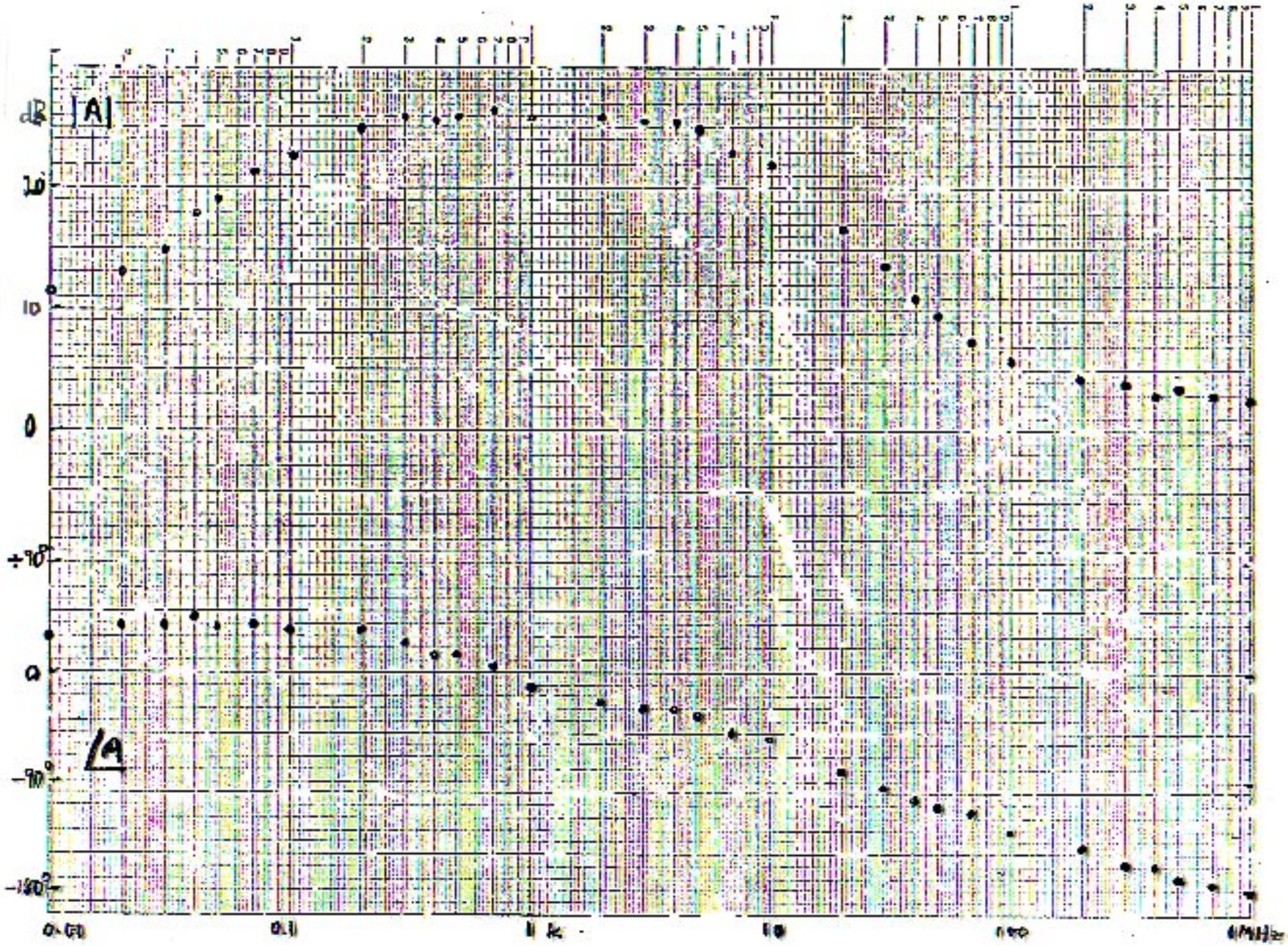
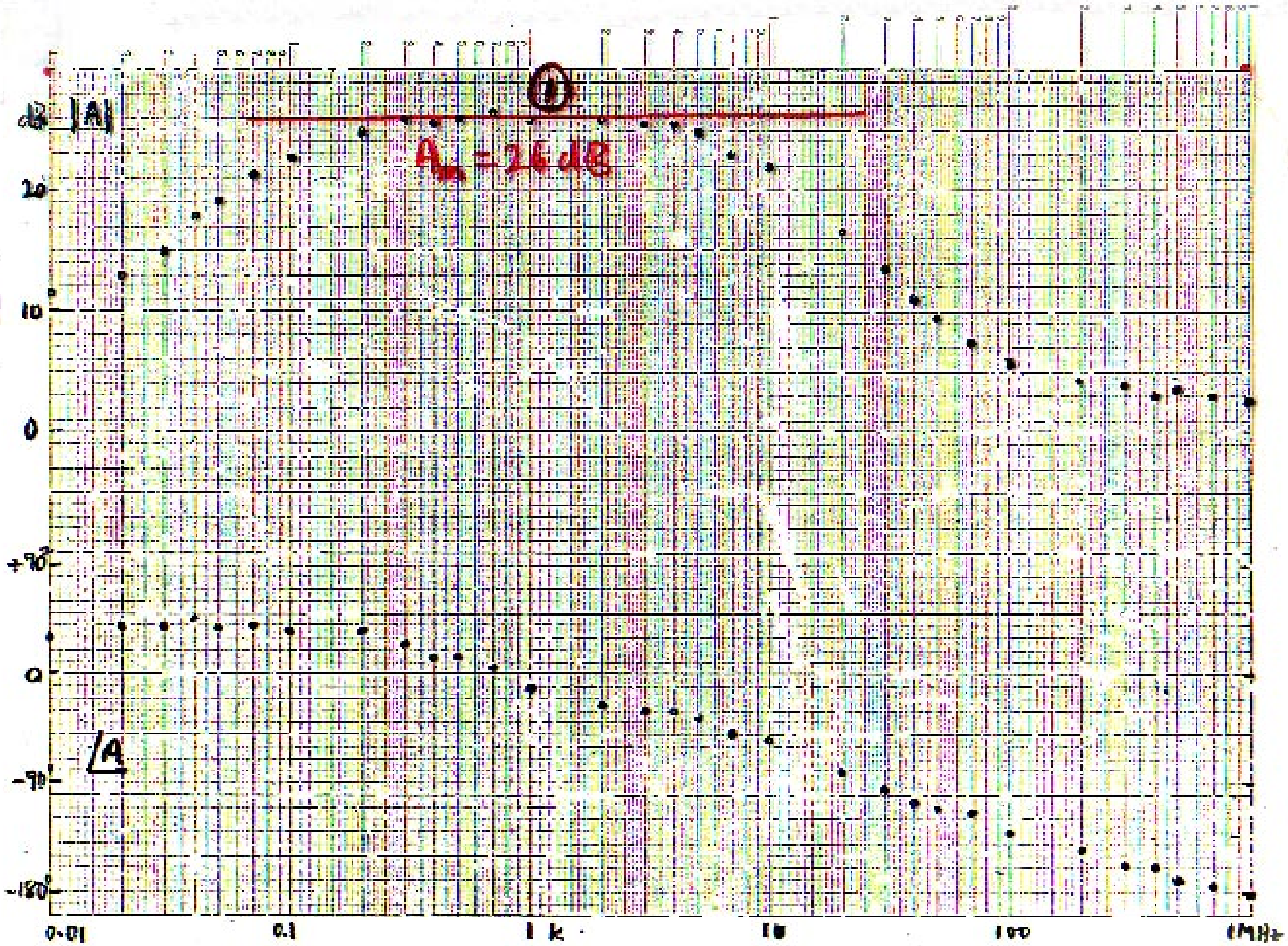
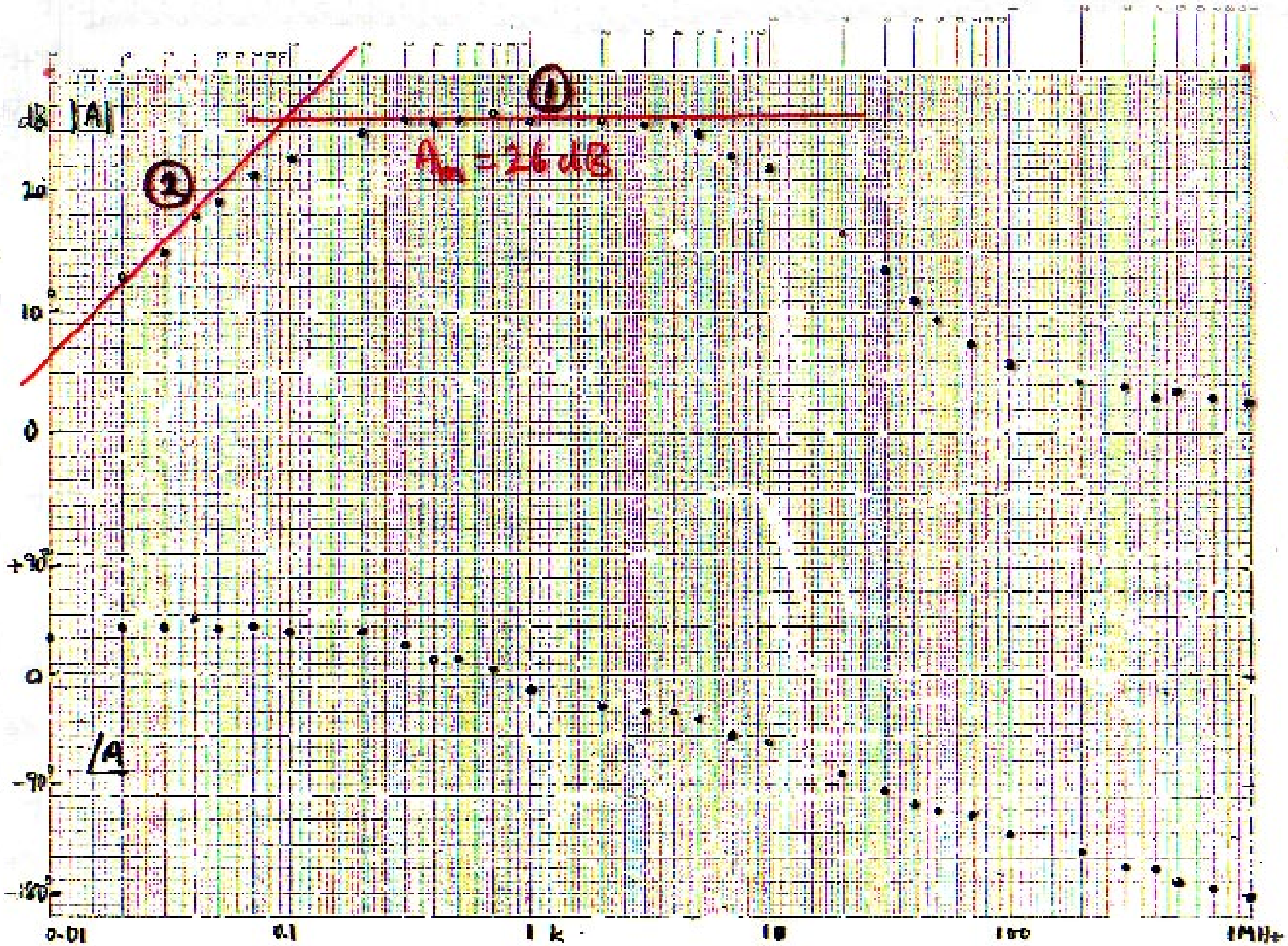
EXERCISE 4.1

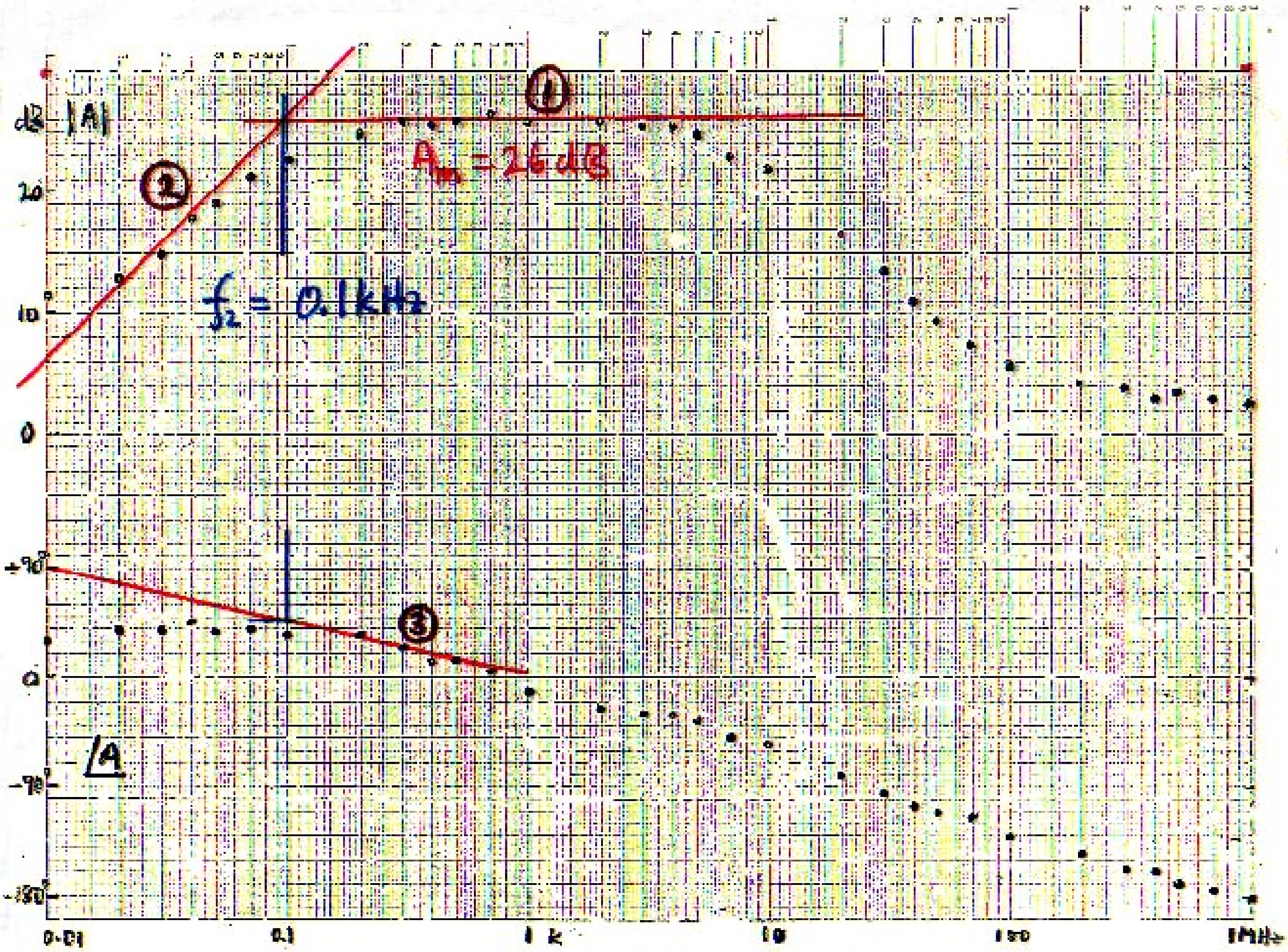
SOLUTION


dB
[A]
10
0
+90°
0
-90°
-180°
LA

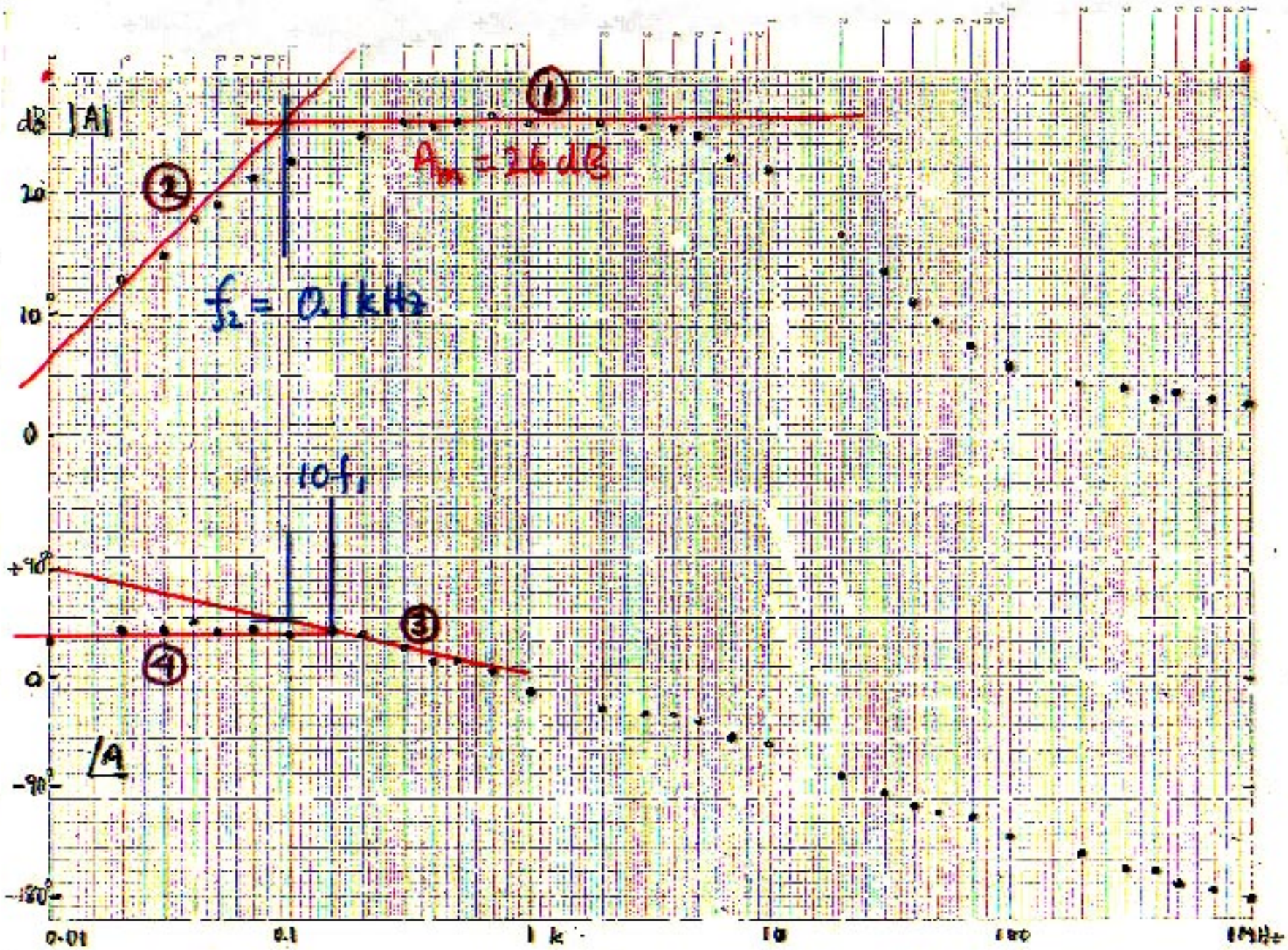


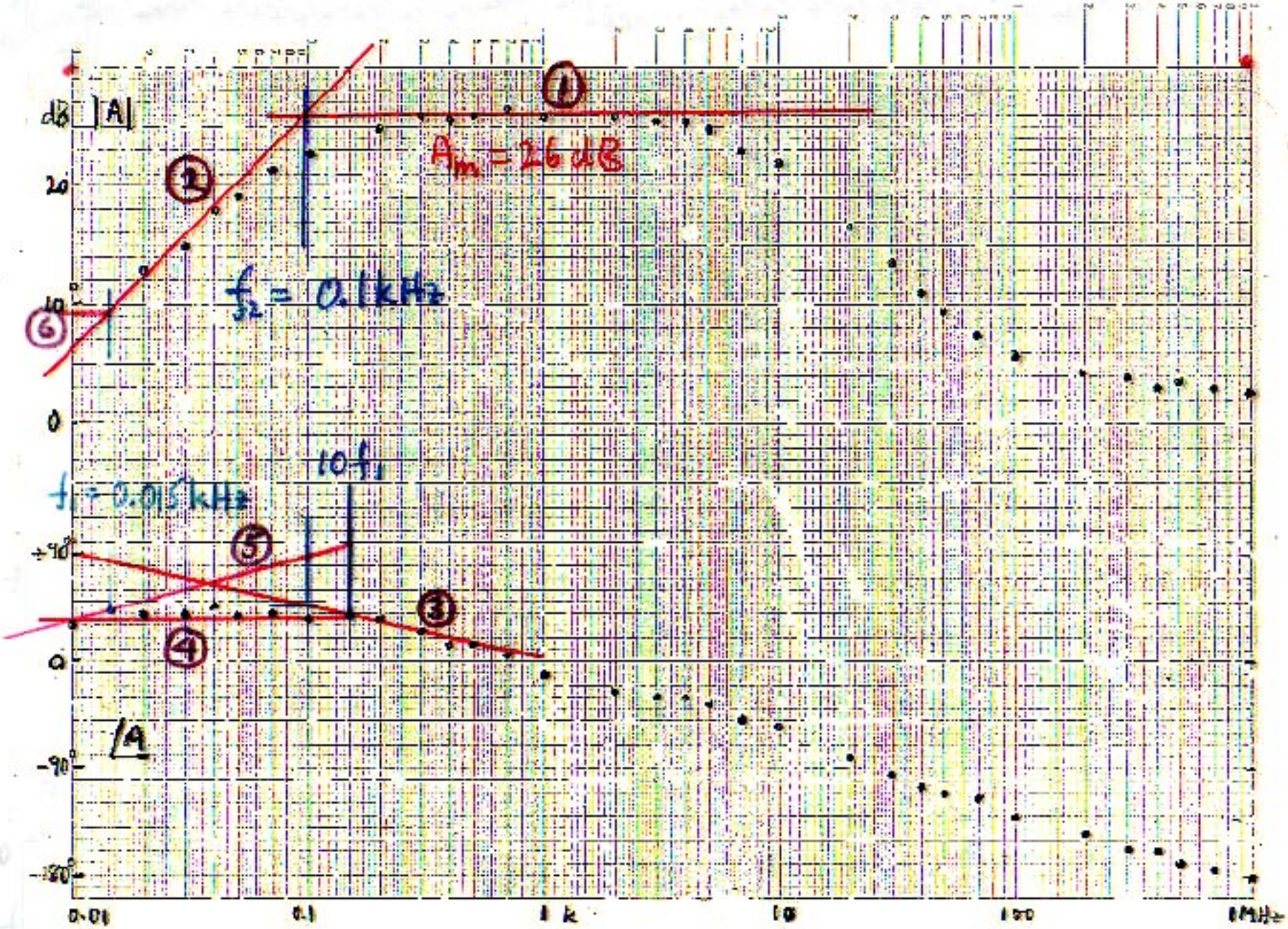
①
dB |A|
$A_m = 26$ dB
20
10
0
+90°
0
-90°
-180°
∠A
0.01
0.1
1 k
10
100
(M)Hz

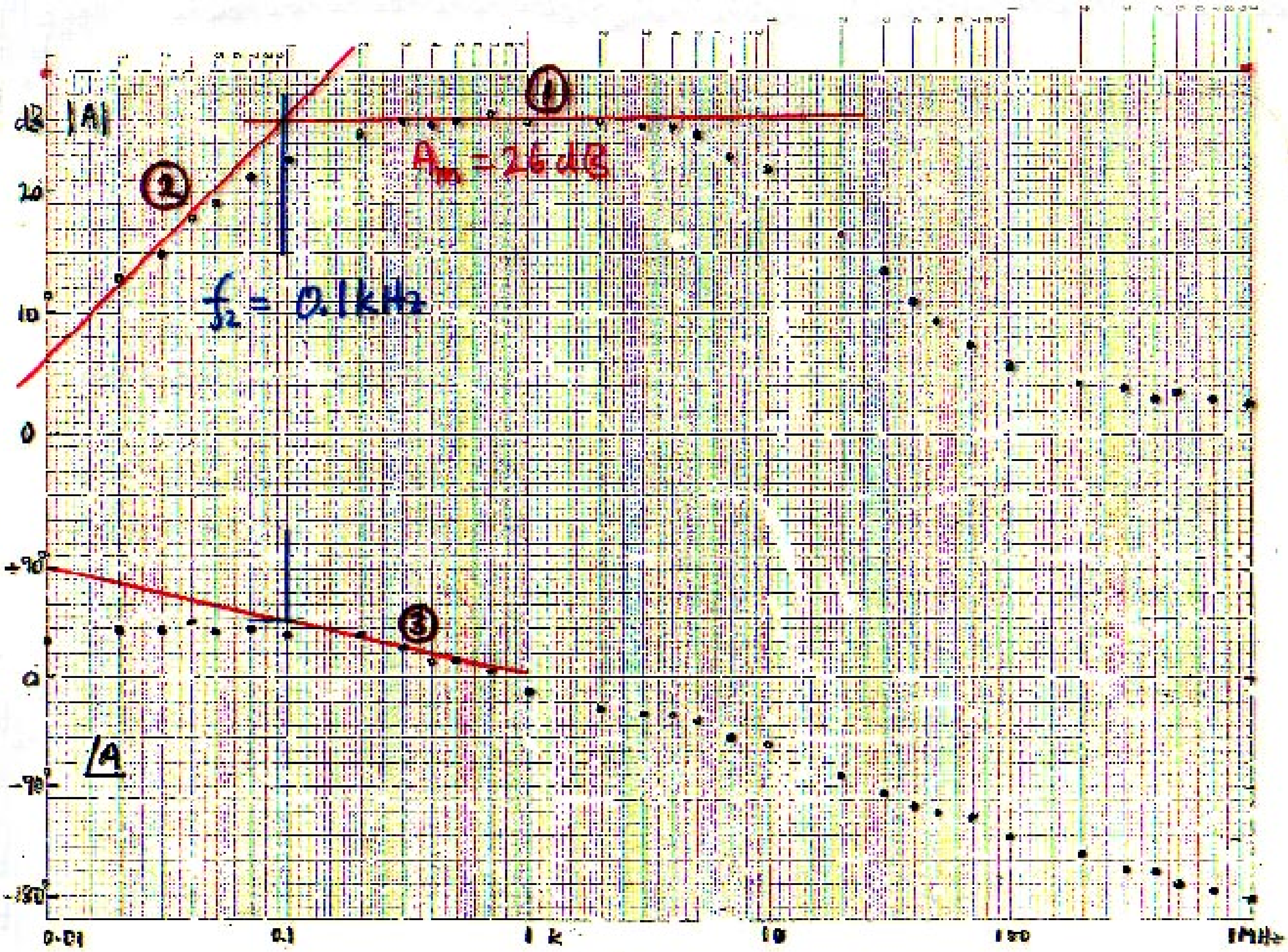

dB |A|
①
Am = 26 dB
②
20
10
0
+90°
0
-90°
-180°
/A
0.01
0.1
1 k
10
100
1MHz



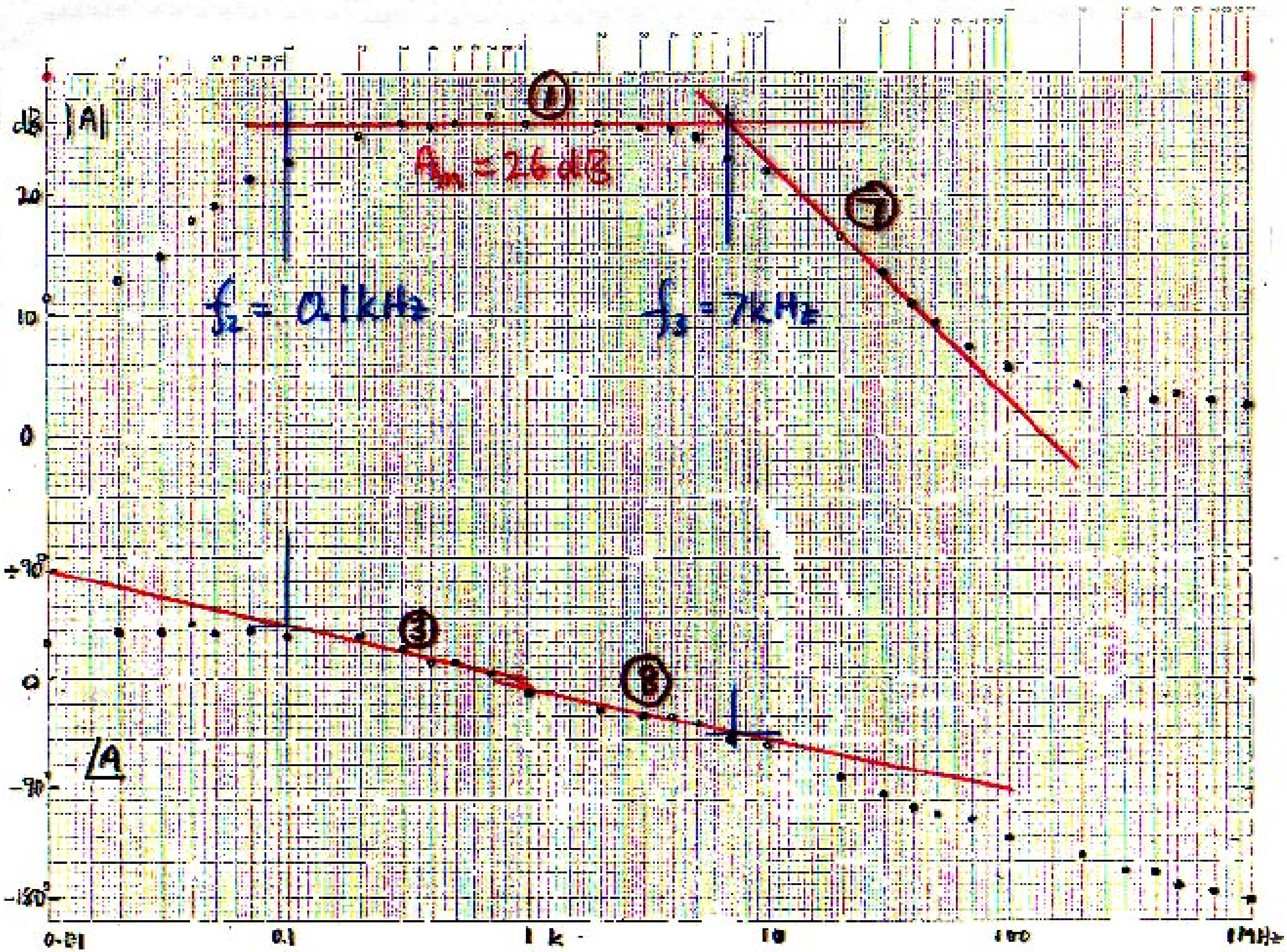
dB |A|
20
10
0
1
2
$A_m = 26$ dB
$f_L = 0.1$ kHz
+90°
0
-90°
-180°
3
/A
0.01
0.1
1 k
10
100
1 MHz


dB |A|
20
10
0
+90°
0
-90°
-180°
0.01
0.1
1 k
10
100
MHz
①
$A_{0k} = 26$ dB
②
$f_2 = 0.1$ kHz
10 f_1
③
④
/A

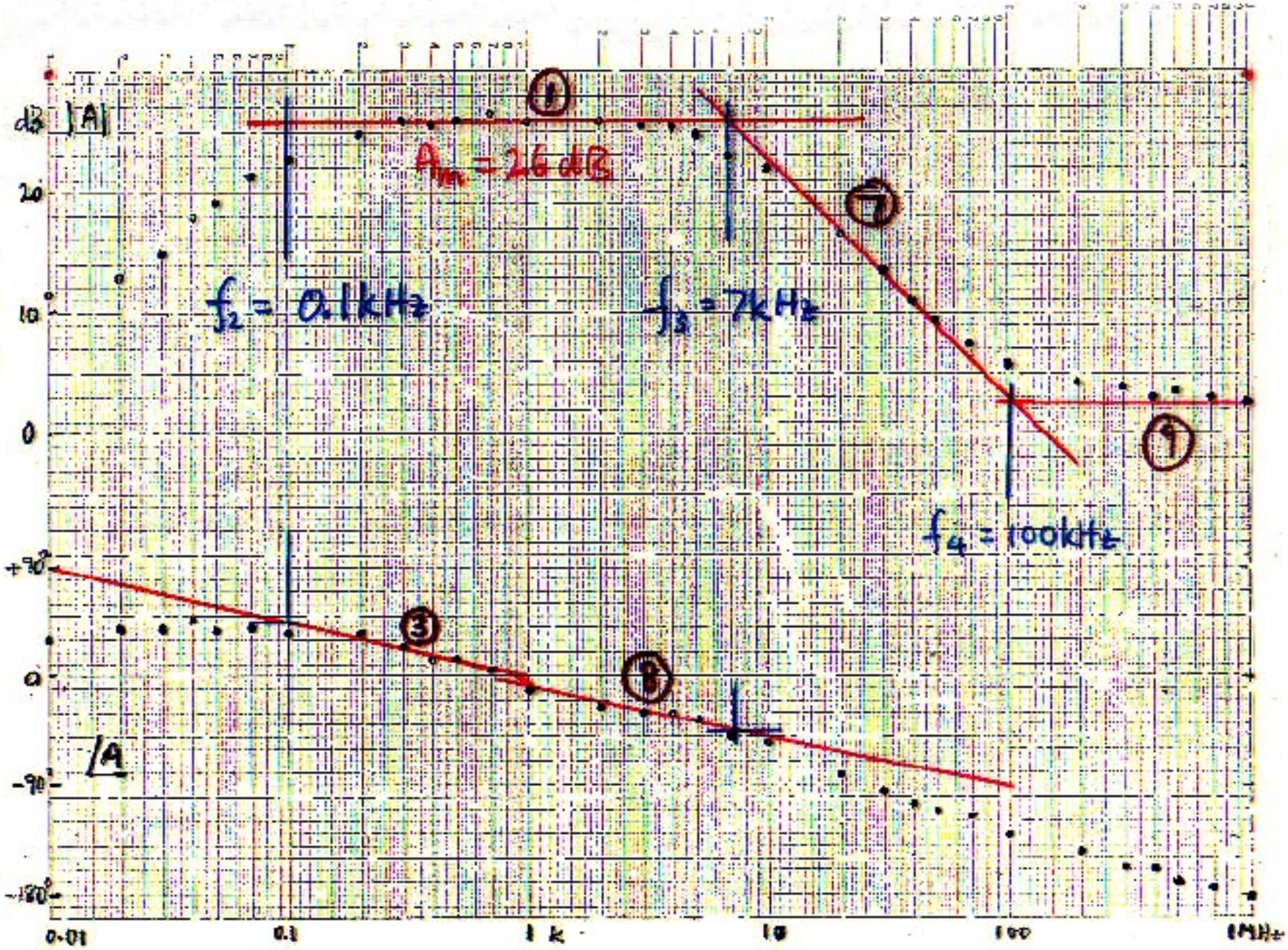

dB |A|
20
10
0
+90°
0
-90°
-180°
0.01
0.1
1 k
10
100
MHz
①
②
③
④
⑤
⑥
$A_m = 26$ dB
$f_2 = 0.1$ kHz
$10 f_1$
$f_1 = 0.015$ kHz
$\angle A$

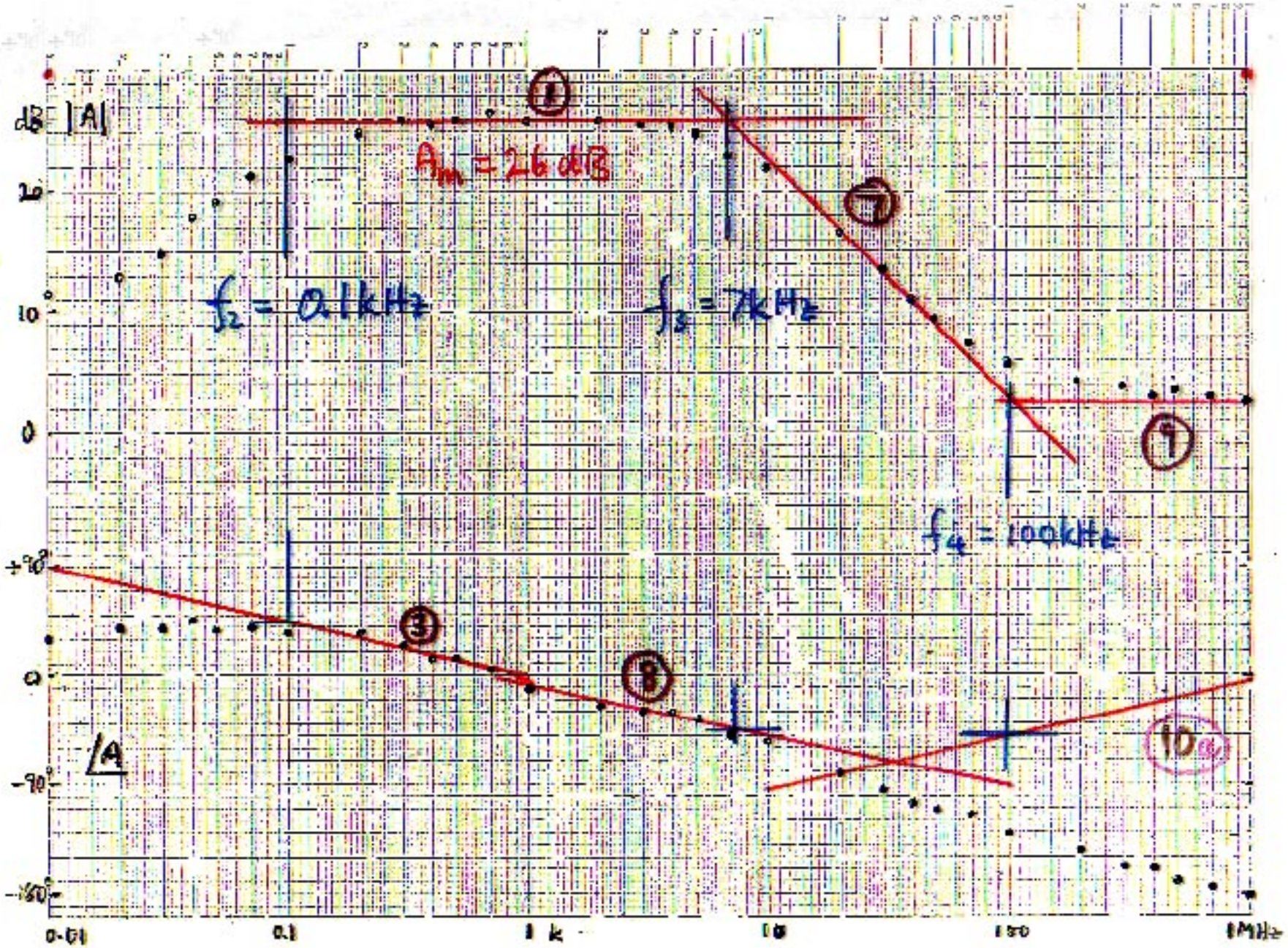


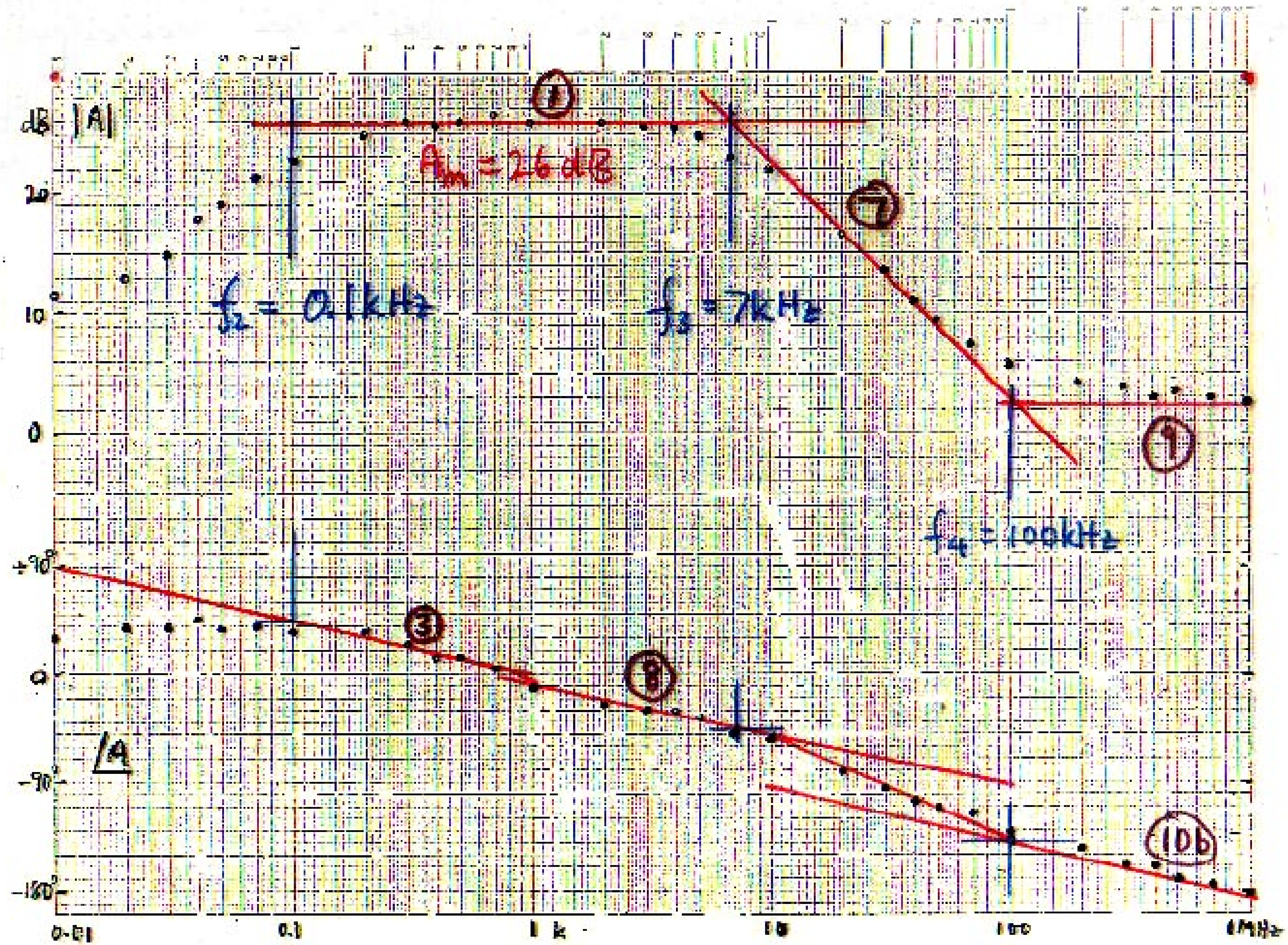
dB |A|
20
10
0
①
$A_m = 26$ dB
②
$f_L = 0.1$ kHz
+90°
③
0
∠A
-90°
-180°
0.01
0.1
1 k
10
100
1 MHz



dB |A|
20
10
0
$A_m = 26$ dB
$f_2 = 0.1$ kHz
$f_3 = 7$ kHz
+90°
0
-90°
-180°
∠A
0.01
0.1
1 k
10
100
1 MHz


dB |A|
20
10
0
+90°
0
-90°
-180°
0.01
0.1
1 k
10
100
MHz
①
$A_{MR} = 26\,dB$
$f_2 = 0.1\,kHz$
②
$f_3 = 7\,kHz$
①
$f_4 = 100\,kHz$
③
④
/A


dB |A|
20
10
0
+90°
0
-90°
-180°
0.01
0.1
1 k
10
100
1MHz
①
$A_m = 26$ dB
②
$f_2 = 0.1$kHz
$f_3 = 7$kHz
①
$f_4 = 100$kHz
③
④
∠A
10 dB



dB |A|
20
10
0
A_m = 26 dB
f_2 = 0.1kHz
f_3 = 7kHz
f_4 = 100kHz
+90°
0
-90°
-180°
∠A
0.01
0.1
1 k
10
100
1MHz
1
7
9
3
8
10b

Graphical solution sequence

Identify (1)

Identify (2): fixes corner $f_2 = 0.1\,kHz$

Draw (3)

Identify (4) as combination of a +45°/dec slope with (3).

Identify intersection of (3) and (4) at 0.15 kHz.

Hence draw (5), which identifies corner $f_1 = 0.015\,kHz$, and hence identify (6). Note that this process via $\angle A$ gives more accurate location of (6) than solely $|A|$ would, since low-frequency magnitude asymptote is not available.

Identify (7); draw (8)

Identify (9), draw (10a). Obviously (10a) is no good; but if invert to (10b) is OK.

Hence analytic form is

$$A = A_m \frac{\left(1+\frac{\omega_1}{s}\right)\left(1-\frac{s}{\omega_{rhp}}\right)}{\left(1+\frac{\omega_2}{s}\right)\left(1+\frac{s}{\omega_3}\right)}$$

Note right half-plane (rhp) zero

$A_m = 26\,dB$;

$f_1 = 0.015\,kHz$ $f_2 = 0.1\,kHz$

$f_3 = 7\,kHz$ $f_4 = 100\,kHz$