

$$y = \frac{x+2}{4x^3 - 20x^2 + 31x - 15} \quad \begin{array}{l} \text{جمع ضرایب} \\ \text{صفر است} \\ \text{پس عبارت} \end{array} \quad \begin{array}{l} 4x^3 - 20x^2 + 31x - 15 \\ -4x^3 + 4x^2 \\ \hline -14x^2 + 31x - 15 \\ +14x^2 - 14x \\ \hline 15x - 15 \\ -15x + 15 \\ \hline 0 \end{array} \quad \begin{array}{l} x-1 \\ 4x^2 - 14x + 15 \end{array} \quad (1)$$

خرج بر 1-2 بخش پذیر است

$$\Rightarrow \frac{x+2}{(x-1)(4x^2 - 14x + 15)} = \frac{x+2}{(x-1)(2x-5)(2x-3)}$$

$$\Rightarrow (x-1)(2x-5)(2x-3) \neq 0 \quad \begin{array}{l} \rightarrow x-1 \neq 0 \rightarrow \boxed{x \neq 1} \\ \rightarrow 2x-5 \neq 0 \rightarrow \boxed{x \neq \frac{5}{2}} \\ \rightarrow 2x-3 \neq 0 \rightarrow \boxed{x \neq \frac{3}{2}} \end{array}$$

$$D_f = \mathbb{R} - \left\{ 1, \frac{3}{2}, \frac{5}{2} \right\}$$

$$y = \frac{x+3}{3x^3 - x^2 - 11x - 4}$$

جمع ضرایب توان های فرد و زوج با هم برابر است پس عبارت مجزئ  
1+3 بخش پذیر است

$$\begin{array}{l} 3x^3 - x^2 - 11x - 4 \\ -3x^3 - 3x^2 \\ \hline -4x^2 - 11x - 4 \\ +4x^2 + 4x \\ \hline -7x - 4 \\ +7x + 7 \\ \hline 0 \end{array} \quad \begin{array}{l} x+1 \\ 3x^2 - 4x - 4 \end{array}$$

ریشه این عبارت  
اراه دنا

$$\frac{x+3}{(x+1)(3x^2 - 4x - 4)}$$

$$(x+1)(3x^2 - 4x - 4) \neq 0$$

$$x+1 \neq 0 \rightarrow \boxed{x \neq -1}$$

$$\Delta = b^2 - 4ac$$

$$\Delta = 16 - 4(-4 \times 3)$$

$$\Delta = 16 + 48 = 64$$

$$x = \frac{-b \pm \sqrt{\Delta}}{2a} \Rightarrow \frac{4 \pm 8}{6} \Rightarrow$$

$$x \neq 2 \quad x \neq \frac{2}{3} \quad \leftarrow \begin{array}{l} \boxed{x = 2} \\ \boxed{x = \frac{2}{3}} \end{array}$$

$$D_f = \mathbb{R} - \left\{ -1, \frac{2}{3}, 2 \right\}$$

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$$\text{الف) } y = \frac{x+1}{x-\sqrt{r-rx}}$$

$$x - \sqrt{r-rx} \neq 0$$

$$(x)^r \neq (\sqrt{r-rx})^r$$

$$x^r \neq r-rx$$

$$x^r + rx - r \neq 0$$

$$(x+r)(x-1) \neq 0$$

$$\begin{cases} x+r \neq 0 \rightarrow \boxed{x \neq -r} \\ x-1 \neq 0 \rightarrow \boxed{x \neq 1} \end{cases}$$

$$\sqrt{r-rx} \rightarrow r-rx \geq 0 \rightarrow \boxed{x \leq \frac{r}{r}}$$

$$D_f = (-\infty, \frac{r}{r}] - \{-r, 1\}$$

$$\text{ب) } y = \frac{x+r}{x-\sqrt{r-rx}}$$

$$x - \sqrt{r-rx} \neq 0$$

$$x \neq \sqrt{r-rx}$$

$$x^r \neq r-rx$$

$$x^r - rx + r \neq 0$$

$$(x-1)(x-r) \neq 0$$

$$\begin{cases} x-1 \neq 0 \rightarrow \boxed{x \neq 1} \\ x-r \neq 0 \rightarrow \boxed{x \neq r} \end{cases}$$

$$\sqrt{r-rx} \rightarrow r-rx \geq 0$$

$$\boxed{x \geq \frac{r}{r}}$$

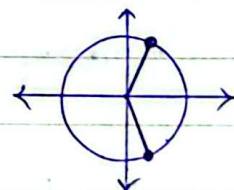
$$D_f = [\frac{r}{r}, +\infty) - \{1, r\}$$

$$\text{الف) } y = \frac{\sin x}{r \cos x - 1}$$

$$r \cos x - 1 \neq 0$$

$$\cos x \neq \frac{1}{r}$$

$$D_f = \mathbb{R} - \{r k \pi \pm \frac{\pi}{r}\}$$

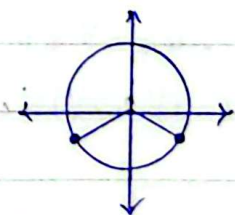


$$\text{ب) } y = \frac{\cos x + 1}{r \sin x + 1}$$

$$r \sin x + 1 \neq 0$$

$$\sin x \neq -\frac{1}{r}$$

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



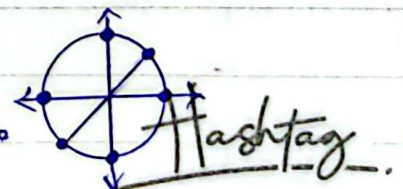
$$\text{ج) } y = \frac{\tan x + r}{\cot x - 1}$$

$$\cot x - 1 \neq 0 \rightarrow \cot x \neq 1$$

$$\cot x = \frac{\cos x}{\sin x} \rightarrow \sin x \neq 0$$

$$\tan x = \frac{\sin x}{\cos x} \rightarrow \cos x \neq 0$$

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

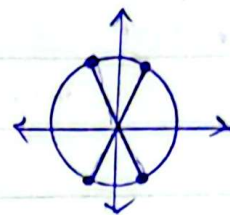


$$y = \frac{\sin x + 1}{\sin^2 x - 1}$$

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

$$\sin^2 x \neq 1$$

$$\sin x \neq \pm 1$$

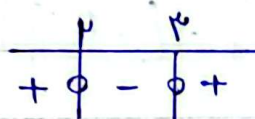


$$D_f = \mathbb{R} - \left\{ 2k\pi + \frac{\pi}{2}, 2k\pi + \frac{3\pi}{2}, 2k\pi + \frac{5\pi}{2}, 2k\pi + \frac{7\pi}{2} \right\}$$

$$a) x^2 - 5x + 4 > 0$$

(K)

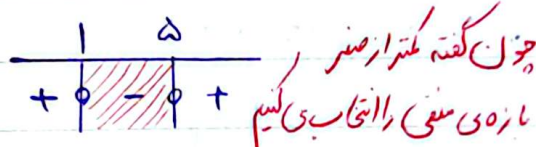
$$(x-1)(x-4) > 0 \rightarrow \begin{cases} x > 4 \\ x < 1 \end{cases}$$



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

$$b) x^2 - 9x + 4 < 0$$

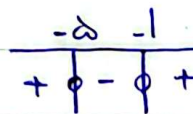
$$(x-1)(x-4) < 0 \rightarrow \begin{cases} x < 1 \\ x > 4 \end{cases}$$



$$D_f = (1, 4)$$

$$c) x^2 + 4x + 5 \geq 0$$

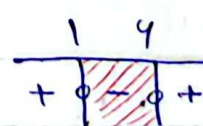
$$(x+1)(x+5) \geq 0 \rightarrow \begin{cases} x \geq -1 \\ x \leq -5 \end{cases}$$



$$D_f = (-\infty, -5] \cup [-1, +\infty)$$

$$d) x^2 - 5x + 4 \leq 0$$

$$(x-1)(x-4) \leq 0 \rightarrow \begin{cases} x \leq 1 \\ x \geq 4 \end{cases}$$



$$D_f = [1, 4]$$

چون گفته کمتر یا مساوی  
ممنوع بازه‌ی منفی  
را انتخاب می‌کنیم

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$$\text{الف) } y = \frac{x^2 - 2x + 2}{x - 5} < 0$$

$$\begin{array}{c|c|c|c} 1 & 2 & 5 & \\ \hline - & + & - & + \end{array}$$

$$D_f = (-\infty, 1) \cup (2, 5)$$

$$\frac{(x-1)(x-2)}{x-5} < 0 \rightarrow \begin{cases} x < 1 \\ x < 2 \end{cases} \quad (5)$$

$$x - 5 \neq 0 \rightarrow x \neq 5$$

$$\text{ب) } y = \frac{x^2 - 1}{x^2 - 4x + 5} \geq 0$$

$$\begin{array}{c|c|c|c} -1 & & 5 & \\ \hline + & - & - & + \end{array}$$

$$D_f = (-\infty, -1] \cup (5, +\infty)$$

$$\frac{(x-1)(x+1)}{(x-1)(x-5)} \geq 0 \rightarrow \begin{cases} x \geq 1 \\ x \geq -1 \end{cases}$$

$$\left\{ \begin{array}{l} x \geq 1 \\ x \geq 5 \end{array} \right\} \rightarrow x \geq 5$$

$$\text{الف) } y = \sqrt{\frac{x^2 - 4x + 3}{x^2 - 1}}$$

$$\frac{x^2 - 4x + 3}{x^2 - 1} \geq 0 \rightarrow \frac{(x-1)(x-3)}{(x-1)(x^2 + x + 1)} \geq 0 \quad (4)$$

عوامل + است

چون دلتای آن منفی شود

$$\Delta = b^2 - 4ac$$

$$\Delta = 1 - 4 = -3$$

$$\begin{array}{c|c|c|c} 1^* & 3 & & \\ \hline - & - & - & + \end{array}$$

$$D_f = [3, +\infty)$$

بیشتر  
در صورت

$$x \geq 1, x \geq 3$$

منفی

$$x - 1 > 0 \rightarrow x > 1$$

$$\text{ب) } y = \sqrt{\frac{x^2 - 4x + 3}{x^2 - 1}}$$

چون فرجه را در یکال ۳ است محدودیت فقط در مخرج داریم

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

$$(x-1)(x+1) \neq 0$$

$$x \neq \pm 1$$

$$D_f = \mathbb{R} - \{\pm 1\}$$

الف)  $y = \log(x^2 - 3x)$

$$x^2 - 3x > 0$$

$$x(x-3) > 0$$

$$x > 0 \quad x > 3$$

$$\begin{array}{c} 0 \quad 3 \\ + \quad - \quad + \end{array}$$

(V

$$D_f = (-\infty, 0) \cup (3, +\infty)$$

ب)  $\log_{|x|-2}^{14-x^2}$

$$14 - x^2 > 0 \rightarrow 14 > x^2 \rightarrow x^2 < 14$$

$$-4 < x < 4$$

$$|x|-2 > 0 \rightarrow |x| > 2$$

$$x > 2 \quad x < -2$$

$$D_f = (-4, -2) \cup (-2, -2) \cup (2, 4) \cup (4, 4)$$

$$|x|-2 \neq 1 \rightarrow x-2 \neq 1$$

$$x \neq 3$$

$$-x-2 \neq 1 \rightarrow x \neq -3$$

ج)  $\log_{10-x} \frac{x^2 - 5x + 4}{x-3}$

$$\frac{x^2 - 5x + 4}{x-3} > 0$$

$$\frac{(x-3)(x-4)}{x-3} > 0$$

$$10-x > 0 \rightarrow x < 10$$

$$x > 3 \quad \cap \quad x > 4 \quad x > 4$$

$$10-x \neq 1 \rightarrow x \neq 9$$

$$D_f = (3, 9) \cup (9, 10)$$

$$y = \sqrt{x^2 - 11x + 28} + \log_x \sqrt{34 - x^2}$$

$$x^2 - 11x + 28 \geq 0$$

$$(x-4)(x-7) \geq 0$$

$$x \geq 4 \quad x \geq 7$$

$$\sqrt{34 - x^2} > 0$$

$$34 > x^2 \rightarrow x^2 < 34$$

$$-4 < x < 4$$

$$x > 0$$

$$x \neq 1$$

$$\begin{array}{c} -4 \quad 0 \quad 1 \quad 4 \quad 7 \quad \vee \\ - \quad + \quad - \quad + \quad - \quad + \quad - \end{array}$$

$$D_f = (-4, 0) \cup (1, 4] \cup (4, 7]$$

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$$y = \frac{n^2 - n}{n^2 + n} \rightarrow y = \frac{n(n-1)}{n(n+1)}$$

(1)

$$\frac{-1}{+} \frac{0}{-} \frac{1}{+} \quad \text{دوش سرخ}$$

|           | -1 | 0 | 1 |
|-----------|----|---|---|
| $n^2 - n$ | +  | + | - |
| $n^2 + n$ | +  | - | + |
| $p(n)$    | +  | - | + |

دوش آبی

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

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

$$n - f(n) = 0$$

(9)

$$n = f(n)$$

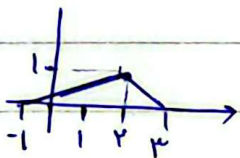
$$f(n) = 0$$

$$f(n) = -2, 2$$

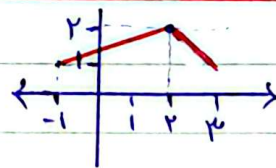
$$n = -1, 3$$

|            | -2 | -1 | 2 | 3 |
|------------|----|----|---|---|
| $n - f(n)$ | -  | -  | + | + |
| $f(n)$     | +  | -  | - | + |
| $p$        | -  | +  | - | + |

$$D_f = [-2, 1] \cup [2, 3]$$

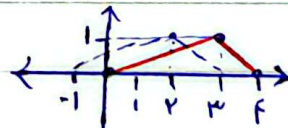


f(n) + 1

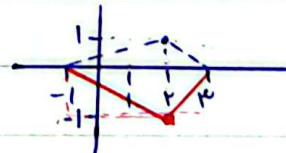


(10)

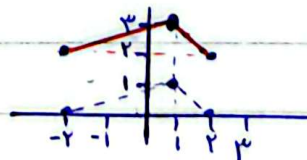
f(n-1)



-f(n)



f(n+1) + 2



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