# Exercise 2.3

## Rules for Finding the Characteristic

**(i) For a number *greater* than 1:**

$$Characteristic = number\ of\ digits\ to\ the\ left\ of\ the\ decimal\ point - 1$$

**(ii) For a number *less* than 1:**

$$Characteristic = -(number\ of\ zeros\ between\ the\ decimal\ point\ and\ the\ first\ non\ zero\ digit + 1)$$

**Note:** When the characteristic is negative, we write it with ***bar***.

## Logarithm of a Number

$$Logarithm = Characteristic + Mantissa$$

**1. Find the characteristic of the following numbers:**

**(i) 5287**

$$Characteristic = 4 - 1$$
$$= 3$$

**(ii) 59.28**

$$Characteristic = 2 - 1$$
$$= 1$$

**(iii) 0.0567**

$$Characteristic = -(1 + 1)$$
$$= \bar{2}$$



**(iv) 234.7**

$$Characteristic = 3 - 1$$
$$= 2$$

**(v) 0.000049**

$$Characteristic = -(4 + 1)$$
$$= \bar{5}$$

**(vi) 145000**

$$Characteristic = 6 - 1$$
$$= 5$$

**2. Find the logarithm of the following numbers:**

**(i) 43**

$$Characteristic = 2 - 1 = 1$$
$$Mantissa = 0.6335 \qquad (Table\ Value = 6335)$$
$$\log 43 = 1 + 0.6335$$
$$\log 43 = 1.6335$$

**(ii) 579**

$$Characteristic = 3 - 1 = 2$$
$$Mantissa = 0.7627 \qquad (Table\ Value = 7627)$$
$$\log 579 = 2 + 0.7627$$
$$\log 579 = 2.7627$$

**(iii) 1.982**

$$Characteristic = 1 - 1 = 0$$
$$Mantissa = 0.2971 \qquad (Table\ Value = 2967 + 4 = 2971)$$

$$\log 1.982 = 0 + 0.2971$$
$$\log 1.982 = 0.2971$$

**(iv) $0.0876$**

$$Characteristic = -(1+1) = -2$$
$$Mantissa = 0.9425 \qquad (Table\ Value = 9425)$$
$$\log 0.0876 = -2 + 0.9425$$
$$\log 0.0876 = -1.0575$$

**(v) $0.047$**

$$Characteristic = -(1+1) = -2$$
$$Mantissa = 0.6721 \qquad (Table\ Value = 6721)$$
$$\log 0.047 = -2 + 0.6721$$
$$\log 0.047 = -1.3279$$

**(vi) $0.000354$**

$$Characteristic = -(3+1) = -4$$
$$Mantissa = 0.5490 \qquad (Table\ Value = 5490)$$
$$\log 0.000354 = -4 + 0.5490$$
$$\log 0.000354 = -3.4510$$

Note: The place between the first non-zero digit from left and its next digit is called reference position. For example, in $1332$, the reference position is between $1$ and $3$ ($1\hat{}332$).

**3. If $\log 3.177 = 0.5019$, then find:**

Since $\log 3.177 = 0.5019$. So, $Characteristic = 0$ and $Mantissa = 0.5019$

**(i) $\log 3177$**



$$Characteristic = 4 - 1 = 3$$
$$Mantissa = 0.5019$$
$$\log 3177 = 3 + 0.5019$$
$$\log 3177 = 3.5019$$

**(ii) $\log 31.77$**

$$Characteristic = 2 - 1 = 1$$
$$Mantissa = 0.5019$$
$$\log 3177 = 1 + 0.5019$$
$$\log 3177 = 1.5019$$

**(iii) $\log 0.03177$**

$$Characteristic = -(1+1) = -2$$
$$Mantissa = 0.5019$$
$$\log 0.03177 = -2 + 0.5019$$
$$\log 0.03177 = -1.4981$$

**4. Find the value of $x$:**

**(i) $\log x = 0.0065$**

Since $\log x = 0.0065$. So, $Characteristic = 0$ and $Mantissa = 0.0065$

$$Table\ value\ of\ 0.0065 = 1014 + 1 = 1\hat{}015$$

So

$$x = Anti \log 0.0065$$
$$x = 1.015$$

Since $characteristic = 0$, therefore decimal point will be at reference position.

**(ii) $\log x = 1.192$**

Since $\log x = 1.192$. So, $Characteristic = 1$ and $Mantissa = 0.192$

$$Table\ value\ of\ 0.192 = 1\overset{\wedge}{,}556$$

So

$$x = Anti \log 1.192$$
$$x = 15.56$$

Since $characteristic = 1$, therefore decimal point will be after 1 digits right from the reference position.

**(iii) $\log x = -3.434$**

$$\log x = -3.434$$
$$\log x = -4 + 4 - 3.434$$
$$\log x = -4 + 0.566$$
$$\log x = \bar{4}.566$$

Since $\log x = \bar{4}.566$. So, $Characteristic = \bar{4}$ and $Mantissa = 0.566$

$$Table\ value\ of\ 0.566 = 3\overset{\wedge}{,}681$$

So

$$x = Anti \log \bar{4}.566$$
$$x = 0.0003681$$

Since $characteristic = \bar{4}$, therefore decimal point will be before 4 digits left from the reference position.

**(iv) $\log x = -1.5726$**

$$\log x = -1.5726$$
$$\log x = -2 + 2 - 1.5726$$
$$\log x = -2 + 0.4274$$
$$\log x = \bar{2}.4274$$

Since $\log x = \bar{2}.4274$. So, $Characteristic = \bar{2}$ and $Mantissa = 0.4274$



$$Table\ value\ of\ 0.4274 = 2673 + 2 = 2\overset{\wedge}{,}675$$

So

$$x = Anti \log \bar{2}.4274$$
$$x = 0.02675$$

Since $characteristic = \bar{2}$, therefore decimal point will be before 2 digits left from the reference position.

**(v) $\log x = 4.3561$**

Since $\log x = 4.3561$. So, $Characteristic = 4$ and $Mantissa = 0.3561$

$$Table\ value\ of\ 0.3561 = 2270 + 1 = 2\overset{\wedge}{,}271$$

So

$$x = Anti \log 4.3561$$
$$x = 22710$$

Since $characteristic = 4$, therefore decimal point will be after 4 digits right from the reference position.

**(vi) $\log x = -2.0184$**

$$\log x = -2.0184$$
$$\log x = -3 + 3 - 2.0184$$
$$\log x = -3 + 0.9816$$
$$\log x = \bar{3}.9816$$

Since $\log x = \bar{3}.9816$. So, $Characteristic = \bar{3}$ and $Mantissa = 0.9816$

$$Table\ value\ of\ 0.9816 = 9572 + 13 = 9\overset{\wedge}{,}585$$

So

$$x = Anti \log \bar{3}.9816$$
$$x = 0.009585$$

Since $characteristic = \bar{3}$, therefore decimal point will be before 3 digits left from the reference position.