

الف)  $y = \frac{x+5}{x^2 - 2x^2 + 3x - 15} \xrightarrow{\div x-1} \frac{x+5}{(x-1)(x-2)(x-5)} \rightarrow x \neq 1, \frac{5}{2}, \frac{5}{3} \rightarrow D_f = R - \left\{1, \frac{5}{2}, \frac{5}{3}\right\}$

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ب)  $y = \frac{x+3}{x^2 - x^2 - x - 5} \xrightarrow{\div x+1} \frac{x+3}{(x+1)(x-2)(x+5)} \rightarrow x \neq -1, 2, -5 \rightarrow D_f = R - \left\{-1, 2, -5\right\}$

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

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

الف)  $y = \frac{\sin x}{r \cos x - 1} \rightarrow r \cos x - 1 \neq 0 \rightarrow r \cos x \neq 1 \rightarrow \cos x \neq \frac{1}{r} \rightarrow D_f = R - \left\{x \mid \cos x = \frac{1}{r}\right\}$

1, 2

ب)  $y = \frac{\cos x + 1}{r \sin x + 1} \rightarrow r \sin x + 1 \neq 0 \rightarrow \sin x \neq -\frac{1}{r} \rightarrow D_f = R - \left\{x \mid \sin x = -\frac{1}{r}\right\}$

ج)  $y = \frac{\tan x + 2}{\cot x - 1} \rightarrow \begin{cases} \cot x \neq 1 \rightarrow x \neq k\pi + \frac{\pi}{4} \\ \sin x \neq 0 \rightarrow x \neq k\pi \end{cases} \rightarrow D_f = R - \left\{k\pi, k\pi + \frac{\pi}{4}\right\}$   
 $\cos x \neq 0$

د)  $y = \frac{\sin^2 x + 1}{\sin^2 x - 3} \rightarrow \sin^2 x - 3 \neq 0 \rightarrow \sin^2 x \neq 3 \rightarrow \sin^2 x \neq \frac{3}{r} \rightarrow \sin x \neq \pm \frac{\sqrt{3}}{r} \rightarrow D_f = R - \left\{x \mid \sin x = \pm \frac{\sqrt{3}}{r}\right\}$

الف)  $x^2 - 8x + 9 > 0 \rightarrow (x-2)(x-4) \rightarrow \frac{2}{x-2} > \frac{9}{x-4} \rightarrow (-\infty, 2) \cup (4, \infty)$

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ب)  $x^2 - 6x + 5 < 0 \rightarrow (x-1)(x-5) \rightarrow \frac{1}{x-1} < \frac{5}{x-5} \rightarrow (1, 5)$

ج)  $x^2 + 4x + 4 \geq 0 \rightarrow (x+2)(x+2) \rightarrow \frac{-4}{x+2} \geq \frac{-1}{x+2} \rightarrow (-\infty, -2] \cup [-2, \infty)$

د)  $x^2 - 7x + 6 \leq 0 \rightarrow (x-1)(x-6) \rightarrow \frac{1}{x-1} \leq \frac{6}{x-6} \rightarrow [1, 6]$

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

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ب)  $\frac{x^2 - 1}{x^2 - 6x + 5} > 0 \rightarrow \frac{(x-1)(x+1)}{(x-1)(x-5)} > 0 \rightarrow \frac{1}{x-1} > \frac{1}{x-5} \rightarrow (-\infty, -1] \cup (5, \infty), x \neq 1$

$$الف) y = \sqrt{\frac{x^2 - 5x + 3}{x^2 - 1}} \rightarrow \begin{cases} x^2 - 5x + 3 \geq 0 \rightarrow (x-1)(x-3) \rightarrow x \in (-\infty, 1] \cup [3, \infty) \\ x^2 - 1 > 0 \rightarrow x^2 > 1 \rightarrow x > 1 \end{cases} \rightarrow D_f = [3, \infty)$$

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$$ب) y = \sqrt{\frac{x^2 - 5x + 3}{x^2 - 1}} \rightarrow x^2 - 1 \neq 0 \rightarrow x \neq \pm 1 \rightarrow D_f = \mathbb{R} - \{-1, 1\}$$

$$ج) y = \log(x^2 - 3x) \rightarrow x^2 - 3x > 0 \rightarrow x(x-3) > 0 \rightarrow \begin{matrix} x & & 3 \\ + & - & + \end{matrix} \rightarrow D_f = (-\infty, 0) \cup (3, \infty)$$

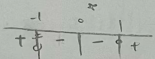
$$د) y = \log \frac{1-x}{1+x} \rightarrow \begin{cases} 1-x > 0 \rightarrow -1 < x < 1 \\ 1+x > 0 \rightarrow x > -1 \end{cases} \rightarrow D_f = (-1, 1)$$

$$هـ) y = \log \frac{x^2 - 3x + 1}{x^2 - 3x} \rightarrow \begin{cases} x^2 - 3x + 1 > 0 \rightarrow x < 1.5 \text{ or } x > 1.5 \\ x^2 - 3x > 0 \rightarrow x < 0 \text{ or } x > 3 \end{cases} \rightarrow D_f = (-\infty, 0) \cup (3, \infty)$$

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$$و) y = \sqrt{x^2 - 11x + 21} + \log x \rightarrow \begin{cases} x^2 - 11x + 21 \geq 0 \rightarrow (x-3)(x-7) \geq 0 \rightarrow x \leq 3 \text{ or } x \geq 7 \\ x > 0 \end{cases} \rightarrow D_f = (0, 3] \cup [7, \infty)$$

$$ز) y = \frac{x^2 - x}{x^2 + x} \rightarrow x(x-1) > 0 \rightarrow x < 0 \text{ or } x > 1 \rightarrow D_f = (-\infty, 0) \cup (1, \infty)$$



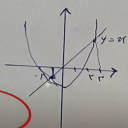
|           |    |   |   |   |
|-----------|----|---|---|---|
|           | -1 | 0 | 1 | 2 |
| $x^2 - x$ | +  | + | - | + |
| $x^2 + x$ | +  | + | - | + |
| $P(x)$    | +  | + | - | + |

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$$y = \frac{x - f(x)}{f(x)} \rightarrow x - f(x) = 0 \rightarrow x = f(x) \rightarrow x = -1, 3$$

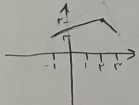
$$f(x) = 0 \rightarrow x = -3, 2$$

$$D_f = (-\infty, -3) \cup (-2, 2) \cup (3, \infty)$$

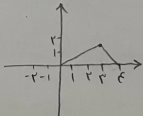


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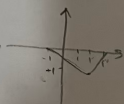
$$الف) f(x) + 1$$



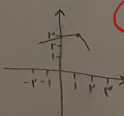
$$ب) f(x-1)$$



$$ج) -f(x)$$



$$د) f(x+1) + 2$$



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