

$$\log_{mn} m^n = \log_{mn} mn + \log_{mn} m = b, \quad \log_m m^n = 1 + \log_m n$$

$$\log_{mn} m = \frac{1}{a+1} \rightarrow b = \left[1 + \frac{a}{a+1} \right] = \boxed{1}$$

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الف) $x > 0$ ① و $\log_{\frac{1}{x}} \frac{x}{1} \neq 0 \rightarrow x \neq 1$ و $\frac{x}{\log_{\frac{1}{x}} \frac{x}{1}} > 0$

$$\frac{0}{-1} + \frac{1}{1} \rightarrow \boxed{x \in (0, 1)}$$

ب) $x^2 - x - 2 > 0 \rightarrow (x-2)(x+1) > 0 \rightarrow \frac{-1}{2} < x < 2 \rightarrow x \in \mathbb{R} - [-1, 2]$ ①

$$x^2 - 1 \geq 0 \rightarrow x^2 \geq 1 \rightarrow x \in \mathbb{R} - (-1, 1)$$
 ②
$$\hookrightarrow \boxed{\text{①} \cap \text{②} = x \in \mathbb{R} - [-1, 2]}$$

$$2 \log_a x = \frac{1}{\log_a \sqrt{x}} \rightarrow \log_a \sqrt{x} = \frac{1}{2} \rightarrow t + \frac{1}{t} = 2$$

$$\frac{t^2 - 2t + 1}{t} = 0 \rightarrow t = 1 \rightarrow \log_a \sqrt{1} = 1 \rightarrow \boxed{a = 3}$$

$$\log 10 - \log 2 = \log^a \rightarrow \log^a = 0.17 \rightarrow \log^{\frac{a}{3}} = 0.17$$

$$\log^9 = 0.17 \text{ و } \log^{15} = 1.1 \rightarrow 0.17x^3 + 0.17x - 1.1 = 0$$

$$3x^3 + 17x - 11 = 0 \rightarrow x^3 + 17x - 33 = 0 \rightarrow (x+11)(x-3) = 0$$

$$x = \left\{ \begin{array}{l} -11 \\ 3 \end{array} \right\} \rightarrow 1 \pm \frac{11}{3} = \boxed{\frac{14}{3}}$$

$$\log^2_a \times \log^3_a = \log^4_a \rightarrow \log^4_a = 1.4 \rightarrow \frac{\log^4_a}{\log^4_a} = \frac{1 + \log^4_a}{0.17 + \log^4_a}$$

$$\frac{1.4}{1.9} = \boxed{\frac{14}{19}}$$

$$\log_{mn} m^n = \log_{mn}^{mn} + \log_{mn} m = b, \quad \log_{\frac{m}{a}}^m = 1 + \log_{\frac{m}{a}}^{\frac{m}{a}}$$

$$\log_{mn}^m = \frac{a}{a+1} \rightarrow b = \left[1 + \frac{a}{a+1} \right] = \boxed{1}$$

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الف) $x > 0$ ① و $\log_{\frac{1}{x}} \frac{x}{\log \frac{1}{x}} \neq 0 \rightarrow x \neq 1$ و $\frac{x}{\log \frac{1}{x}} > 0$

$$\frac{0}{-} + \frac{1}{+} = - \rightarrow \boxed{x \in (0, 1)}$$

ب) $x^2 - x - 2 > 0 \rightarrow (x-2)(x+1) > 0 \rightarrow \frac{-1}{-} \frac{2}{+} = + \rightarrow x \in \mathbb{R} - [-1, 2]$ ①

$$x^2 - 1 \geq 0 \rightarrow x^2 \geq 1 \rightarrow x \in \mathbb{R} - (-1, 1)$$
 ②
$$\hookrightarrow \boxed{\text{①} \cap \text{②} = x \in \mathbb{R} - [-1, 2]}$$

$$2 \log_a x = \frac{1}{\log_{\sqrt{x}} a} \rightarrow \log_{\sqrt{x}} a = 2 \rightarrow t + \frac{1}{t} = 2$$

$$\frac{t^2 - 2t + 1}{t} = 0 \rightarrow t = 1 \rightarrow \log_{\sqrt{a}} a = 1 \rightarrow \boxed{a = 3}$$

$$\log^1 10 - \log^2 7 = \log^3 5 \rightarrow \log^3 5 = 0.17 \rightarrow \log^{\frac{5}{3}} 5 = 0.17$$

$$\log^2 9 = 0.18 \text{ و } \log^1 15 = 1.1 \rightarrow 0.17 x^2 + 0.18 x - 1.1 = 0$$

$$17x^2 + 18x - 11 = 0 \rightarrow x^2 + 18x - 33 = 0 \rightarrow (x+11)(x-3) = 0$$

$$x = \frac{-18 \pm \sqrt{18^2 + 4 \cdot 11 \cdot 3}}{2} = \frac{-18 \pm 22}{2} = \boxed{\frac{14}{2} = 7}$$

$$\log^2 5 \times \log^3 7 = \log^4 5 \rightarrow \log^4 5 = 1.4 \rightarrow \frac{\log^1 5}{\log^1 5} = \frac{1 + \log^4 5}{0.5 + \frac{\log^4 5}{1.4}}$$

$$\frac{1.5}{1.9} = \boxed{\frac{15}{19}}$$