Examples 1 in Common Logs

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Note that a small dot $\cdot$ is a multiplication operator unless specified otherwise,
e.g. 3 x 5 = 3·5 = 15.

Note also, that no use of calculator is allowed in this set of examples.

0. Assuming $\mathbf{\log} \boldsymbol{X} = \boldsymbol{c} + \boldsymbol{m} = \mathbf{-1.123}$, find the characteristic $\boldsymbol{c}$ and the mantissa $\boldsymbol{m}$.

1. Assuming $\mathbf{\log} \boldsymbol{Y} = \boldsymbol{c} + \boldsymbol{m} = \mathbf{-0.207}$, find the characteristic $\boldsymbol{c}$ and the mantissa $\boldsymbol{m}$.

2. Put the expressions below into the form of $\bar{\mathbf{2}}\mathbf{.309}$.

2.0. $\bar{\mathbf{1}}\mathbf{.4256} + \bar{\mathbf{3}}\mathbf{.7233}$

2.1. $\bar{\mathbf{3}}\mathbf{.4263} - \bar{\mathbf{2}}\mathbf{.2573}$

2.2. $\bar{\mathbf{2}}\mathbf{.3751} \cdot \mathbf{4}$

2.3. $\dfrac{\bar{\mathbf{3}}\mathbf{.2564}}{\mathbf{2}}$

Suggestions or Solutions
To the Problems in the Examples 1

0. Assuming **log X = c + m = -1.123**, find the characteristic ***c*** and the mantissa ***m*.**

Let's briefly check the basics of common logs.

The **base in a common log** is **10**, which is usually omitted. So assuming $K > 0$, and taking the common log of K, we get **log K = c + m**, where c is an integer called the characteristic, m is called the mantissa, and $0 \le m < 1$. Again, **0 ≤ the mantissa < 1**.

Now, we have this: **log X = c + m = -1.123 = -1 – 0.123**.
However, the mantissa is not -0.123, because **0 ≤** (the mantissa ***m***) **< 1**.

So we want to extract the mantissa m from **-0.123**.
-0.123 = -1 + 1 – 0.123 = -1 + 0.877 $\Rightarrow$ -0.123 = **-1 + 0.877**.

So the mantissa m is 0.877.

Thus, -1.123 = -1 – 0.123 = -1 **– 1 + 0.877** = -2 + 0.877 = $\bar{2}$**.877.**

Therefore, c **= -2** and m **= 0.877**.

In short:

-1.123 = -1 – 0.123 = -1 – 1 + 1 – 0.123 = -1 – 1 + 0.877 = -2 + 0.877 = $\bar{2}$**.877.**
$\therefore$ c **= -2**, and m **= 0.877**.

Let's now, consider a general case.

Suppose **log K = -A.BCD**, where **A**, **B**, **C**, and **D** are single digit integers.

Then, we can put it this way: **log *K* = -A – 0.BCD**.
(For instance, if **log *K* = -2.1093**, we get **log *K* = -2 – 0.1093**.)

We know however, **0 ≤ the mantissa < 1**.

So **-0.BCD** is not the mantissa, and **-A** is not the characteristic, either.

And we know this: **1 < 1 – 0.BCD < 0**.

So we can put it this way: **log *K* = -A – 0.BCD = -A – 1 + 1 – 0.BCD**.

Therefore, the characteristic ***c*** is **-A – 1 = -(A + 1)**, and the mantissa ***m*** is **1 – 0.BCD**.

On the other hand, if **log *K* = $\overline{\text{A}}$.BCD** , we get this: **log *K* = -A + 0.BCD**.

Therefore, the characteristic ***c*** is **-A**, and the mantissa ***m*** is **0.BCD**.

1. Assuming **log *Y* = *c* + *m* = -0.207**, find the characteristic ***c*** and the mantissa ***m*.**

The mantissa is not -0.207, because **0 ≤** (the mantissa ***m***) **< 1**.

So we want to extract the mantissa ***m*** from **-0.207**.
-0.207 = -1 + 1 – 0.207 = -1 + 0.793 ⇒ -0.207 = **-1 + 0.793 = $\bar{1}$.793**.

Therefore, the mantissa ***m*** is 0.793, and the characteristic ***c*** is –1.

In short:

-0.207 = -1 + 1 – 0.207 = -1 + 0.793 = $\bar{1}$.793.
∴ ***c* = -1**, and ***m* = 0.793**.

2.

To begin with, note that a mantissa cannot be negative, and thus, has to be $\geq \mathbf{0}$.

If $\log X = -1.1234$, the characteristic is not -1, and the mantissa is not 0.1234 either.

That's because $\log X = -1 - 0.1234 = -1 - 1 + 1 - 0.1234 = -2 + 0.8766$.

So the characteristic is -2, and the mantissa is 0.8766. If however, $\log Y = \bar{1}.1234$, then

$\log Y = -1 + 0.1234$, so the characteristic is -1, and the mantissa is 0.1234.

1.0. $\bar{1}.4256 + \bar{3}.7233$

First, we can set $\bar{1}.4256 = -1 + 0.4256$, and $\bar{3}74233 = -3 + 0.7233$.

Thus next, $\bar{1}.4256 + \bar{3}.7233$ = -1 + 0.4256 – 3 + 0.7233 = -4 + 1.1489 = -4 + 1 + 0.1489

= -3 + 0.1489 = $\bar{3}.1489$.

1.1. $\bar{3}.4263 - \bar{2}.2573$

We can set $\bar{3}.4263 = -3 + 0.4263$, and $\bar{2}.2573 = -2 + 0.2573$.

So we get $\bar{3}.4263 - \bar{2}.2573$ = -3 + 0.4263 – (-2 + 0.2573) = -3 + 0.4263 + 2 – 0.2573

= -1 + 0.1690 = $\bar{1}.1690$.

1.2. $\bar{2}.3751 \cdot 4$

We can set $\bar{2}.3751 = -2 + 0.3751$.

So we get $\bar{2}.3751 \cdot 4$ = (-2 + 0.3751)4 = -8 + 1.5004 = -8 + 1 + 0.5004

= -7 + 0.5004 = $\bar{7}.5004$.

1.3. $\frac{\bar{3}.2564}{2}$

We can set $\bar{3}.2564 = -3 + 0.2564$.

Thus, we get $\frac{\bar{3}.2564}{2} = \frac{-3 + 0.2564}{2}$ = -1.5 + 0.1282 = -1 – 0.5 + 0.1282

= -1 – 1 + 1 – 0.5 + 0.1282 = -2 + 0.5 + 0.1282 = -2 + 0.6282 = $\bar{2}.6282$.