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۲. انتگرال های نوشتاری

مسئله

$$\text{a)} f(x) = \sqrt{\frac{x-1}{x}} - \frac{x}{x-1} \geq 0 \quad \frac{(x-1)^2 - x^2}{x(x-1)} = \frac{x^2 - 2x + 1 - x^2}{x^2 - x}$$

$$= \frac{-2x+1}{x(x-1)} \quad \begin{array}{c} x \\ 0 \end{array} \quad \begin{array}{c} 1 \\ 0 \end{array} \quad \begin{array}{c} 1 \\ 0 \end{array} \quad \begin{array}{c} 1 \\ 0 \end{array} \quad D = (-\infty, 0) \cup \left[\frac{1}{2}, 1\right)$$

$$-2x+1=0 \quad x=\frac{1}{2}$$

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

$$1 - \frac{x}{x+1} = \frac{1}{x+1}$$

$$\frac{x}{x+1} + \frac{1}{x+1} \neq 0 \Rightarrow \frac{x+1}{(x+1)(x+1)} \neq 0$$

$$x+1 \neq 0 \quad x \neq -1 \quad x+1 \neq 0 \quad x \neq -1$$

$$x-1 \neq 0 \quad x \neq 1 \quad x+1 \neq 0 \quad x \neq -1$$

$$D = \mathbb{R} - \left\{-1, -\frac{1}{2}, -1, 0, 1\right\}$$

$$\text{c)} f(x) = \left(\left(\frac{1}{x}\right)^x - 9\right)(x^x - 9) \quad \left(\left(\frac{1}{x}\right)^x - 9\right)(x^x - 9) \geq 0$$

$$\left(\frac{1}{x}\right)^x - 9 \geq 0 \quad \frac{1}{x} \geq 9^{1/x} \quad x < -2 \quad x > 2 \quad \begin{array}{c} x \\ 0 \end{array} \quad \begin{array}{c} 2 \\ 0 \end{array} \quad \begin{array}{c} 2 \\ 0 \end{array} \quad D = (-\infty, 2] \cup [2, \infty)$$

$$x^x - 9 \geq 0 \quad x^x \geq 9 \quad x^x \geq 9 \quad x \leq 2 \quad \begin{array}{c} x \\ 0 \end{array} \quad \begin{array}{c} 2 \\ 0 \end{array} \quad \begin{array}{c} 2 \\ 0 \end{array} \quad D = (-\infty, 2] \cup [2, \infty)$$

$$\text{d)} \sqrt{x-1} + \sqrt{x+1} = 2 \quad \sqrt{x-1} \geq 0 \quad x \geq 1$$

$$\sqrt{x+1} = 2 - \sqrt{x-1} \quad \begin{array}{c} x \\ 0 \end{array} \quad \begin{array}{c} 1 \\ 0 \end{array} \quad \begin{array}{c} 1 \\ 0 \end{array} \quad \begin{array}{c} 1 \\ 0 \end{array} \quad D = [1, 1]$$

$$y = \sqrt{x-1} - \sqrt{x+1} + 1 \pm 1 = (\sqrt{x-1} - 1)^2 - 1 \quad \sqrt{x-1} = 1 \quad x = 2$$

$$f(x) = \frac{\log(x^2 - x - 2)}{\sqrt{x^2 - 1} + 1}$$

$$x^2 - x - 2 > 0 \quad (x+1)(x-2) > 0 \quad \begin{array}{c} x \\ 0 \end{array} \quad \begin{array}{c} -1 \\ 0 \end{array} \quad \begin{array}{c} 2 \\ 0 \end{array} \quad \begin{array}{c} 2 \\ 0 \end{array} \quad D = (-\infty, -1) \cup (2, \infty)$$

$$x^2 - 1 > 0 \quad x > 1 \quad x > 1 \quad x < -1 \quad \sqrt{x^2 - 1} + 1 \neq \sqrt{x^2 - 1} + -1 \quad \begin{array}{c} x \\ 0 \end{array} \quad \begin{array}{c} 1 \\ 0 \end{array} \quad \begin{array}{c} 1 \\ 0 \end{array} \quad \begin{array}{c} 1 \\ 0 \end{array}$$

$$f(x) = \sqrt{\frac{x-a}{x-b}} \quad D = [-a, b]$$

$$x-a \geq 0 \quad -a \leq x \leq b \quad a = -\frac{1}{2} \quad \sqrt{-(x^2 + \frac{1}{2}x - \frac{1}{2})}$$

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$$f(x) = \begin{cases} x^2 - 2 & x > 1 \\ x^2 + 2 & x < 1 \end{cases} \quad \text{and} \quad g(x) = \sqrt{f(x) - x}$$

$$x > 1 \quad g(x) = \sqrt{x^2 - 2 - x} = \sqrt{x^2 - x - 2} \geq 0 \quad \begin{array}{c} x \\ 0 \end{array} \quad \begin{array}{c} 2 \\ 0 \end{array} \quad \begin{array}{c} 2 \\ 0 \end{array} \quad \begin{array}{c} 2 \\ 0 \end{array} \quad D = [1, +\infty)$$

$$x < 1 \quad g(x) = \sqrt{x^2 + 2 - x} = \sqrt{x^2 - x + 2} \geq 0 \quad \begin{array}{c} x \\ 0 \end{array} \quad \begin{array}{c} -1 \\ 0 \end{array} \quad \begin{array}{c} -1 \\ 0 \end{array} \quad \begin{array}{c} -1 \\ 0 \end{array} \quad D = (-\infty, 1)$$

$$D = [1, +\infty) \cup (-\infty, 1) = \mathbb{R}$$

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$$f(x) = x^p - \varepsilon x$$

$$f\left(\sin \frac{\pi}{p} + i \cos \frac{\pi}{p}\right)$$

(9)

$$\frac{\sqrt{p}}{\sin \frac{\pi}{p} + i \cos \frac{\pi}{p}} = \frac{\sqrt{p} + i}{i} \quad f\left(\frac{\sqrt{p} + i}{i}\right) = \left(\frac{\sqrt{p} + i}{i}\right)^p - f\left(\frac{\sqrt{p} + i}{i}\right)$$

$$= \left(\frac{p + i + \sqrt{p}i}{i}\right) - f\left(\frac{\sqrt{p} + i}{i}\right) = \frac{p + i + \sqrt{p}i}{i} + \frac{\sqrt{p} + i}{i} = -\frac{1}{i}$$

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

$$f\left(f\left(\frac{a+1}{a-1}\right)\right) = a$$

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

$$a \neq 1$$

$$f\left(f\left(\frac{a+1}{a-1}\right)\right) = \frac{a+1}{a-1} \times \frac{\frac{a+1}{a-1} + 1}{\frac{a+1}{a-1} - 1}$$

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

$$= \frac{a+1}{a-1} \times \frac{2a}{a-2}$$

$$= \frac{2a(a+1)}{(a-1)(a-2)}$$

$$f(x) = x^p - \varepsilon x$$

$$y(x) = \sqrt{x^p - 1}$$

$$f(y(a)) = -\varepsilon \quad a \neq 1$$

$$(\sqrt{a^p - 1})^p - \varepsilon(\sqrt{a^p - 1}) = -\varepsilon$$

$$\sqrt{a^p - 1}$$

$$a = \pm \sqrt{a}$$

$$|a^p - 1| - \varepsilon \sqrt{a^p - 1} = -\varepsilon$$

$$a^p - 1 - \varepsilon \sqrt{a^p - 1} = -\varepsilon \quad (a^p - 1)^2 = 0 \quad a = 1 \quad (\sqrt{a^p - 1})^p = (1)^p = 1 \quad 1 - \varepsilon = -\varepsilon$$

$$f(x+p) = x^p - \omega x + 4 \rightarrow f(x) \times f(-x)$$

$$x+p = \varepsilon \quad x=1 \quad (1)^p - \omega(1) + 4 = 1 - \omega + 4 = \varepsilon$$

$$x+p = -p \quad x=-4 \quad (-4)^p - \omega(-4) + 4 = p^4 + p\omega + 4 = \varepsilon$$

$$p \times p^p = 1 \quad p \neq 0$$

$$f(\sqrt{p} \cos \theta + i \sin \theta) = \tan^p \theta$$

$$f(p/a)$$

(10)

$$f \cos^p \theta + i \sin^p \theta = p/a$$

$$-\frac{p}{x} \times \varepsilon = -1 \varepsilon$$

$$(f \cos^p \theta + i \sin^p \theta - p/a) = 0$$

$$\cos^p \theta + i \sin^p \theta - 1 \varepsilon = 0$$

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

$$\cos \theta = \frac{1}{\varepsilon} = 1 \frac{1}{\varepsilon} \quad \checkmark$$

$$\cos \theta = -\frac{1}{\varepsilon} = -1 \frac{1}{\varepsilon} \quad \times$$

$$\cos \theta = \frac{1}{\varepsilon} \quad \theta = 40^\circ \quad \tan^p 40^\circ = (\sqrt{p})^p = 1 \quad \checkmark$$

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