

الف) $y = \frac{x+2}{x^3 - 20x^2 + 31x - 10}$

$x^3 - 20x^2 + 31x - 10 = 0 \Rightarrow x = 1$

$x^3 - 17x + 10 = (x-1)(x^2 - 16x + 10)$
 $x = \sqrt{10} \text{ و } \frac{1}{\sqrt{10}}$

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$x^3 - 20x^2 + 31x - 10 = (x-1)(x^2 - 16x + 10)$

ب) $y = \frac{x+3}{x^3 - x^2 - 11x - 12}$

$x^3 - 11x - 12 = 0 \Rightarrow x = -1$

$x^3 - x^2 - 11x - 12 = (x+1)(x^2 - 2x - 12)$

$x^3 - 2x - 12 = (x+2)(x^2 - 4x - 6) = 0 \Rightarrow x = 2 \text{ و } -\frac{1}{2}$

الف) $y = \frac{x+1}{x - \sqrt{3-2x}}$

$3-2x \geq 0 \Rightarrow 3 \geq 2x \Rightarrow 1.5 \geq x$

$x - \sqrt{3-2x} \neq 0 \Rightarrow x \neq \sqrt{3-2x} \Rightarrow x^2 \neq 3-2x$

$Df = (1, 1.5] \cup [1.5, -\infty)$

ب) $y = \frac{x+2}{x^2 - 2x - 3}$

$x^2 - 2x - 3 \geq 0 \Rightarrow x \geq 3 \text{ و } x \leq -1$

$Df = [\frac{1}{2}, 1) \cup (1, 3) \cup (3, +\infty)$

الف) $\frac{\sin x}{x \cos x - 1}$

$x \cos x - 1 \neq 0 \Rightarrow x \cos x \neq 1 \Rightarrow \cos x \neq \frac{1}{x}$

$Df = \mathbb{R} - \{k\pi + \frac{\pi}{2}, k\pi + \frac{3\pi}{2}\}$

ب) $\frac{\cos x + 1}{x \sin x + 1}$

$x \sin x + 1 \neq 0 \Rightarrow x \sin x \neq -1 \Rightarrow \sin x \neq -\frac{1}{x}$

$Df = \mathbb{R} - \{2k\pi + \frac{3\pi}{2}, 2k\pi + \frac{7\pi}{2}\}$

ج) $\frac{\tan x + 2}{\cot x - 1}$

$\cot x = \frac{\cos x}{\sin x} \Rightarrow \sin x \neq 0 \Rightarrow x \neq k\pi$

$Df = \mathbb{R} - \{k\pi + \frac{\pi}{2}, k\pi\}$

د) $\frac{\sin x + 1}{x \sin^2 x - 3}$

$x \sin^2 x - 3 \neq 0 \Rightarrow \sin x \neq \frac{\sqrt{3}}{x}$

الف) $x^2 - 5x + 4 > 0 \Rightarrow (x-4)(x-1) > 0 \Rightarrow x < 1 \text{ و } x > 4$

ب) $x^2 - 4x + 4 < 0 \Rightarrow (x-2)^2 < 0 \Rightarrow x = 2$

$Df = (-\infty, 1) \cup (4, +\infty)$

ج) $x^2 + 4x + 4 > 0 \Rightarrow (x+2)^2 > 0 \Rightarrow x \neq -2$

$Df = (-\infty, -2) \cup (-2, +\infty)$

د) $x^2 - 4x + 4 \leq 0 \Rightarrow (x-2)^2 \leq 0 \Rightarrow x = 2$

$Df = [1, 4]$

الف) $\frac{x^2 - 3x + 2}{x - 4} < 0 \Rightarrow (x-2)(x-1) > 0 \Rightarrow x < 1 \text{ و } x > 2$

$Df = (-\infty, 1) \cup (2, +\infty)$

ب) $\frac{x^2 - 1}{x^2 - 4x + 4} \geq 0$

$x^2 - 1 = 0 \Rightarrow x = 1 \text{ و } -1$

$(x-2)^2 > 0 \Rightarrow x \neq 2$

$Df = (-\infty, -1) \cup (-1, 1) \cup (1, 2) \cup (2, +\infty)$

$Df = (-\infty, -1] \cup [1, 2) \cup (2, +\infty)$

$$a) y = \sqrt{\frac{x^2 - 2x + 2}{x^2 - 1}}$$

$$Df = [2, +\infty)$$

$$x^2 - 1 \neq 0 \Rightarrow x \neq 1$$

$$\frac{x^2 - 2x + 2}{x^2 - 1} \geq 0 \quad (x-2)(x-1) \Rightarrow x=2$$

$$\frac{-}{+} \quad \frac{+}{-} \quad \frac{-}{+}$$

$$b) y = \sqrt[3]{\frac{x^2 - 2x + 2}{x^2 - 1}}$$

$$x^2 - 1 \neq 0 \quad x^2 \neq 1 \quad x \neq 1, -1$$

$$Df = \mathbb{R} - \{1, -1\}$$

$$a) y = \log(x^2 - 2x)$$

$$x^2 - 2x > 0 \Rightarrow x^2 > 2x \quad Df = (2, +\infty) \cup (0, -\infty)$$

$$b) y = \log |x-2|$$

$$|x-2| > 0 \Rightarrow |x| > 2 \Rightarrow x > 2 \text{ or } x < -2$$

$$Df = (-\infty, -2) \cup (2, +\infty)$$

$$c) y = \log \frac{x^2 - 2x + 2}{x^2 - 1}$$

$$10 - x \neq 1 \quad 10 - x > 0 \quad x \neq 9 \quad x < 10$$

$$Df = x > 2$$

$$(x-2)(x-1) \Rightarrow x=2 \text{ or } x=1$$

$$d) y = \sqrt{x^2 - 1} \ln(x+2) + \log x$$

$$x^2 - 1 \geq 0 \Rightarrow x \geq 1 \text{ or } x \leq -1 \quad \ln(x+2) > 0 \Rightarrow x > -2$$

$$Df = [1, 2) \cup (10, +\infty)$$

$$y = \frac{x^2 - x}{x^2 + x}$$

$$Df = (-\infty, -1) \cup (1, +\infty)$$

$$\frac{-}{+} \quad \frac{+}{-} \quad \frac{-}{+}$$

$$y = \sqrt{\frac{x - f(x)}{f(x)}}$$

$$f(x) \neq 0 \Rightarrow x \neq -2 \text{ or } 2$$

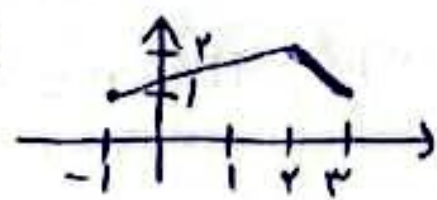
$$x - f(x) \geq 0 \Rightarrow x = f(x) \Rightarrow -1 \text{ or } 2$$

$$\frac{x - f(x)}{f(x)} \geq 0$$

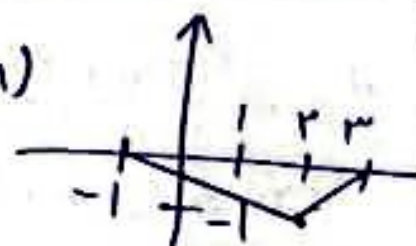
$$\frac{-}{+} \quad \frac{+}{-} \quad \frac{-}{+}$$

$$Df = (-\infty, -2) \cup [-1, 2) \cup [2, +\infty)$$

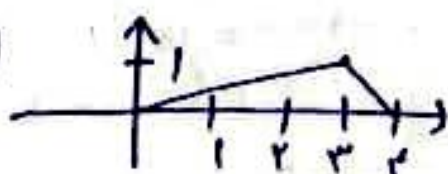
$$a) = f(x) + 1$$



$$c) -f(x)$$



$$b) f(x-1)$$



$$d) f(x+1) + 2$$

