

$y = \sqrt{x f(x)}$ $x f(x) \geq 0 \Rightarrow$
 $Df = [-\infty, 0] \cup [2, \infty]$

Sign chart for $x f(x)$:

x	$-\infty$	-4	-2	0	2	∞
$f(x)$	$+$	$+$	$+$	0	$+$	$+$
$x f(x)$	$+$	$+$	$+$	0	$+$	$+$

$y = \sqrt{\frac{-x}{f(x)}}$ $f(x) \neq 0$ و $f(x) < 0 \Rightarrow Df = (-\infty, -2) \cup (-1, 0) \cup (2, \infty)$

Sign chart for $\frac{-x}{f(x)}$:

x	$-\infty$	-4	-2	-1	0	1	2	∞
$f(x)$	$+$	$+$	$+$	$+$	0	$+$	$+$	$+$
$-x$	$+$	$+$	$+$	$+$	0	$-$	$-$	$-$
$\frac{-x}{f(x)}$	$+$	$+$	$+$	$+$	0	$-$	$-$	$-$

$f(x) - 2f(2) = x^2 - 3x + 2$ $\boxed{x=2} \Rightarrow f(2) - 2f(2) = 2 - 4 + 2 \Rightarrow \boxed{f(2) = -2}$
 $f(-2) = ?$
 $\boxed{x=-2} \Rightarrow f(-2) + 2 = 4 + 4 + 2 \Rightarrow \boxed{f(-2) = 10}$

$f(f(\omega)) + f(f(1)) = ?$
 $f(x) = \begin{cases} x - \sqrt{x+2} & x > 3 \\ 2x+3 & x \leq 3 \end{cases}$

Calculations:

- $f(\omega) \xrightarrow{1 \text{ sub } b} \omega - \sqrt{\omega+2} = 2$
- $f(2) \xrightarrow{2 \text{ sub } b} 2 \cdot 2 + 3 = 7$
- $f(1) \xrightarrow{2 \text{ sub } b} 2 + 3 = 5$
- $f(\omega) \xrightarrow{1 \text{ sub } b} \omega - \sqrt{\omega+2} = 2$

$f(f(\omega)) + f(f(1)) = 9$

$f(x) = ax^2 - bx + 2$
 $f(x-1) - f(x) = 4x + 2$

Expanding $f(x-1)$:

$$a(x-1)^2 - b(x-1) + 2 - (ax^2 - bx + 2) = 4x + 2$$

$$a(x^2 - 2x + 1) - bx + b + 2 - ax^2 + bx - 2 = 4x + 2$$

$$ax^2 - 2ax + a - bx + b + 2 - ax^2 + bx - 2 = 4x + 2$$

$$a - 2ax - bx + b = 4x + 2$$

Equating coefficients:

$$a - 2a - b = 4 \Rightarrow -a - b = 4$$

$$a + b = -4$$

$a - b = -8$

$f(x) = x^2 - 3x + 1$ $\frac{2f(3) + f(-1)}{f'(2)} = ?$ $\frac{2(1) + 0}{(-1)^2} = \boxed{1}$ $f(3) = 9 - 9 + 1 \Rightarrow f(3) = 1$ $f(-1) = 1 + 3 + 1 \Rightarrow f(-1) = 0$ $f'(2) = 4 - 3 \Rightarrow f'(2) = 1$	6
$f(x) = \begin{cases} 3x+1 & x \geq 2 \text{ ①} \\ x^2 & 2 > x \text{ ②} \end{cases}$ $\frac{3f(4) - 2f(-2)}{f(2)} = ?$ $\frac{f(4)}{f(-2)} \xrightarrow{\text{①} \rightarrow 13} 13$ $\frac{f(-2)}{f(2)} \xrightarrow{\text{②} \rightarrow 4} 4$ $\frac{3(13) - 2(4)}{4} = \boxed{\frac{31}{4}}$	7
$f = \{(2,4), (3,1), (4,1), (1,4)\}$ $\frac{f(f(4)) - f(f(3))}{f(1) - 2} = ?$ $\frac{f(1) - f(1)}{1 - 2} = \frac{0}{-1} = 0$	8
$f(x) = \frac{x^2 + 2x + 9}{x^2 + 2x + 1}$ $f(f(\sqrt{3}-2)) = ?$ $\frac{(x+2)^2 + 1}{(x+2)^2 + 1} = 1$ $f(\sqrt{3}-2) = \frac{(\sqrt{3}-2)^2 + 1}{(\sqrt{3}-2)^2 + 1} = \frac{1}{1} = 1$ $f(1) = \frac{1+2+9}{1+2+1} = \frac{12}{4} = 3$ $f(f(\sqrt{3}-2)) = f(1) = \boxed{3}$	9
$f(x) = x^2 + \frac{1}{x^2}$ $(f(\sqrt{x}))^2 - f(x) = ?$ $f(\sqrt{x}) = x + \frac{1}{x} \Rightarrow f(\sqrt{x})^2 = x^2 + \frac{1}{x^2} + 2$ $x^2 + \frac{1}{x^2} + 2 - x^2 - \frac{1}{x^2} = \boxed{2}$	10