

الف)  $y = \frac{x+3}{x^3 - 20x^2 + 31x - 15} \rightarrow (x-1)(2x-3)(2x-5) \neq 0 \Rightarrow x \neq 1, \frac{3}{2}, \frac{5}{2}$   
 $D_f = \mathbb{R} - \left\{1, \frac{3}{2}, \frac{5}{2}\right\}$

ب)  $y = \frac{x+3}{3x^3 - x^2 - 18x - 4} \rightarrow (x+1)(3x^2 - 4x - 4) \neq 0 \Rightarrow x \neq -1, 2, -\frac{2}{3}$   
 $D_f = \mathbb{R} - \left\{-1, 2, -\frac{2}{3}\right\}$

الف)  $y = \frac{x+1}{x - \sqrt{3-2x}} \rightarrow \begin{cases} 3-2x \geq 0 \Rightarrow 3 \geq 2x \Rightarrow \frac{3}{2} \geq x \\ x - \sqrt{3-2x} \neq 0 \Rightarrow x \neq \sqrt{3-2x} \Rightarrow x^2 \neq 3-2x \end{cases}$   
 $D_f = (-\infty, \frac{3}{2}] - \{1\}$

ب)  $y = \frac{x+2}{x - \sqrt{3x-2}} \rightarrow \begin{cases} x - \sqrt{3x-2} \neq 0 \Rightarrow x^2 - 3x + 2 \neq 0 \Rightarrow (x-1)(x-2) \neq 0 \Rightarrow x \neq 1, 2 \\ 3x-2 \geq 0 \Rightarrow 3x \geq 2 \Rightarrow x \geq \frac{2}{3} \end{cases}$   
 $D_f = [\frac{2}{3}, +\infty) - \{1, 2\}$

الف)  $y = \frac{\sin x}{2\cos x - 1} \rightarrow 2\cos x \neq 1 \Rightarrow \cos x \neq \frac{1}{2} \Rightarrow D_f = \mathbb{R} - \left\{2k\pi + \frac{\pi}{3}, 2k\pi + \frac{5\pi}{3}\right\}$

ب)  $y = \frac{\cos x + 1}{2\sin x + 1} \rightarrow 2\sin x \neq -1 \Rightarrow \sin x \neq -\frac{1}{2} \Rightarrow D_f = \mathbb{R} - \left\{2k\pi + \frac{7\pi}{6}, 2k\pi + \frac{11\pi}{6}\right\}$

ج)  $y = \frac{\tan x + 2}{\cot x - 1} \rightarrow \tan x \neq \text{تعریف نشده}, \cot x \neq 1 \Rightarrow D_f = \mathbb{R} - \left\{\frac{k\pi}{2}, k\pi + \frac{\pi}{4}\right\}$

د)  $y = \frac{\sin x + 1}{k\sin x - 3} \rightarrow k\sin x \neq 3 \Rightarrow \sin x \neq \frac{3}{k} \Rightarrow \sin x \neq \pm \frac{\sqrt{3}}{2} \Rightarrow D_f = \mathbb{R} - \left\{k\pi \pm \frac{\pi}{3}\right\}$

الف)  $x^2 - 5x + 4 > 0 \rightarrow (x-2)(x-4) > 0$   
 ب)  $x^2 - 4x + 5 < 0 \rightarrow (x-1)(x-5) < 0$   
 ج)  $x^2 + 4x + 5 \geq 0 \rightarrow (x+1)(x+5) \geq 0$   
 د)  $x^2 - 7x + 9 \leq 0 \rightarrow (x-1)(x-9) \leq 0$

الف)  $\frac{(x^2 - 3x + 2)(x-1)(x-2)}{x-5} < 0$   
 $D_f = (-\infty, 2) \cup (3, 5)$

ب)  $\frac{(x^2 - 1)(x-1)(x+1)}{x^2 - 4x + 5} \geq 0$   
 $D_f = (-\infty, -1] \cup (5, +\infty)$

الف)  $y = \sqrt{\frac{x^3 - 4x + 3}{x^3 - 1}} \rightarrow (x-1)(x-3)$   $\frac{1}{-} \frac{3}{+}$   $D_f = [3, +\infty)$

ب)  $y = \sqrt[3]{\frac{x^3 - 4x + 3}{x^3 - 1}} \rightarrow x^3 \neq 1 \Rightarrow x \neq \pm 1$   $D_f = \mathbb{R} - \{\pm 1\}$

الف)  $y = \log(x^3 - 3x)$   $x^3 - 3x > 0 \Rightarrow x(x-3) > 0$   $\frac{0}{+} \frac{3}{-}$   $D_f = (-\infty, 0) \cup (3, +\infty)$

ب)  $y = \log \frac{14 - x^2}{|x| - 2}$   $14 - x^2 > 0 \Rightarrow 14 > x^2 \Rightarrow -4 < x < 4$   $|x| - 2 \neq 0 \Rightarrow x \neq \pm 2$   $|x| - 2 > 0 \Rightarrow |x| > 2 \Rightarrow x > 2 \text{ or } x < -2$   $D_f = (-4, -2) \cup (-2, 2) \cup (2, 4) \cup (4, 4)$

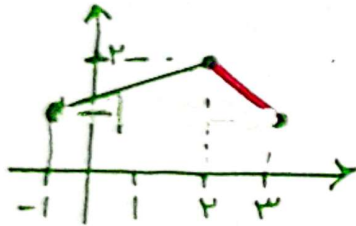
ج)  $y = \log \frac{(x^2 - 5x + 4)(x-4)(x-3)}{10-x}$   $\frac{4}{-} \frac{5}{+}$   $10 - x > 0 \Rightarrow 10 > x$   $10 - x \neq 1 \Rightarrow x \neq 9$   $D_f = (4, 10) - \{9\}$

د)  $y = \sqrt{x^2 - 11x + 28} + \log \sqrt{34 - x^2}$   $x^2 - 11x + 28 > 0 \Rightarrow (x-4)(x-7) > 0$   $\frac{4}{+} \frac{7}{-}$   $34 - x^2 > 0 \Rightarrow 34 > x^2 \Rightarrow -6 < x < 6$   $x > 0 \Rightarrow x \neq 1$   $D_f = (0, 4] - \{1\}$

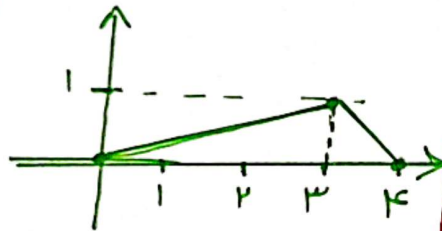
$y = \frac{x^2 - x}{x^2 + x}$   $\frac{x(x-1)}{x(x+1)}$   $\frac{0}{+} \frac{1}{-}$   $\frac{0}{+} \frac{-1}{-}$   $\frac{1}{+} \frac{0}{-}$   $\frac{2}{+}$

$y = \sqrt{\frac{x - f(x)}{f(x)}}$   $\frac{-1}{-} \frac{3}{+}$   $D_f = [-2, -1] \cup (2, 3]$

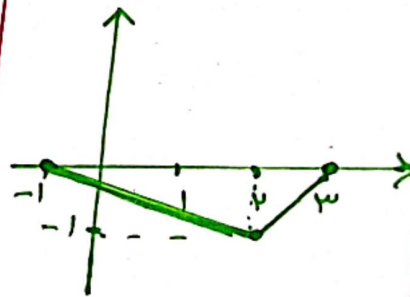
الف)  $f(x) + 1$



ب)  $f(x-1)$



ج)  $-f(x)$



د)  $f(x+1) + 2$

