

(الف) $\frac{x^2-4x}{x^3-x} \geq 0 \Rightarrow \frac{x(x-4)}{x(x^2-1)} \geq 0$

Sign chart: $\frac{-}{+} \frac{+}{+} \frac{+}{-} \frac{-}{+}$ at $x = -1, 0, 1, 4$

$D_f = (-\infty, -1) \cup (0, 1) \cup (4, +\infty)$

(ب) $\frac{x^5-x^3}{x^3-x} \geq 0 \Rightarrow \frac{x^3(x^2-1)}{x(x^2-1)} \geq 0$

Sign chart: $\frac{+}{+} \frac{+}{+} \frac{+}{+}$ at $x = -1, 0, 1$

$D_f = (-\infty, -1) \cup (0, 1) \cup (1, +\infty)$

(الف) $x+|x| > 0$

$x=0 \times$
 $x>0 \checkmark$
 $x<0 \times$

$D_f = (0, +\infty)$

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(ب) $x|x| > 0$

$x=0 \times$
 $x>0 \checkmark$
 $x<0 \times$

$D_f = (0, +\infty)$

(الف) $2-[x] \geq 0 \Rightarrow [x] \leq 2 \Rightarrow x < 3 \Rightarrow D_f = (-\infty, 3)$

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(ب) $2-[x] > 0 \Rightarrow [x] < 2 \Rightarrow x < 2 \Rightarrow D_f = (-\infty, 2)$

(الف) $[x - \frac{1}{3}] + [x + \frac{2}{3}] \geq 0$

$[x + \frac{2}{3} + 1] + [x + \frac{2}{3}] \geq 0$
 $2[x + \frac{2}{3}] - 1 \geq 0 \Rightarrow [x + \frac{2}{3}] \geq \frac{1}{2}$
 $x + \frac{2}{3} \geq 1 \Rightarrow x \geq \frac{1}{3}$

$D_f = [\frac{1}{3}, +\infty)$

(ب) $[x - \frac{1}{3}] + [-(x - \frac{1}{3})] \geq 0$

$x - \frac{1}{3} \in \mathbb{Z} \Rightarrow D_f = \{x | x = k + \frac{1}{3}, k \in \mathbb{Z}\}$

(الف) $\sin x - 1 \neq 0 \Rightarrow \sin x \neq 1$

$x \neq \frac{\pi}{2} \Rightarrow D_f = \mathbb{R} - \{\frac{\pi}{2} + 2k\pi\}$

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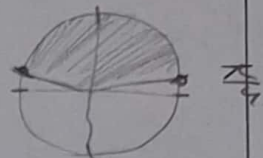
(ب) $2\sin^2 x - 1 \neq 0 \Rightarrow \sin^2 x \neq \frac{1}{2} \Rightarrow \sin x \neq \pm \frac{1}{\sqrt{2}} = \pm \frac{\sqrt{2}}{2}$

$x \neq \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$

$D_f = \mathbb{R} - \{\frac{\pi}{4} + k\pi, \frac{3\pi}{4} + k\pi\}$

الف) $\sqrt{2} \sin x - 1 \geq 0 \quad \sqrt{2} \sin x \geq 1 \quad 1 \leq \sin x \leq \frac{\sqrt{2}}{2}$

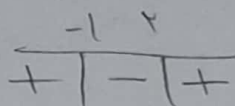
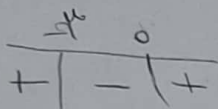
$D_f = [\sqrt{2}x + \frac{\pi}{4}, \sqrt{2}x + \frac{3\pi}{4}]$



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ب) $\cos x - 1 \geq 0 \quad \cos x \geq 1 \quad \cos x = 1 \quad D_f = 2k\pi$

الف) $-1 \leq |x| - 2 \leq 1 \quad 1 \leq |x| \leq 3 \quad D_f = [-3, -1] \cup [1, 3]$



ب) $x^2 + 3x + 1 \leq 1$
 $x^2 + 3x \leq 0 \quad x(x+3) \rightarrow -3$

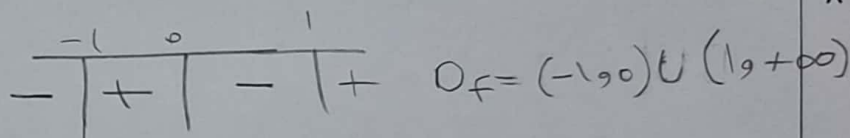
$x^2 + 3x + 1 \geq -1$
 $(x+1)(x+2) \rightarrow -2$
 $D_f = [-2, -1] \cup [-1, 0]$

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الف) $2 - \log_3(x-2) \geq 0 \quad \log_3(x-2) \leq 2 \quad x-2 \leq 9 \quad x \leq 11$
 $x > 2 \quad D_f = (2, 11]$

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ب) $x^3 - x > 0$
 $0 < x(x^2 - 1) \rightarrow \pm 1$



الف) $x^2 + 1 \neq 0 \quad x^2 \neq -1 \quad D_f = \mathbb{R}$

ب) $x^2 - 1 \neq 0 \quad x^2 \neq 1 \quad x \neq 0 \quad D_f = \mathbb{R} - \{0\}$

ج) $x^2 - 2 \neq 0 \quad x^2 \neq 2 \quad \log_2 x \neq 2 \quad D_f = \mathbb{R} - \{\log_2 4\}$

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د) $x^2 - 3 \neq 0 \quad x^2 \neq 3 \quad \log_3 x \neq 3 \quad D_f = \mathbb{R} - \{\log_3 27\}$

الف) $x+1 \in \mathbb{W} \quad x \in \mathbb{W} - 1 \quad x \in \frac{\mathbb{W}-1}{x}$

$D_f = \{x | x = \frac{k-1}{x}, k \in \mathbb{W}\}$

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ب) $\frac{x^2-2}{x^2-5} \in \mathbb{W} \quad x^2-2 \in x^2\mathbb{W}-5\mathbb{W}$
 $x^2-2 \in -5\mathbb{W}+x^2$

$x \in \frac{-5\mathbb{W}+x^2}{x^2-2}$

$D_f = \{x | x = \frac{-5k+x^2}{x^2-2}, k \in \mathbb{W}\}$

$x(x^2-2) \in -5\mathbb{W}+x^2$