

شماره کلاس: 5

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$$الف) f(n) = \sqrt{\frac{n-1}{n} - \frac{n}{n-1}} \geq 0 \rightarrow \frac{n-1}{n} - \frac{n}{n-1} \geq 0$$

$$\frac{(n-1)^2 - n^2}{n(n-1)} \geq 0 \rightarrow \frac{(n-1-n)(n-1+n)}{n(n-1)} \geq 0 \rightarrow \frac{-1(2n-1)}{n(n-1)} \geq 0$$

$$\frac{0}{+} \frac{+}{-} \frac{1}{+} \frac{-}{-} \rightarrow D_f = (-\infty, 0) \cup \left[\frac{1}{2}, +\infty\right)$$

$$ب) f(n) = \frac{1}{n+1} - \frac{2}{n} \rightarrow n \neq 0, n \neq -1 \quad I$$

$$\frac{2}{n-1} + \frac{1}{n+2} \rightarrow \frac{2}{n-1} + \frac{1}{n+2} \neq 0$$

$$II \quad \frac{2n+4}{(n-1)(n+2)} \neq 0 \xrightarrow{II, I} D_f = \mathbb{R} - \left\{-\frac{5}{2}, -1, 0, 2\right\}$$

$$ان) f(n) = \sqrt{\left(\left(\frac{1}{2}\right)^n - 9\right)(32 - 4^n)} \geq 0 \rightarrow \left(\frac{1}{2}\right)^n = 9$$

$$\boxed{n = -2}$$

$$\begin{aligned} 32 &= 4^n \\ 4^{\frac{5}{2}} &= 2^{5n} \\ \boxed{n = \frac{5}{2}} \end{aligned}$$

$$\frac{-x}{+} \frac{2,5}{-} \frac{+}{+} \rightarrow D_f = (-\infty, -2] \cup [2, 5) + \infty$$

$$ب) \sqrt[n]{n-1} + \sqrt[n]{n+1} = 3 \rightarrow \sqrt[n]{n+1} = 3 - \sqrt[n]{n-1}$$

$$\rightarrow 3 - \sqrt[n]{n+1} \geq 0 \rightarrow 3 \geq \sqrt[n]{n+1} \rightarrow |1| \geq n-1 \rightarrow n \leq 12$$

$$\sqrt[n]{n-1} \rightarrow n-1 \geq 0 \rightarrow n \geq 1 \rightarrow D_f = [1, 12]$$

$$f(n) = \log(n^2 - n - 2) \rightarrow n^2 - n - 2 > 0 \rightarrow (n-2)(n+1) > 0 \quad I$$

$$\sqrt{n^2-1} + 1 \rightarrow \sqrt{n^2-1} \neq -1, \sqrt{n^2-1} \rightarrow n^2-1 \geq 0 \quad II$$

$$I \cap II \rightarrow D_f = (-\infty, -1) \cup (2, +\infty)$$

$$f(x) = \sqrt{-x^r + ax + r}$$

$$\frac{-r}{-r+1} = \frac{b}{-r+1}$$

(r)

$$\begin{aligned} x=-r &\rightarrow -r - r(-r) + r = 0 \\ -ra &= 1 \rightarrow a = -\frac{1}{r} \end{aligned}$$

$$\Rightarrow f(x) = \sqrt{-x^r - \frac{1}{r}x + r} \rightarrow -x^r - \frac{1}{r}x + r \geq 0$$

$$a+b = -\frac{1}{r} + \frac{1}{r} = 0$$

(r)

$$-rx^r - x + r \geq 0$$

$$x^r - x - 1 \geq 0$$

$$(x-r)(x+r) \geq 0 \rightarrow x = \frac{r}{-r} = -1$$

$$x = \frac{-r}{-r} = 1, a = b$$

$$f(x) = \begin{cases} rx-r & x \geq 1 \\ rx+r & x < 1 \end{cases}$$

$$\rightarrow g(x) = \sqrt{\begin{cases} rx-r-x & x \geq 1 \\ rx+r-x & x < 1 \end{cases}}$$

(c)

$$rx-r \geq 0 \rightarrow x \geq 1$$

$$rx+r \geq 0 \rightarrow x \geq -r$$

$$\rightarrow [-r, +\infty) = D_f$$

(r)

$$f(x) = rx^r - rx$$

(y)

$$f\left(\sin\frac{\pi}{r} + \cos\frac{\pi}{r}\right) = f\left(\frac{\sqrt{r}}{r} + 1\right) \rightarrow r\left(\frac{\sqrt{r}}{r} + 1\right)^r - r\left(\frac{\sqrt{r}}{r} + 1\right)$$

$$\rightarrow r\left(\frac{r}{r} + 1 + \sqrt{r}\right) - \frac{r\sqrt{r}}{r} - r = \frac{r}{r} + r + r\sqrt{r} - r\sqrt{r} - r = \frac{1}{r}$$

$$f(x) = \frac{x+1}{x-1}$$

$$\rightarrow f(f(x)) = x \rightarrow f(x) = \frac{x+1}{x-1}$$

(v)

$$\rightarrow \frac{\frac{ra}{a-1}}{\frac{r}{a+1}} = a$$

$$\rightarrow \frac{ra(a+1)}{r(a-1)} = a$$

$$\rightarrow f(f(x)) = x \rightarrow \frac{\frac{x+1}{x-1} + 1}{\frac{x+1}{x-1} - 1} = x$$

$$\rightarrow a = 1, R = \frac{1}{2}$$

$$\frac{a+1}{a-1} - 1$$

$$g(x) = \sqrt{x^r - 1}, f(x) = x^r - rx$$

(1)

$$f(g(x)) = -r \rightarrow f(\sqrt{x^r - 1}) = -r \rightarrow \frac{x^r - 1}{r} - r\sqrt{x^r - 1} + r = 0$$

$$x^r - r + r = 0$$

$$\rightarrow (x-r)^r = 0 \rightarrow x = r \rightarrow \sqrt{x^r - 1} = r \rightarrow x^r - 1 = r^2$$

$$x = \pm\sqrt[r]{r^2 + 1}$$

$$f(n+4) = n^2 - 2n + 4$$

$$f(1) \times f(-4) = (1 - 2 + 4) ((-4)^2 - 2(-4) + 4) = 1 \times 24 = 24 \quad (9)$$

$$f(r \cos \alpha + \omega \cos \alpha) = \tan^2 \alpha \quad (10)$$

$$r \cos \alpha + \omega \cos \alpha = r, \omega \rightarrow (r \cos \alpha + \omega \cos \alpha - \frac{r}{r} = 0) \times r$$

$$r \cos \alpha + \omega \cos \alpha - r = 0$$

$$\cos \alpha + \omega \cos \alpha - 1 = 0$$

$$(\cos \alpha - 1)(\cos \alpha + 1) = 0$$

$$\tan^2\left(\frac{\pi}{4}\right) = (\sqrt{r})^2 = r \quad \checkmark \quad \leftarrow n = \frac{r}{r} \quad \leftarrow \cos \alpha = \frac{r}{r} = 1 \rightarrow \text{OK}$$

$$\cos \alpha = \frac{-12}{12} = -1$$

$$-1 \leq \cos \alpha \leq 1 \quad \text{OK}$$