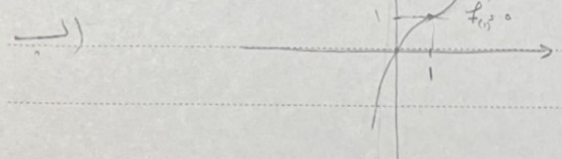


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① الف) $y = x^3 - 3x^2 + 3x \rightarrow y' = 3x^2 - 6x + 3 = 3(x^2 - 2x + 1) = 3(x-1)^2$ $y' = 0$
 $y = x(x^2 - 3x + 3)$ $\Delta < 0$ $y = \frac{3}{-1}$ $x = 1$
 گراف:



② الف) $y = \frac{x^2 + 4}{x^2 - 1} \rightarrow y' = \frac{2x(x^2 - 1) - 2x(x^2 + 4)}{(x^2 - 1)^2} = \frac{2x^3 - 2x - 2x^3 - 8x}{(x^2 - 1)^2} = \frac{-10x}{(x^2 - 1)^2}$
 $y' = 0 \rightarrow x = 0$ $x = 1, -1 \notin D_f$
 نقاط بحرانی: $x = 2$ $x^2 = -1 \rightarrow x = \pm i$

ب) $y = \frac{x^3}{x^2 - 1} \rightarrow y' = \frac{3x^2(x^2 - 1) - 2x(x^3)}{(x^2 - 1)^2} = \frac{3x^4 - 3x^2 - 2x^4}{(x^2 - 1)^2} = \frac{x^4 - 3x^2}{(x^2 - 1)^2}$
 $x^4 - 3x^2 = 0 \rightarrow x^2 = 3 \rightarrow x = \pm\sqrt{3}$
 نقاط بحرانی: $+\sqrt{3}$ و $-\sqrt{3}$ و 0

③ الف) $y = \frac{-x^2 + 4x + 1}{x - 1}$ $y' = \frac{(-2x + 4)(x - 1) - (-x^2 + 4x + 1)}{(x - 1)^2} = \frac{-2x^2 + 4x + 4x - 4 + x^2 - 4x - 1}{(x - 1)^2} = \frac{-x^2 + 4x - 1}{(x - 1)^2}$
 $-x^2 + 4x - 1 = 0 \rightarrow \Delta < 0$
 نقطہ اکسٹرم سببی ندارد

ب) $y = \frac{x^2 - 4x + 5}{x - 1} = \frac{(x-1)(x-3) + 4}{x-1} = x - 3 + \frac{4}{x-1}$ $x = 1 \notin D_f$
 گراف:

④ الف) $y = \frac{2x + 4}{x - 1} \rightarrow$ $x = 1$ (ریشہ مخرب) = میٹب قائم
 $\frac{a}{c}$ و $\frac{b}{c}$ میٹب افقی
 از همگی مواجی محور مختصات می آید
 گراف:


⑤ الف) $\frac{ax + 4}{x - b} \rightarrow$ $x = b$ (ریشہ مخرب) $(2, 3) \rightarrow$ نقطه ای که بر محور میٹب ها است
 $\frac{4}{c} = \frac{a}{c}$
 ب) $y = \frac{3x + 4}{x - 2} \rightarrow y^{-1} = \frac{3x + 4}{x - 2} \rightarrow$ ضابطه تابع معکوس
 گراف:

④ $y = \frac{3x + 1}{x - 2}$ $f = ax + b \rightarrow (2, 3) \rightarrow x + 1 = y$
 معادله مواجی $y = x + 1$
 مواجی $y = -x + 5$

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⑦ $D_f \in \mathbb{R}$ $f'(a) = 0 \rightarrow$ نقطه ۳ $\left. \begin{array}{l} \rightarrow f'(a) = 0 \rightarrow$ نقطه ۴
 } نقطه بحرانی دارد

⑧ $y = |a^2 - a + 2| \Rightarrow$ شکل حدی 

$\Delta > 0 \Rightarrow a^2 - 1 > 0 \rightarrow -\sqrt{2} < a < \sqrt{2} \Rightarrow a \in (-\sqrt{2}, \sqrt{2})$

⑨ $y = \frac{a^2 + 2}{a^2 + a + 2} \sim y' = \frac{2a(a^2 + a + 2) - (2a + 1)(a^2 + 2)}{(a^2 + a + 2)^2} \rightarrow 2a^3 + 2a^2 + 4a - 2a^2 - 4a - 2 = 0$
 $a^2 = 2 \Rightarrow a = \pm\sqrt{2}$

$f(\sqrt{2}) = \frac{4}{4 + \sqrt{2}}$ $f(-\sqrt{2}) = \frac{4}{4 - \sqrt{2}} \rightarrow \frac{14}{14 - 2} = \frac{14}{12} = \frac{7}{6} = \boxed{\frac{7}{6}}$ جواب $= f_{\max}$ αf_{\min}

⑩ $y = a^2 + a - 2$ $y = (a^2 + a - 2) \sim y' = 2(a^2 + a - 2)(2a + 1) < 0$
 $(a-1)(a+2) \rightarrow -\frac{1}{2} < a < \frac{1}{2}$

$y = (a^2 + a - 2) \sim y' = 2(a^2 + a - 2)(2a + 1)$

$\min \sim -\frac{1}{2}$ $\max \sim \frac{1}{2} \Rightarrow$ جواب $= \boxed{0}$

