Exercise 3.4

Q1 Use log tables to find the value of the following

(i) 0.8176×13.64

(ii) $(789.5)^{\frac{1}{8}}$

(iii) $\frac{(1.23)(0.6975)}{(0.0075)(1278)}$

(iv) $\sqrt[5]{2.709} \times \sqrt[7]{1.239}$

(v) $\frac{(1.23)(0.6975)}{(0.0075)(1278)}$

(vi) $\sqrt[3]{\frac{0.7214 \times 20.37}{60.8}}$

(vii) $\frac{83 \times \sqrt[3]{92}}{127 \times \sqrt[5]{246}}$

(viii) $\frac{(438)^3}{(388)^4}$

Solution

i. 0.8176×13.64

Let $x = 0.8176 \times 13.64$

Taking log on both sides

$$\begin{aligned}
\log x &= \log(0.8176 \times 13.64) \\
\log x &= \log 0.8176 + \log 13.64 \\
\log x &= \bar{1}.9125 + 1.1348 \\
\log x &= -1 + 0.9125 + 1 + 0.1348 \\
\log x &= 0.9125 + 0.1348 \\
\log x &= 1.0473
\end{aligned}$$

Taking Antilog on both sides

Antilog $(\log x) = \text{Antilog}(1.0473)$

ii. $(789.5)^{\frac{1}{8}}$

Let $x = \left(789.5\right)^{1/8}$

Taking log on both sides

$$\log x = \log\left(789.5\right)^{1/8}$$
$$\log x = \frac{1}{8}\log 789.5$$
$$\log x = \frac{1}{8}(2.8974)$$
$$\log x = 0.3622$$

Taking Antilog on both sides

$$\text{Antilog}(\log x) = \text{Antilog}(0.3622)$$

$$x = 2.302$$

iii. $\dfrac{0.678 \times 9.01}{0.0234}$

Let $x = \dfrac{0.678 \times 9.01}{0.0234}$

Taking log on both sides

$$\log x = \log\frac{0.678 \times 9.01}{0.0234}$$
$$\log x = \log 0.678 + \log 9.01 - \log 0.234$$
$$\log x = -1 + 0.8312 + 0.9547 - \overline{2} - 0.3692$$
$$\log x = -1 + 2 + 1.7859 - 0.3692$$
$$\log x = 1 + 1.4167$$
$$\log x = 2.4167$$

Taking Antilog on both sides

iv. $\sqrt[5]{2.709}\times\sqrt[7]{1.239}$

$$\text{Let } x=\sqrt[5]{2.709}\times\sqrt[7]{1.239}$$

$$\log x=\log\left[\left(2.709\right)^{1/5}\times(1.239)^{1/7}\right]$$
$$\log x=\log\left[\left(2.709\right)^{1/5}+(1.239)^{1/7}\right]$$
$$\log x=\frac{1}{5}(0.4328)+\frac{1}{7}(0.0931)$$
$$\log x=0.08656+0.0133$$
$$\log x=0.0999$$

Taking Antilog on both sides, we get

$$\text{Antilog}\,(\log x)=\text{Antilog}(0.0999)$$
$$x=1.258$$

v. $\dfrac{(1.23)(0.6975)}{(0.0075)(1278)}$

$$\text{Let } x=\frac{(1.23)(0.6975)}{(0.0075)(1278)}$$

$$\log x=\log\frac{(1.23)(0.6975)}{(0.0075)(1278)}$$
$$\log x=\log\left[(1.23)(0.6975)\right]-\log\left[(0.0075)(1278)\right]$$
$$\log x=\log(1.23)+\log(0.6975)-\log(0.0075)-\log(1278)$$
$$\log x=0.0899+\overline{1}.8435-\overline{3}.8751-3.1065$$
$$\log x=-1+3-3+0.9334-0.9816$$
$$\log x=-2+0.9518$$
$$\log x=\overline{2}.9518$$

Taking Antilog on both sides, we get

$$\text{Antilog}\,x=\text{Antilog}\,(\overline{2}.9518)$$

vi. $\sqrt[3]{\dfrac{0.7214\times 20.37}{60.8}}$

$$\text{Let } x=\sqrt[3]{\frac{0.7214\times 20.37}{60.8}}$$

$$\log x=\log\left(\frac{0.7214\times 2.37}{60.8}\right)^{1/3}$$
$$\log x=\log\frac{1}{3}\left\{\left(\log 0.7214+\log 20.37\right)-\log 60.8\right\}$$
$$\log x=\frac{1}{3}\left\{\bar{1}.8581+1.3090-1.7839\right\}$$
$$\log x=\frac{1}{3}\left\{-1+8581+1+0.3090-1.7839\right\}$$
$$\log x=\frac{1}{3}\left\{-3+4.1671-1.7839\right\}$$
$$\log x=\frac{1}{3}\left\{-3+2.3832\right\}$$
$$\log x=-1+0.7944$$
$$\log x=\bar{1}.7944$$

Taking Antilog on both sides, we get

$$\text{Antilog}(\log x)=\text{Antilog}\left(\bar{1}.7944\right)$$
$$x=0.6229$$

vii. $\dfrac{83\times\sqrt[3]{92}}{127\times\sqrt[5]{246}}$

$$\log x=\log(83\times\sqrt[3]{92})-\log(127\times\sqrt[5]{246})$$
$$\log x=\log 83+\log(92)^{1/3}-\log 127-\log(246)^{1/5}$$
$$\log x=1.9191+\frac{1}{3}(1.9638)-2.1038-\frac{1}{5}(2.3909)$$
$$\log x=-1+3.5737-2.5820$$
$$\log x=\bar{1}.9917$$

Taking Antilog on both sides, we get

viii. $\dfrac{(438)^3\sqrt{0.056}}{(388)^4}$

$$\text{Let } x = \frac{(438)^3\sqrt{0.056}}{(388)^4}$$

$$\log x = \log\frac{(438)^3\sqrt{0.056}}{(388)^4}$$

$$\log x = \log(438)^3 + \log\sqrt{0.056} - \log(388)^4$$

$$\log x = \log(438)^3 + \log(0.056)^{\frac{1}{2}} - \log(388)^4$$

$$\log x = 3\log 438 + \frac{1}{2}\log 0.056 - 4\log 388$$

$$\log x = 3(2.6415) + \frac{1}{2}(\bar{2}.7482) - 4(2.5888)$$

$$\log x = 7.9245 + \bar{1}.3741 - 10.3552$$

$$\log x = 7.9245 - 1 + 0.3741 - 10.3552$$

$$\log x = 8.2986 - 11.3552$$

$$\log x = -4 + 12.2986 - 11.3552$$

$$\log x = -4 + 0.9434$$

$$\log x = \bar{4}.9434$$

Taking Antilog on both sides, we get

$$\text{Antilog}\left(\log x\right) = \text{Antilog}\left(\bar{4}.9434\right)$$

$$x = 0.0008778$$

Q2. A gas is expanding according to the law $pV^n = C$

Find C when $p = 80,\ v = 3.1 \text{ and } n = \dfrac{5}{4}$

Solution:

$$pV^n = C$$

Substituting $p = 80,\ v = 3.1$ and $n = \frac{5}{}$

$$C = 80\left(3.1\right)^{\frac{5}{4}}$$

$$\log C = \log 80(3.1)^{\frac{5}{4}}$$
$$\log C = \log 80 + \frac{5}{4}\log 3.1$$
$$\log C = 1.9031 + \frac{5}{4}(0.4914)$$
$$\log C = 1.9031 + \frac{2.570}{4}$$
$$\log C = 1.9031 + 0.6143$$
$$\log C = 2.5174$$

Taking Antilog on both sides, we get

$$\text{Antilog}\left(\log C\right) = \text{Antilog}\left(2.5174\right)$$
$$C = 329.2$$

Q3. The formula $p = 90(5)^{-q/10}$ applies to the demand of a product, where q is the number of units and p is the price of one unit. How many units will be demanded if the price is Rs18.00?

Solution:

$$p = 90(5)^{-q/10}$$

$$\log p = \log\left[90(5)^{-q/10}\right]$$
$$= \log 90 + \log(5)^{-q/10}$$
$$= \log 90 - \frac{q}{10}\log 5$$
$$\frac{q}{10}\log 5 = \log\frac{90}{p}$$

Putting $p = 18$ in the above equation, we get

$$\frac{q}{10}\log 5 = \log\frac{90}{18}$$
$$\frac{q}{10}\log 5 = \log 5$$

$\frac{q}{10} = 1$

$q = 10$

Therefore, 10 units will be demanded.

Q4. If $A = \pi r^2$ Find A, when $\pi = \frac{22}{7}$ and r = 15.

Solution:

$A = \pi r^2$

$\log A = \log \pi r^2$

$\log A = \log \pi + \log r^2$

$\log A = \log \frac{22}{7} + 2\log 15$

$\log A = \log 22 - \log 7 + 2\log 15$

$\log A = 1.342 = 0.8451 + 2(1.1761)$

$\log A = 2.8495$

Taking Antilog on both sides, we get

$\text{Antilog}(\log A) = \text{Antilog}(2.8495)$

$A = 707.1$

Q5. If V=$V = \frac{1}{3}\pi r^2 h$, find V, when $\pi = \frac{22}{7}$, $r = 2.5$ and $h = 4.2$

Solution:

$V = \frac{1}{3}\pi r^2 h$

Putting values in the above equation

$V = \frac{1}{3} \times \frac{22}{7} \times 25^2 \times 4.2$

$$V = 22 \times 25^2 \times 0.2$$
$$V = 22 \times 25^2 \times \frac{2}{10}$$

$$\log V = \log\left(22 \times 25^2 \times \frac{2}{10}\right)$$
$$\log V = \log 22 + 2\log 25 + \log 2 - \log 10$$
$$\log V = 1.3424 + 2.7959 + 0.3010 - 1$$
$$\log V = 4.4393$$

Taking Antilog on both sides, we get

$$\text{Antilog}(\log V) = \text{Antilog}(4.4393)$$
$$A = 27.50$$