

26-4-2024

Unit 2

Ex 2.8⁵

Q1 Use laws of logarithms to expand for following?

i) $\log 9t$

$= \log 9 + \log t$ Ans.

ii) $\log \frac{59}{s}$

$= \log 59 - \log s$ Ans.

iii) $\log \frac{(5pq^2)}{(xy^3)}$

$= \log (5pq^2) - \log (xy^3)$

$= 2\log(5pq) - 3\log(xy)$

$= 2\log 5 + \log p + \log q - 3\log x - \log y$ Ans.

$$\text{iv) } \log \sqrt{\frac{53.3}{46.4}}$$

$$= \log \left(\frac{53.3}{46.4} \right)^{\frac{1}{2}}$$

$$= \frac{1}{2} \log 53.3 - \log 46.4 \text{ Ans}$$

$$\text{v) } \log \left(\frac{5^2 \cdot t^5 \cdot a^{\frac{1}{3}}}{4.4 \cdot b^3} \right)$$

$$= \log 5^2 \cdot t^5 \cdot a^{\frac{1}{3}} - \log (4.4 \cdot b^3)^{\frac{1}{3}}$$

$$= 2 \log 5 + 5 \log t + \frac{1}{3} \log a - \frac{1}{3} \log 4 - \log 4t - 3 \log b \text{ Ans}$$

$$\text{vi) } \log \sqrt[5]{\frac{7^2 \cdot t^3 \cdot p}{d^6 \cdot b^2}}$$

$$= \log \left(\frac{7^2 \cdot t^3 \cdot p}{d^6 \cdot b^2} \right)^{\frac{1}{5}}$$

$$= \frac{1}{5} (\log 7^2 + \log t^3 + \log p - \log d^6 - \log b^2)$$

$$= \frac{1}{5} (2 \log 7 + 3 \log t + \log p - 6 \log d - 2 \log b) \text{ Ans}$$

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Q2 Use laws of logarithms to combine the following

i) $3\log x - 5\log y$

$$= \frac{3\log x}{5\log y} \quad \log x^3 - \log y^5$$

$$= \log \left(\frac{x^3}{y^5} \right) \text{ Ans}$$

ii) $\frac{1}{2} \log t + \frac{1}{3} \log r - \frac{1}{5} \log s$

$$= \log t^{\frac{1}{2}} + \log r^{\frac{1}{3}} - \log s^{\frac{1}{5}}$$

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$$= \log \left(\frac{t^{\frac{1}{2}} r^{\frac{1}{3}}}{s^{\frac{1}{5}}} \right) \text{ Ans}$$

$$\text{(iii)} \frac{1}{7} [\log 57.7 - 3 \log 9.24 + 4 \log 36.6 - 2 \log 23.3]$$

$$= \frac{1}{7} [\log 57.7 - \log 9.24^3 + \log 36.6^4 - \log 23.3^2]$$

$$= \left(\log \frac{57.7}{9.24^3} \times \log \frac{36.6^4}{23.3^2} \right)^{\frac{1}{7}}$$

$$= \left(\frac{\log(57.7) \times (36.6)^4}{(9.24)^3 \times (23.3)^2} \right)^{\frac{1}{7}}$$

$$\text{(iv)} \sqrt[7]{\frac{\log(57.7) \times (36.6)^4}{(9.24)^3 \times (23.3)^2}} \text{ Ans}$$

$$\text{(ii)} 5 \log 6 - 7 \log 9.42 + \frac{1}{3} \log t - \frac{1}{2} \log 32.2 + \frac{2}{3} \log a$$

$$= \log 6^5 - \log 9.42^7 + \log t^{\frac{1}{3}} - \log 32.2^{\frac{1}{2}} + \log a^{\frac{2}{3}}$$

$$\frac{\log 6^5}{9.42^7} \times \frac{\log t^{\frac{1}{3}}}{32.2^{\frac{1}{2}}} \times \log a^{\frac{2}{3}}$$

$$\frac{\log(6)^5 \times (t)^{\frac{1}{3}} \times (a)^{\frac{2}{3}}}{(9.42)^7 \times (32.2)^{\frac{1}{2}}} \text{ Ans}$$

$$v) \frac{5}{4} \log 37.74 - \frac{1}{4} \log 53.71 + \frac{1}{4} \log 28.83$$

$$= \log 37.74^{\frac{5}{4}} - \log 53.71^{\frac{1}{4}} + \log 28.83^{\frac{1}{4}}$$

$$\frac{\log (37.74)^{\frac{5}{4}} \times \log (28.83)^{\frac{1}{4}}}{(53.71)^{\frac{1}{4}}}$$

$$\frac{\log (37.74)^{\frac{5}{4}} \times \log (28.83)^{\frac{1}{4}}}{(53.71)^{\frac{1}{4}}} \text{ Ans.}$$

Q3 Use laws of logarithms to evaluate the following?

i) $\log_2 15$

$$= \frac{\log 15}{\log 2}$$

$$= \frac{\log 3 \times 5}{\log 2}$$

$$= \log 3 + \log 5 - \log 2$$

$$= 0.4771 + 0.6989 - 0.3010$$

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 = 0.875 Ans.

ii) $\log_9 \sqrt[3]{9}$

$$= \frac{\log \sqrt[3]{9}}{\log 9}$$

$$= \frac{\log (9)^{\frac{1}{3}}}{\log 9}$$

$$= \frac{1}{3} \frac{\log 9}{\log 9}$$

$$= \frac{1}{3} \text{ Ans.}$$

iii) $\log_3 65$

$= \frac{\log 65}{\log 3}$

$= \frac{\log 5 \times 13}{\log 3}$

$= \log 5 + \log 13 - \log 3$

$= 0.6989 + 1.1139 - 0.4771$

$= 1.3357 \text{ Ans.}$

v) $\log_{\sqrt{7}} 343$

$= \frac{\log 343}{\log \sqrt{7}}$

$= \frac{\log 343}{\log (7)^{\frac{1}{2}}}$

$= \log 343 - \frac{1}{2} \log 7$

$= 2.5353 - \frac{1}{2} (0.8456)$

$= 2.1128 \text{ Ans}$

iv) $\log_{\sqrt{3}} 72.34$

$= \frac{\log 72.34}{\log \sqrt{3}}$

$= \frac{\log 72.34}{\log (3)^{\frac{1}{2}}}$

$= \log 72.34 - \frac{1}{2} \log 3$

$= 1.8593 - \frac{1}{2} (0.4771)$

$= 1.62075 \text{ Ans.}$

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Q4 $\log_b 2 = 0.3010, \log_b 3 = 0.4771, \log_b 5 = 0.6990$

i) $\log_b \frac{6}{5}$

$= \log_b \frac{2 \times 3}{5}$

$= \log_b 2 + \log_b 3 - \log_b 5$

$= 0.3010 + 0.4771 - 0.6990 = 1.0458 \text{ Ans}$

$= 0.0791 \text{ Ans}$

ii) $\log_b \frac{100}{9}$

$\log_b \frac{2^2 \times 5^2}{3^2}$

$2 \log_b 2 + 2 \log_b 5 - 2 \log_b 3$

$2(0.3010) + 2(0.6990) - 2(0.4771)$

iii)

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$$\log_b \frac{\sqrt[3]{450}}{\sqrt{27}}$$

$$\log_b \frac{(2 \times 5^2 \times 3^2)^{\frac{1}{3}}}{(3^3)^{\frac{1}{2}}}$$

$$= (\log_b 2 + \log_b 5^2 + \log_b 3^2)^{\frac{1}{3}} - \frac{1}{2} \log_b (3^3)$$

$$= \frac{1}{3} (\log_b 2 + 2 \log_b 5 + 2 \log_b 3) - \frac{1}{2} (3 \log_b 3)$$

$$= \frac{1}{3} (0.3010 + 2(0.6990) + 2(0.4771)) - \frac{1}{2} [3(0.4771)]$$

$$= \frac{1}{3} (0.3010 + 1.398 + 0.9542) - \frac{1}{2} [1.4313]$$

$$= \frac{1}{3} (2.6532) - \frac{1}{2} (1.4313)$$

$$= 0.8844 - 0.7156$$

$$= 0.1688 \text{ Ans.}$$

$$\text{iv) } \log_b 0.024$$

$$= \log_b \frac{24}{100}$$

$$= \log_b \frac{2^3 \times 3}{2^2 \times 5^2}$$

$$= \log_b 2^3 + \log_b 3 - \log_b 2^2 - \log_b 5^2$$

$$= 3 \log_b 2 + \log_b 3 - 2 \log_b 2 - 2 \log_b 5$$

$$= 3(0.3010) + (0.4771) - 2(0.3010) - 2(0.6990)$$

$$= 0.903 + 0.4771 - 0.602 - 1.398$$

$$= 1.3801 - 3$$

$$= -1.6199$$

$$v) \log_b \sqrt[7]{5^{\frac{2}{5}}}$$

$$= \log_b \sqrt[7]{\frac{27}{5}}$$

$$= \log_b \left(\frac{27}{5}\right)^{\frac{1}{7}}$$

$$= \frac{1}{7} (\log_b 3^3 - \log_b 5)$$

$$= \frac{1}{7} (3 \log_b 3 - \log_b 5)$$

$$= \frac{1}{7} (3(0.4771) - (0.6990))$$

$$= \frac{1}{7} (1.4313 - 0.6990)$$

$$= \frac{1}{7} (0.7323)$$

$$= \cancel{0.1046} \text{ Ans.}$$