

1.2.4

$$\begin{aligned} \text{a) } & \log(16) + 2 \log(3) - 2 \log(2) - \frac{1}{2} \log(9) \\ & = \log(2^4) + 2 \log(3) - 2 \log(2) - \frac{1}{2} \log(3^2) \\ & = 4 \log(2) - 2 \log(2) + 2 \log(3) - \log(3) \\ & = 2 \log(2) + \log(3) \end{aligned}$$

$$\begin{aligned} \text{b) } & \log(15) + 3 \log(10) - \log(30) - \log(5) \\ & = \underbrace{\log(3) + \log(5)} + \underbrace{3 \log(2) + 3 \log(5)} \\ & \quad - \underbrace{\log(2) - \log(3) - \log(5) - \log(5)}_{-\log(30)} \\ & = 2 \log(2) + 2 \log(5) = 2(\log(2) + \log(5)) \\ & = 2 \underbrace{\log(10)}_{=1} = 2 \end{aligned}$$

$$c) 4 \log(5) - \log(5) - 3 \log(3) + \log(3)$$

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

$$d) \frac{\log(4.5) + 2 - \log(2)}{\log(5 \cdot 1000) - \log(5) + \log(10^{-1})}$$

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

$$= \frac{2 + \log(5) + \log(2)}{2} = \frac{2 + \log(10)}{2}$$

$$= \frac{2+1}{2} = \frac{3}{2}$$