

$f(x) = \sqrt{x^2 - 4x}$ $f\left(\sin \frac{\pi}{4} + \cos u\right)$ $\downarrow \text{Sing.}$ $\frac{\sqrt{3}}{2} + 1 \rightarrow \frac{\sqrt{3} + 1}{2}$ $f\left(\frac{\sqrt{3} + 1}{2}\right) = \sqrt{\left(\frac{\sqrt{3} + 1}{2}\right)^2 - 4\left(\frac{\sqrt{3} + 1}{2}\right)} = \sqrt{\frac{3 + 2\sqrt{3} + 1}{4} - 2(\sqrt{3} + 1)} = \sqrt{\frac{4 + 2\sqrt{3}}{4} - \frac{8 + 4\sqrt{3}}{4}} = \sqrt{\frac{-4 - 2\sqrt{3}}{4}} = \sqrt{\frac{-1 - \frac{\sqrt{3}}{2}}{1}} = \sqrt{-1 - \frac{\sqrt{3}}{2}}$	$f(x) = \sqrt{x^2 - 4x}$ $f\left(\frac{a+1}{a-1}\right) = a \rightarrow \frac{a+1}{a-1} + 1 = \frac{a+1}{a-1} + \frac{a-1}{a-1} = \frac{2a}{a-1}$ $f\left(\frac{2a}{a-1}\right) = a \rightarrow \frac{2a}{a-1} + 1 = \frac{2a}{a-1} + \frac{a-1}{a-1} = \frac{3a-1}{a-1}$ $\frac{3a-1}{a-1} = a \rightarrow 3a-1 = a(a-1) \rightarrow 3a-1 = a^2 - a \rightarrow a^2 - 4a + 1 = 0 \rightarrow a = \frac{4 \pm \sqrt{16-4}}{2} = \frac{4 \pm \sqrt{12}}{2} = 2 \pm \sqrt{3}$	$f(x) = \sqrt{x^2 - 4x}$ $g(x) = \sqrt{x^2 - 1}$ $f(g(x)) = \sqrt{x^2 - 4\sqrt{x^2 - 1}} = 0 \rightarrow x^2 - 4\sqrt{x^2 - 1} = 0 \rightarrow x^2 = 4\sqrt{x^2 - 1} \rightarrow x^4 = 16(x^2 - 1) \rightarrow x^4 - 16x^2 + 16 = 0$ $z = x^2 \rightarrow z^2 - 16z + 16 = 0 \rightarrow z = \frac{16 \pm \sqrt{256 - 64}}{2} = \frac{16 \pm \sqrt{192}}{2} = \frac{16 \pm 8\sqrt{3}}{2} = 8 \pm 4\sqrt{3}$ $x^2 = 8 \pm 4\sqrt{3} \rightarrow x = \pm \sqrt{8 \pm 4\sqrt{3}}$	$f(x+y) = \sqrt{x^2 - 4x + y}$ $f(-y) \times f(4) \rightarrow \sqrt{y^2 - 4(-y)} \times \sqrt{16 - 4 \times 4} = \sqrt{y^2 + 4y} \times 0 = 0$ $x+y = -y \rightarrow x = -2y$ $y^2 + y_0 + y = y^2$ $y = 0$	$f(\sqrt{\cos^2 x + 2 \cos x}) = \tan^2 x$ $\sqrt{\cos^2 x + 2 \cos x} = \tan x \rightarrow \cos^2 x + 2 \cos x = \tan^2 x \rightarrow \cos^2 x + 2 \cos x = \frac{\sin^2 x}{\cos^2 x} \rightarrow \cos^4 x + 2 \cos^3 x = \sin^2 x$ $\cos^4 x + 2 \cos^3 x = 1 - \cos^2 x \rightarrow \cos^4 x + 2 \cos^3 x + \cos^2 x = 1$ $\cos^2 x (\cos^2 x + 2 \cos x + 1) = 1 \rightarrow \cos^2 x (\cos x + 1)^2 = 1 \rightarrow \cos x (\cos x + 1) = \pm 1$ $\cos x = 1 \rightarrow x = 0$ $\cos x = -1 \rightarrow x = \pi$
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1	$f(x) = \sqrt{\frac{x-1}{x} - \frac{x}{x-1}} = \sqrt{\frac{x^2 - x + 1 - x^2}{x^2 - x}} = \sqrt{\frac{1-x}{x^2 - x}}$ $(-\infty, 0) \cup [1, +\infty) = D_f$ $\frac{1}{\frac{1}{x+1} - \frac{x}{x}} = \frac{x}{1-x}$ $\frac{1}{\frac{x}{x+1} + \frac{1}{x+2}} = \frac{x(x+2)}{x+3}$ $IR - \left\{ \frac{x^2 - x + 1 - x^2}{x^2 - x} \right\} = D_f$ $x=1 \rightarrow \frac{1}{x+1} + \frac{1}{x+2} = \frac{1}{x+3} \rightarrow x=1$
2	$f(x) = \sqrt{((x-1) - 9)(x^2 - 4x)}$ $x^2 - 4x = x(x-4) \rightarrow x=0 \text{ or } x=4$ $x-1 > 0 \rightarrow x > 1$ $x-1 < 0 \rightarrow x < 1$ $D_f = [1, 4]$
3	$f(x) = \frac{\log x}{\sqrt{x-1} + 1}$ $x-1 > 0 \rightarrow x > 1$ $D_f = (1, +\infty)$
4	$f(x) = \sqrt{x^2 + 2x - 3}$ $x^2 + 2x - 3 = 0 \rightarrow x = -3 \text{ or } x = 1$ $D_f = (-\infty, -3] \cup [1, +\infty)$
5	$f(x) = \begin{cases} x^2 - 2 & x > 1 \\ x^2 + 2 & x < 1 \end{cases}$ $g(x) = \sqrt{f(x)} - x$ $x > 1 \rightarrow \sqrt{x^2 - 2} - x = \sqrt{x^2 - 2} - x$ $x < 1 \rightarrow \sqrt{x^2 + 2} - x = \sqrt{x^2 + 2} - x$ $D_{fg(x)} = [-3, +\infty)$