

$$a = \alpha + \beta = 1 + 3 = 4 \checkmark, \quad b = \alpha\beta = 3 \times 1 = 3 \checkmark$$

$$a + b = 4 + 3 = \boxed{7} \checkmark$$

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$$n - 3n = 0 \rightarrow -1 - 3n = 0 \rightarrow 3n = -1 \rightarrow n = -\frac{1}{3} \checkmark$$

$$t = (k-2)n + m - 1 \begin{cases} n < \varepsilon \rightarrow t > 0 \\ n > \varepsilon \rightarrow t < 0 \end{cases} \rightarrow k-2 < 0 \rightarrow k < 2 \xrightarrow{k \in \mathbb{N}} \underline{k=1} \checkmark$$

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$$\rightarrow t = -n + m - 1 \rightarrow -1 + m - 1 = 0 \rightarrow \underline{m=2} \checkmark$$

$$\rightarrow \frac{m}{n} + k = \frac{2}{-\frac{1}{3}} + 1 = -1 \cdot 2 + 1 = \boxed{-1} \checkmark$$

$$\begin{aligned} -\frac{1}{3}n^2 + 2n + 4 &> \frac{1}{3} \\ \rightarrow -n^2 + 6n + 12 &> 1 \\ \rightarrow 0 &> n^2 - 6n - 11 \end{aligned}$$

$$\rightarrow \frac{-1 \pm \sqrt{1+48}}{+1 \mp 2} \rightarrow \begin{matrix} \text{بازای این} \\ \text{بازای آن} \end{matrix}$$

$$(-1, 2) = (a, b)$$

$$\rightarrow \underline{a=-1} \checkmark, \underline{b=2} \checkmark \rightarrow b-a = 2 - (-1)$$

$$= \boxed{3} \checkmark$$

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$$f(n) = n^2 - 3n^2 - n + 3 = n^2(n-3) - (n-3) = (n^2-1)(n-3) = (n-1)(n+1)(n-3)$$

$$(n-1)(n+1)(n-3) < 0 \rightarrow \frac{1 \cdot 3}{+1 \mp 1} \rightarrow (a, b) = (1, 3) \begin{cases} a=1 \checkmark \\ b=3 \checkmark \end{cases}$$

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$$\xrightarrow{n > 3} \text{بزرگترین} \rightarrow n = \frac{a+b}{2} = \frac{3+1}{2} = 2 \rightarrow f(2) = (2-1)(2-3) = 1 \times (-1) = \boxed{-1} \checkmark$$

$$\textcircled{1} a-1 < 0 \rightarrow \underline{a < 1}$$

$$\textcircled{2} \Delta < 0 \rightarrow (a-1)^2 - 4(a-1) \xrightarrow{t=a-1} t^2 - 4t < 0 \rightarrow 0 < t < 4 \rightarrow 0 < a-1 < 4$$

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$$\xrightarrow{+1} \underline{1 < a < 5}$$

$$\textcircled{1} \cap \textcircled{2} = (-\infty, 1) \cap (1, 5) = \boxed{\emptyset} \checkmark$$

$$\frac{m(m^r+m)}{m-r} = \frac{m^r(m+1)}{m-r} > 0 \rightarrow \frac{0 \quad r}{-r \quad - \quad +}$$

$$\boxed{x = (r, +\infty)} \quad \checkmark \quad \left(\begin{array}{c} \infty \\ \vdots \\ r \end{array} \right)$$

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$$\frac{(x^r-x-r)(x-1)^r}{(x^r+x+1)(r-x)^r} = \frac{(x-r)(x+r)(x-1)^r}{(x^r+x+1)(r-x)^r} \leq 0 \rightarrow \frac{-r \quad 1 \quad r \quad r}{+ \quad + \quad - \quad -}$$

$$\rightarrow \boxed{x = [-r, r) \cup [r, +\infty)} \quad \checkmark \quad \left(\begin{array}{c} \infty \\ \vdots \\ -r \end{array} \right)$$

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$$\frac{rx^r-rx}{x^r+r} < r \rightarrow \frac{rx^r-rx}{x^r+r} - r < 0 \rightarrow \frac{x^r-rx-r}{x^r+r} < 0$$

$$\frac{(x-r)(x+r)}{x^r+r} < 0 \rightarrow \frac{-r \quad r}{+ \quad +} \rightarrow x = (a, b) = (-r, r) \quad \left\{ \begin{array}{l} a = -r \\ b = r \end{array} \right.$$

$$\rightarrow b-a = r - (-r) = 2r \quad \checkmark \quad \left(\begin{array}{c} r \\ \vdots \\ -r \end{array} \right)$$

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$$\textcircled{1} \frac{rx^r-rx}{x+1} < 0 \rightarrow \frac{x(r-x)}{x+1} = \frac{x(x-r)}{x+1} < 0 \rightarrow \frac{-1 \quad 0 \quad r}{- \quad + \quad -}$$

$$\rightarrow \underline{x = (-\infty, -1) \cup (0, \frac{r}{r})}$$

$$\textcircled{2} \frac{rx^r-rx}{x+1} > -1 \rightarrow \frac{rx^r-rx}{x+1} + 1 = \frac{rx^r-rx+x+1}{x+1} > 0 \rightarrow \frac{-1}{- \quad +}$$

$$\rightarrow \underline{x = (-1, +\infty)} \quad \rightarrow \boxed{x = \textcircled{1} \cap \textcircled{2} = (0, \frac{r}{r})} \quad \checkmark \quad \left(\begin{array}{c} \infty \\ \vdots \\ 0 \end{array} \right)$$

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$$\frac{x^r-1}{x} \leq r \rightarrow \frac{x^r-1}{x} - r \leq 0 \rightarrow \frac{x^r-rx-1}{x} \leq 0$$

$$\rightarrow \frac{(x-d)(x+r)}{x} \leq 0 \rightarrow \frac{-r \quad 0 \quad d}{- \quad + \quad -} \rightarrow \boxed{x = [-\infty, -r] \cup (0, d]} \quad \checkmark \quad \left(\begin{array}{c} \infty \\ \vdots \\ -r \end{array} \right)$$

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