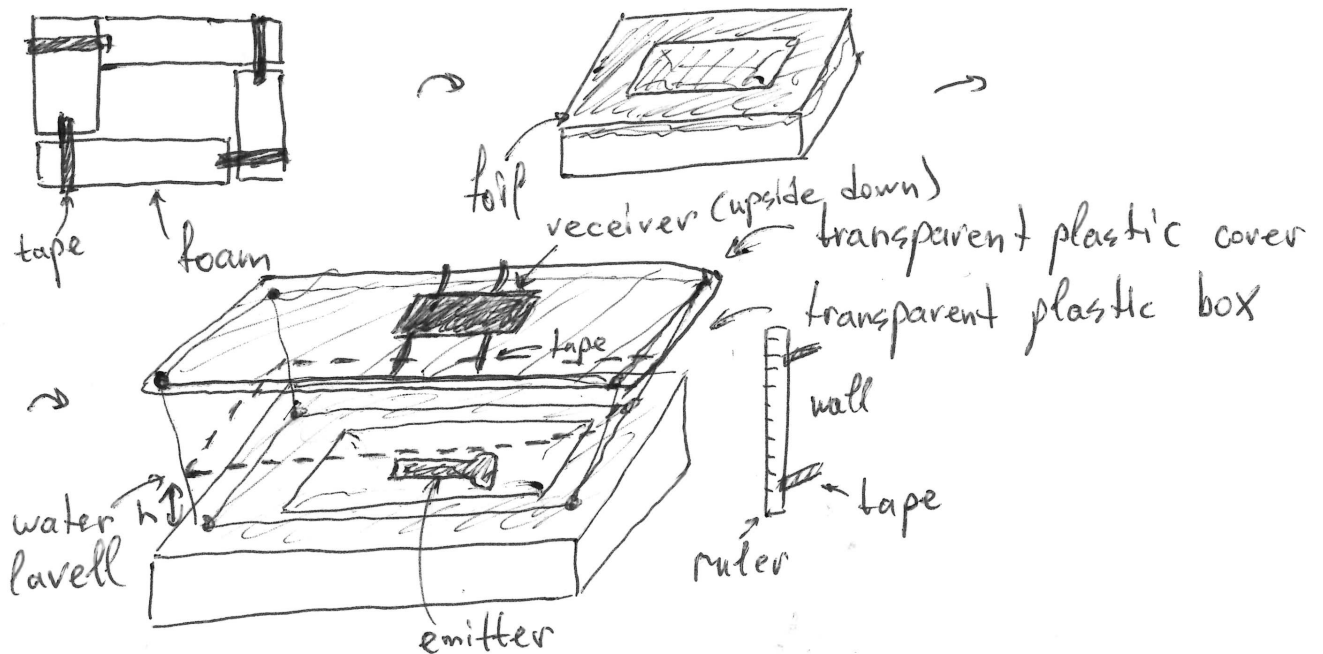
$$N = 10 \log_{10} \left(\frac{P}{1 \text{ mW}} \right) \Rightarrow P = 1 \text{ mW} \cdot 10^{\frac{N}{10}}$$

$$N_{\min} = -140 \text{ dB} \Rightarrow P_{\min} = 1 \text{ mW} \cdot 10^{\frac{-140}{10}} = 10^{-14} \text{ mW}$$

Answer: $P_{\min} = 10^{-14} \text{ mW}$

Задача 2

Содержимое герметизировать:



Измеряем зависимость $N(h)$.



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water is over



h, mm	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	78		
N_1, dB	-42	-24	-32	-44	-33	-33	-38	-45	-40	-32	-34	-39	-38	-32	-33	-36	-34		
N_2, dB	-43	-25	-35	-46	-39	-34	-37	-45	-42	-33	-38	-39	-38	-32	-33	-37	-34		
N_3, dB	-43	-25	-37	-47	-39	-33	-38	-45	-40	-32	-38	-40	-38	-32	-33	-36	-34		
$\langle N \rangle, \text{dB}$	-43	-25	-36	-44	-39	-33	-38	-45	-41	-32	-38	-39	-38	-32	-33	-36	-34		

Температура зависит от h . (plot $\langle N \rangle(h)$)

Δ = peak-to-peak distance \rightarrow

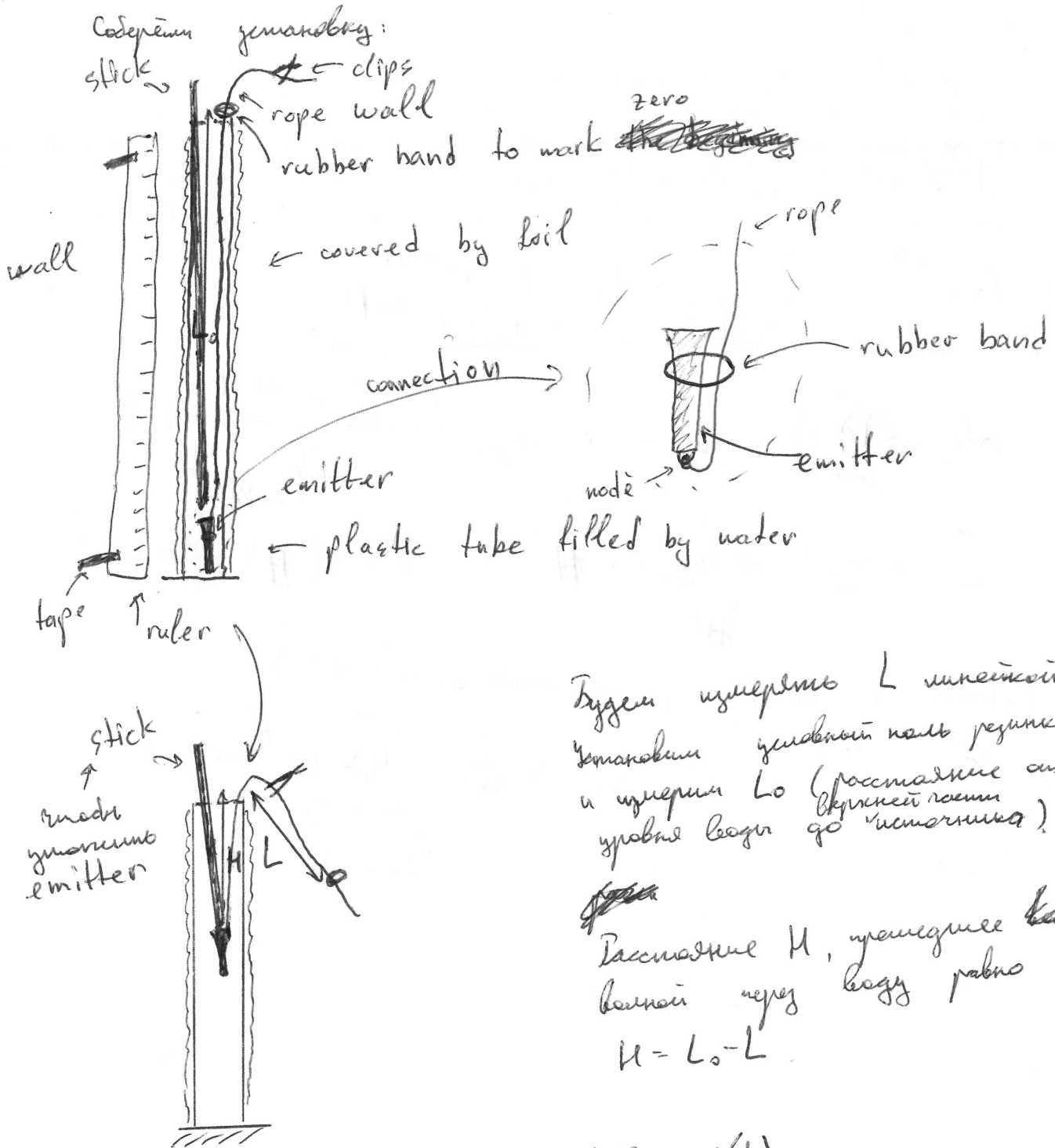
$$\rightarrow \langle \Delta \rangle = \frac{15 + 20 + 20 + 20 + 15 + 20}{6} \text{ mm} = 18 \text{ mm}$$

↑
from plot

Answer: $\Delta = 18 \text{ mm}$.



Задача 3



Высота измеренная L измерили.
 Значение звуковой скорости
 и измерили L₀ (расстояние от
 уровня воды до "излучателя")

Расстояние H, измерили
 между уровнем воды и
 $H = L_0 - L$

Скорость звука ~~измерили~~ N(L):



~~had data~~
had data
cf

H, cm	0	5	10	15	20	25	30	35	40	45	50								
M_1, dB	-46	-55	-47	-53	-52	-48	-54	-59	-49	-47									
M_2, dB	-46	-56	-48	-53	-52	-49	-54	-53	-49	-47									
M_3, dB	-47	-55	-49	-53	-52	-80	-54	-59	-49	-47									
M_4, dB	-46	-55	-48	-53	-52	-49	-54	-59	-49	-47									

$$E = E_0 \cdot e^{-\alpha z} e^{i(kz - \omega t)}$$

$$\langle P \rangle = \langle u \rangle \cdot c = \frac{\epsilon_0 E_0^2}{2} \cdot c = \frac{\epsilon_0 E_0^2 \cdot e^{-2\alpha z}}{2} \cdot c \rightarrow$$

$$\Rightarrow 10 \log_{10} \left(\frac{\langle P \rangle}{1 \text{ mW}} \right) = \langle N \rangle = 10 \log_{10} \left(\frac{\frac{\epsilon_0 E_0^2 \cdot e^{-2\alpha z}}{2} \cdot c}{1 \text{ mW}} \right)$$

$$= C - 20\alpha \log_{10} e \cdot z \Rightarrow \langle N \rangle (z) - \text{linear}$$

Method of Least Squares (without had data):

$$R = -0,41 \Rightarrow$$

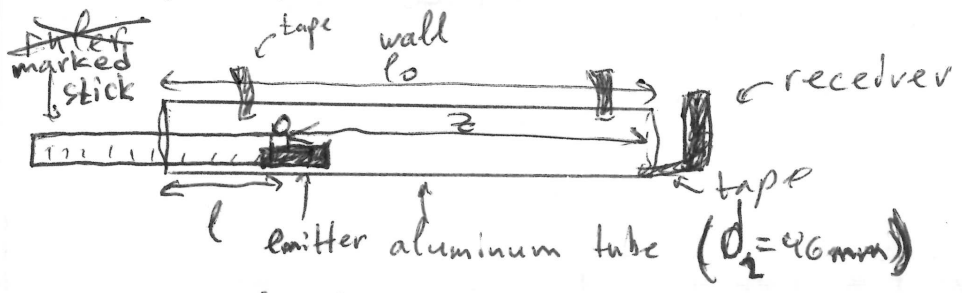
$$\alpha = 0,044 \frac{1}{\text{cm}} = \boxed{4,4 \text{ m}^{-1} = \alpha}$$

Answer:

u76

задание 4а

Содержимое задания:



$z = l_0 - l$

$l_0 = (50 \pm 1) \text{ cm}$

Измеренное значение $N(l)$



$l, \text{ cm}$	0	5	10	15	20	24	26	28	42	49								
$z, \text{ cm}$	50	45	40	35	30	46	44	42	38	36								
$N_1, \text{ dB}$	-39	-83	-124	---	-56	-43	-90	-106	---	---								
$N_2, \text{ dB}$	-40	-83	-123	---	-55	-44	-90	-105	---	---								
$N_3, \text{ dB}$	-40	-82	-124	---	-56	-43	-90	-106	---	---								
$\langle N \rangle, \text{ dB}$	-40	-83	-124	---	-56	-43	-90	-106	---	---								
$P, \text{ mW}$																		

↑ too low

↑ too low

air $\Rightarrow \alpha = 0$.

$E = E_0 \cdot e^{i(kz - \omega t)} = E_0 \cdot e^{i(\frac{2\pi}{\lambda}z - \omega t)} = E_0 \cdot e^{-\frac{2\pi z}{\lambda}} \cdot e^{-i\omega t}$

$\omega^2 = (k_x^2 + k_z^2) c^2$

Suppose: $\omega \gg ck_x \Rightarrow \omega^2 = c^2 k^2 \Rightarrow \omega = c \cdot (i\pi)^2$

$\langle P \rangle = \frac{\epsilon_0 E_0^2 \cdot c}{2} \cdot e^{-2\alpha z}$

$\Rightarrow \langle N \rangle = 10 \log_{10} \left(\frac{\langle P \rangle}{1 \text{ mW}} \right) = 10 \log_{10} \left(\frac{\frac{\epsilon_0 E_0^2 \cdot c}{2} \cdot e^{-2\alpha z}}{1 \text{ mW}} \right) =$

$= C + 20\alpha \log_{10} e \cdot z \Rightarrow \langle N \rangle(z) - \text{linear}$

Method of least squares:

$\alpha = 8,79 \Rightarrow \lambda = 0,84 \text{ cm} = 8,4 \text{ mm} \Rightarrow \nu = 0,97 \frac{1}{\text{cm}} = 97 \text{ m}^{-1}$



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Задача 4б

Земанова анаморфа земановска уз
заганад 4а (по глуме урџа)

$$d_2 = 46 \text{ mm} \Rightarrow \mu_2 = \cancel{54} 54 \text{ m}^{-1}$$

$$d_1 = 41 \text{ mm} :$$

l, sm	0	2	4	6	8	10	
z, sm	50	48	46	44	42	40	
M_1, dB	-45	-59	-44	-96	-111	---	
M_2, dB	-45	-59	-44	-96	-111	---	
M_3, dB	-45	-59	-44	-96	-111	---	
$\langle M \rangle, \text{dB}$	-45	-59	-44	-96	-111	---	

$$n \text{ of LS: } \alpha = 6,45 \Rightarrow \mu = 94 \text{ m}^{-1}$$

$$d_3 = 59 \text{ mm}$$

l, sm	0	2	4	6	8	10	12		
z, sm	50	48	46	44	42	40	38		
M_1, dB	-43	-56	-69	-84	-96	-109	-123		
M_2, dB	-43	-55	-69	-84	-94	-109	-124		
M_3, dB	-43	-56	-69	-84	-96	-109	-123		
$\langle M \rangle, \text{dB}$	-43	-56	-69	-84	-96	-109	-123		

$$n \text{ of LS: } \alpha = 6,93 \Rightarrow \mu = 80 \text{ m}^{-1}$$

$$d_4 = 100 \text{ mm} :$$

← ма ме земановска, мауко безмисауно
(не наменаване на еман)
 $l_0 = 115 \text{ sm}$

l, sm	2	4	12	17	22	27	32	40	45
z, sm	113	108	109	98	93	88	83	105	100
M_1, dB	-62	-81	-97	-116	---	---	---	-91	-105
M_2, dB	-65	-83	-94	-113	---	---	---	-94	-105
M_3, dB	-62	-82	-97	-114	---	---	---	-91	-105
$\langle M \rangle, \text{dB}$	-63	-82	-94	-115	---	---	---	-91	-105

$$n \text{ of LS: } \alpha = 3,33 \Rightarrow \mu = 38 \text{ m}^{-1}$$

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Прогонка заганул и в

see graph $u(d)$

итерки корано романисо на упрелуно \Rightarrow

$$\rightarrow u = A + B \cdot d$$

$$A = 142 \text{ m}^{-1}$$

$$B = -1,0 \frac{\text{m}^{-1}}{\text{mm}}$$

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$$P = U \cdot C = \frac{e^2 \cdot E^2}{c} C$$

46 mm

61

56

61

66

21

16

81

86

91

96

101

106

111

116

121

124

Quelqu'un
unit a receive

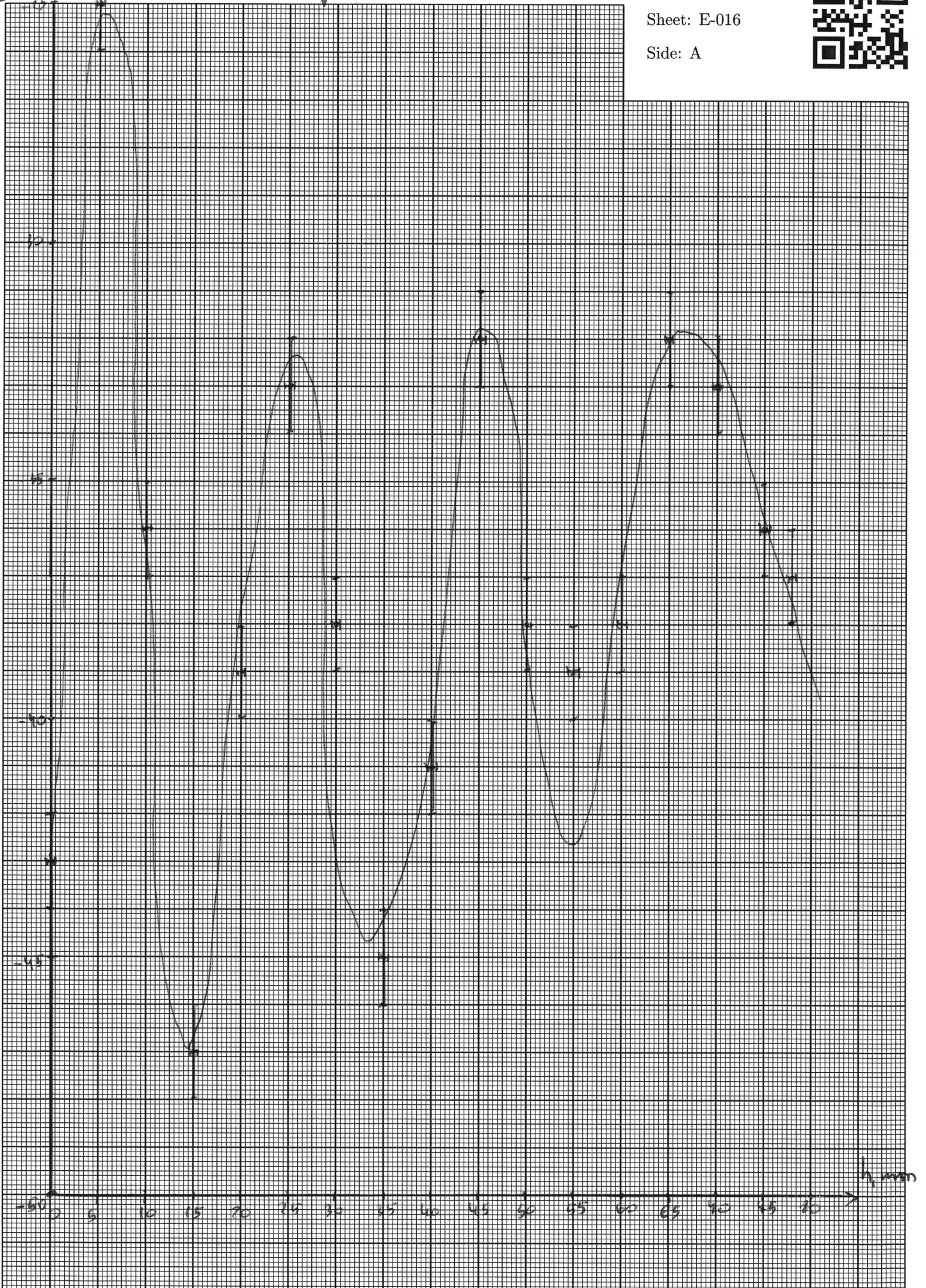
2/6 N_i dB

plot $\langle N \rangle (h)$

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plot $\eta(d)$

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