Samples **Logarithms SOLUTIONS**

1. (**1**) $\log_{15} 15^{20} = 20$

(**2**) $1 = 2^0$, so $\log_2 1 = 0$

(**3**) $\dfrac{1}{125} = 5^{-3}$, so $\log_5 \dfrac{1}{125} = \log_5 5^{-3} = -3$. Hence the answer is -3.

(**4**) $10000 = 10^4$, so $\log_{10} 10000 = 4$

(**5**) $\dfrac{1}{10} = 10^{-1}$, so $\log_{10} \dfrac{1}{10} = -1$

(**6**) $\ln e^{-19} = -19$

(**7**) $\dfrac{1}{e^{19}} = e^{-19}$, so $\ln \dfrac{1}{e^{19}} = \ln e^{-19} = -19$. Hence the answer is -19.

(**8**) $4 = 16^{\frac{1}{2}}$, so $\log_{16} 4 = \dfrac{1}{2}$

2. (**1**) $\log_{17} 17^{10} = 10$

(**2**) $3 = 3^1$, so $\log_3 3 = 1$

(**3**) $\dfrac{1}{2} = 2^{-1}$, so $\log_2 \dfrac{1}{2} = \log_2 2^{-1} = -1$. Hence the answer is -1.

(**4**) $1 = 10^0$, so $\log_{10} 1 = 0$

(**5**) $\dfrac{1}{10} = 10^{-1}$, so $\log_{10} \dfrac{1}{10} = -1$

(**6**) $\ln e^{-14} = -14$

(**7**) $\dfrac{1}{e^{13}} = e^{-13}$, so $\ln \dfrac{1}{e^{13}} = \ln e^{-13} = -13$. Hence the answer is -13.

(**8**) $2 = 8^{\frac{1}{3}}$, so $\log_8 2 = \dfrac{1}{3}$

3. (**1**) $\log_{19} 19^{16} = 16$

(**2**) $5 = 5^1$, so $\log_5 5 = 1$

(**3**) $\dfrac{1}{4} = 4^{-1}$, so $\log_4 \dfrac{1}{4} = \log_4 4^{-1} = -1$. Hence the answer is -1.

(**4**) $100 = 10^2$, so $\log_{10} 100 = 2$

(**5**) $\dfrac{1}{1000} = 10^{-3}$, so $\log_{10} \dfrac{1}{1000} = -3$

(**6**) $e = e^1$, so $\ln e = 1$

(**7**) $\dfrac{1}{e} = e^{-1}$, so $\quad \ln \dfrac{1}{e} = \ln e^{-1} = -1$. Hence the answer is -1.

(**8**) $5 = 125^{\frac{1}{3}}$, so $\quad \log_{125} 5 = \dfrac{1}{3}$