

Exercise 3.3**Q. 1: Write the following into sum or difference.**

- (i) $\log(A \times B) = \log A + \log B$
- (ii) $\log \frac{15.2}{30.5} = \log 15.2 - \log 30.5$
- (iii) $\log \frac{21 \times 5}{8} = \log(21 \times 5) - \log 8$
 $= \log 21 + \log 5 - \log 8$
- (iv) $\log \sqrt[3]{\frac{7}{15}} = \log \left(\frac{7}{15}\right)^{\frac{1}{3}}$
 $= \frac{1}{3} \log \left(\frac{7}{15}\right)$
 $= \frac{1}{3} (\log 7 - \log 15)$
- (v) $\log \frac{(22)^{1/3}}{5^3} = \log(22)^{\frac{1}{3}} - \log 5^3$
 $= \frac{1}{3} \log 22 - 3 \log 5$
- (vi) $\log \frac{25 \times 47}{29} = \log(25 \times 47) - \log 29$
 $= \log 25 + \log 47 - \log 29$

Q. 2: Express $\log x - 2 \log x + 3 \log(x + 1) - \log(x^2 - 1)$ as a single logarithm.

$$\begin{aligned}
 \log x - 2 \log x + 3 \log(x + 1) - \log(x^2 - 1) &= \log x - \log x^2 + \log(x + 1)^3 - \log(x^2 - 1) \\
 &= \log \frac{x}{x^2} + \log \frac{(x+1)^3}{(x^2-1)} \\
 &= \log \frac{x}{x^2} + \log \frac{(x+1)^3}{(x-1)(x+1)} \\
 &= \log \frac{1}{x} + \log \frac{(x+1)^2}{(x-1)} \\
 &= \log \frac{(x+1)^2}{x(x-1)}
 \end{aligned}$$

Q. 3: Write the following in the form of a single logarithm.

- (i) $\log 21 + \log 5 = \log(21 \times 5)$
- (ii) $\log 25 - 2 \log 3 = \log 25 - \log 3^2$
 $= \log \frac{25}{3^2}$
- (iii) $2 \log x - 3 \log y = \log x^2 - \log y^3$
 $= \log \frac{x^2}{y^3}$
- (iv) $\log 5 + \log 6 - \log 2 = \log(5 \times 6) - \log 2$
 $= \log \frac{5 \times 6}{2}$

Q. 4: Calculate the following:

(i) $\log_3 2 \times \log_2 81 = \frac{\log 2}{\log 3} \times \frac{\log 81}{\log 2}$
 $= \frac{\log 3^4}{\log 3}$
 $= \frac{4 \log 3}{\log 3}$
 $= 4$

$$\begin{aligned}
 \text{(ii)} \quad \log_5 3 \times \log_3 25 &= \frac{\log 3}{\log 5} \times \frac{\log 25}{\log 3} \\
 &= \frac{\log 5^2}{\log 5} \\
 &= \frac{2\log 5}{\log 5} \\
 &= 2
 \end{aligned}$$

Q. 3: If $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 5 = 0.6990$, then find the values of the following

$$\begin{aligned}
 \text{(i)} \quad \log 32 &= \log 2^5 \\
 &= 5\log 2 \\
 &= 5(0.3010) \\
 &= 1.5050 \\
 \text{(ii)} \quad \log 24 &= \log(8 \times 3) \\
 &= \log 8 + \log 3 \\
 &= \log 2^3 + \log 3 \\
 &= 3\log 2 + \log 3 \\
 &= 3(0.3010) + 0.4771 \\
 &= 1.3801 \\
 \text{(iii)} \quad \log \sqrt{3\frac{1}{3}} &= \log \sqrt{\frac{10}{3}} \\
 &= \log \left(\frac{10}{3}\right)^{\frac{1}{2}} \\
 &= \frac{1}{2} \log \left(\frac{5 \times 2}{3}\right) \\
 &= \frac{1}{2} (\log 5 + \log 2 - \log 3) \\
 &= \frac{1}{2} (0.6990 + 0.3010 - 0.4771) \\
 &= \frac{1}{2} (0.5229) \\
 &= 0.2615 \\
 \text{(iv)} \quad \log \frac{8}{3} &= \log 8 - \log 3 \\
 &= \log 2^3 - \log 3 \\
 &= 3\log 2 - \log 3 \\
 &= 3(0.3010) - 0.4771 \\
 &= 0.4259 \\
 \text{(v)} \quad \log 30 &= \log(2 \times 3 \times 5) \\
 &= \log 2 + \log 3 + \log 5 \\
 &= 0.3010 + 0.4771 + 0.6990 \\
 &= 1.4771
 \end{aligned}$$