[illegible]

[illegible]

I [illegible]

(2) $f(x) = 2x^4 - 9x^2 + 1$ ([illegible])

$\Rightarrow f'(x) = 8x^3 - 18x = 2x(4x^2 - 9) = 2x(2x-3)(2x+3)$

x	$-\infty$		-1.5		0		1.5		∞
$f'(x)$		$-$	0	$+$	0	$-$	0	$+$	
$f(x)$	∞	$\searrow$	$(-1.5, -9.125)$	$\nearrow$	$(0, 1)$	$\searrow$	$(1.5, -9.125)$	$\nearrow$	∞

[illegible]

[illegible] II [illegible]

II (1) $[0,3]$ $f(x) = x - \sqrt{|x^2-3x+2|} = \begin{cases} x-\sqrt{x^2-3x+2} & ([illegible]\ x\geq 2) \\ x-\sqrt{-x^2+3x-2} & (1\leq x\leq 2) \end{cases}$

$f_1'(x) = \left(x-\sqrt{x^2-3x+2}\right)' = 1-\frac{2x-3}{2\sqrt{x^2-3x+2}} = \frac{2\sqrt{x^2-3x+2}-2x+3}{2\sqrt{x^2-3x+2}}$

$f_2'(x) = \left(x-\sqrt{-x^2+3x-2}\right)' = 1-\frac{-2x+3}{2\sqrt{-x^2+3x-2}} = \frac{2\sqrt{-x^2+3x-2}+2x-3}{2\sqrt{-x^2+3x-2}}$

$f_1'(x)=0 \Rightarrow 2\sqrt{x^2-3x+2} = 2x-3 \Rightarrow 4\cancel{x^2}-12x+8 = \cancel{4x^2}-12x+9 \Rightarrow 1=0$

[illegible]

$f_2'(x)=0 \Rightarrow 2\sqrt{-x^2+3x-2} = 3-2x \Rightarrow -4x^2+12x-8 = 4x^2-12x+9$

$\Rightarrow 8x^2-24x+17=0 \Rightarrow x_{1,2} = \frac{24\pm\sqrt{24^2-544}}{16} = \frac{6\pm\sqrt{2}}{4}$ 1.85..., 1.146...

$f(0) = 0-\sqrt{|2|} = -\sqrt{2} = -1.414$

$f(1) = 1-\sqrt{|1-3+2|} = 1$ [illegible]

$f(2) = 2-\sqrt{|4-6+2|} = 2$ [illegible]

$f(3) = 3-\sqrt{|3^2-3\cdot 3+2|} = 3-\sqrt{2} = 1.585\ldots$

$f\left(\frac{6\pm\sqrt{2}}{4}\right) = \frac{6\pm\sqrt{2}}{4} - \sqrt{\left|\left(\frac{6\pm\sqrt{2}}{4}\right)^2 - 3\left(\frac{6\pm\sqrt{2}}{4}\right)+2\right|} = \frac{6\pm\sqrt{2}}{4} - \sqrt{\left|\frac{36+2\pm12\sqrt{2}}{16} - \frac{18}{4} \mp \frac{3\sqrt{2}}{4}+2\right|}$

$= \frac{6\pm\sqrt{2}}{4} - \sqrt{\left|\frac{38-72\pm\sqrt{2}(12-12)+32}{16}\right|} = \frac{6\pm\sqrt{2}}{4} - \sqrt{\frac{1}{8}} = \frac{6\pm\sqrt{2}-\frac{4}{\sqrt{8}}}{4}$

$= \frac{6\pm\sqrt{2}\pm\sqrt{2}}{4}$ $\frac{3}{2}$, $\frac{3-\sqrt{2}}{2} = 0.79$

[illegible]

$(0, -\sqrt{2})$ [illegible]

$(2, 2)$ [illegible]

III - 2

(2)

$\sphericalangle E = \sphericalangle D = \sphericalangle F = \sphericalangle FBD = \frac{\pi}{2}$ [illegible]

$FB = DE = 8\,cm$

$BD = EF = 18\,cm$

$S = AE \cdot CE$

[illegible]

[illegible]

$AE = x$, $CE = y$ $\Rightarrow$ $AF = x - 18$, $CD = y - 8$

$\triangle AFB \sim \triangle BDC \Rightarrow \frac{AF}{BF} = \frac{BD}{CD} \Rightarrow \frac{x-18}{8} = \frac{18}{y-8} \Big/ \cdot \frac{8(y-8)}{x-18}$

$\begin{pmatrix} x > 18 \\ y > 8 \end{pmatrix}$ [illegible]

$\Rightarrow \frac{y-8}{1} = \frac{144}{x-18} \Rightarrow \boxed{y = 8 + \frac{144}{x-18}}$

$\Rightarrow S = xy = 8x + \frac{144x}{x-18}$

$f(x) = S = 8x + \frac{144x}{x-18}$

$f'(x) = 8 + \frac{144(x-18) - 144x}{x^2 - 36x + 324} = \frac{8x^2 - 288x + 2592 - 2592}{(x-18)^2}$

$\Rightarrow f'(x) = \frac{8x(x-36)}{(x-18)^2}$

$f'(x) = 0 \Rightarrow \frac{8x(x-36)}{(x-18)^2} \Rightarrow \Big/ \cdot \frac{(x-18)^2}{8x} \Rightarrow x - 36 = 0 \Rightarrow x = 36$

$(x \neq 0$ [illegible]$)$ $\Rightarrow y = 16$

$\Rightarrow \boxed{\begin{pmatrix} AE \\ CE \end{pmatrix} = \begin{pmatrix} 36 \\ 16 \end{pmatrix}}$

[illegible] $(36, 16)$

(4)

פתרון

נסמן [illegible]

M – מרכז הבסיס

$\alpha = \angle A$

$AM = BM = R$ רדיוס הקונוס

$MC = H$ גובה הקונוס

$DM = EM = r$ רדיוס הגליל

$h = NM = EF = DG$ גובה הגליל

$V =$ נפח הגליל $= \pi r^2 h$

[illegible] h [illegible] r [illegible] V [illegible]

[illegible]

$$\tan\alpha = \frac{CM}{AM} = \frac{H}{R}$$

$$\tan\alpha = \frac{DG}{AD} = \frac{CN}{NG} \Rightarrow \frac{h}{R-r} = \frac{H-h}{r} \Rightarrow hr = (H-h)(R-r)$$

$$\Rightarrow hr = HR - hr - (rH - Rh) \Rightarrow HR = rH + Rh$$

$$\Rightarrow H = \frac{rH}{R} + h \Rightarrow h = H\left(1 - \frac{r}{R}\right)$$

$$\Rightarrow V = \pi r^2 h = \pi r^2 H\left(1 - \frac{r}{R}\right) = \pi H\left(r^2 - \frac{r^3}{R}\right)$$

$$f(r) = \pi H\left(r^2 - \frac{r^3}{R}\right) \Rightarrow f'(r) = \pi H\left(2r - \frac{3r^2}{R}\right)$$

[illegible]

$$f'(r) = 0 \Rightarrow 2r - \frac{3r^2}{R} = 0 \Rightarrow \left(\frac{3}{R}r - 2\right)r = 0 \Rightarrow \begin{cases} r = 0 & ([illegible]) \\ r = \frac{2}{3}R \end{cases}$$

$$V = \pi H\left(\left(\tfrac{2}{3}R\right)^2 - \frac{\left(\tfrac{2}{3}R\right)^3}{R}\right) = \pi HR^2\left(\frac{4}{9} - \frac{8}{27}\right) = \frac{4}{27}\pi HR^2$$

$\boxed{\frac{4}{27}\pi HR^2}$ נפח הגליל המקסימלי הוא:

($\frac{4}{9}$ מנפח הקונוס!)

[illegible] | **III - 6** | [illegible]

[illegible] $y=x^2$ [illegible] $3x+4y+12=0$?

[illegible] (x, x^2) [illegible]

$$d = \frac{|Ax_0+By_0+C|}{\sqrt{A^2+B^2}} = \frac{|3x+4x^2+12|}{\sqrt{3^2+4^2}} = \frac{1}{5}\left|4x^2+3x+12\right|$$

~~[illegible]~~

~~$|x|' = \sqrt{x^2}' = \frac{2x}{2\sqrt{x^2}} = \frac{x}{|x|}$~~

~~$f(x) = |4x^2+3x+12| \Rightarrow f'(x) = \frac{4x^2+3x+12}{|4x^2+3x+12|}\cdot(8x+3)$~~

~~$4x^2+3x+12=0 \Rightarrow x = \frac{-3\pm\sqrt{9-4\cdot4\cdot12}}{8} \Rightarrow$~~

[illegible]

$4x^2+3x+12=0 \qquad \Delta = 3^2-4\cdot4\cdot12 = -183$

[illegible]

$d = f(x) = \frac{4}{5}x^2+\frac{3}{5}x+\frac{12}{5}$

$f'(x) = \frac{8}{5}x+\frac{3}{5} \Rightarrow \quad f'(x)=0 \Rightarrow \frac{8}{5}x+\frac{3}{5}=0 \Rightarrow 8x+3=0 \Rightarrow x=-\frac{3}{8}$

$\boxed{\left(-\frac{3}{8}, \frac{9}{64}\right)}$ [illegible]

(2-4) 11/11

①

$f(x) = x^4 + 6x^2 + 20x - 2$

$f'(x) = 4x^3 + 12x + 20$

$f''(x) = 12x^2 + 12$

$f''(x) = 0 \Rightarrow x^2 = -1$ אין פתרון

אין פתרון למשוואה ⇐ אין נקודות פיתול ⇐ הפונקציה קמורה כלפי מעלה ∪

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④ $f(x) = \dfrac{e^x}{x-1}$

$f'(x) = \dfrac{e^x(x-1) - e^x}{(x-1)^2} = \dfrac{e^x(x-2)}{(x-1)^2}$

$f''(x) = \dfrac{-e^x(x-2)\left[(x-1)^2\right]' + \left[e^x(x-2)\right]'(x-1)^2}{(x-1)^4} = \dfrac{-e^x(x-2)(2x-2) + (x-1)^2\left(e^x + e^x(x-2)\right)}{(x-1)^4}$

$\Rightarrow f''(x) = \dfrac{e^x}{(x-1)^4}\left[-2(x-2)(x-1) + (x-1)^2(x-1)\right] = \dfrac{e^x}{(x-1)^3}\left(-2x+4+(x^2-2x+1)\right)$

$\Rightarrow f''(x) = \dfrac{e^x}{(x-1)^3}\left(x^2 - 4x + 5\right)$ $\qquad x^2 - 4x + 5 = 0 \Rightarrow \Delta = 16 - 20 = -4$

⇐ $\Delta < 0$ ⇐ $e^x(x^2 - 4x + 5)$ תמיד חיובי, ולכן קביעת הסימן תלויה רק ב-
$x-1$ הסימן של

⇐ קעורה: בתחום $(-\infty, 1)$ הפונקציה קעורה כלפי מטה ∩
נקודה: $x=1$ הנקודה לא מוגדרת (לא בתחום)
קמורה: בתחום $(1, \infty)$ הפונקציה קמורה כלפי מעלה ∪

תרגיל 6	IV 6	

(6) $f(x)=\frac{\ln x}{x}$ $D: x>0 \iff x\in(0,+\infty)$

$f'(x)=\frac{\frac{1}{x}\cdot x-1\cdot\ln x}{x^2}=\frac{1-\ln x}{x^2}$

$f''(x)=\frac{\left(-\frac{1}{x}\right)\cdot x^2-2x(1-\ln x)}{x^4}=\frac{2x\ln x-3x}{x^4}=\frac{2\ln x-3}{x^3}$

$f''(x)=0 \Rightarrow 2\ln x-3=0 \Rightarrow \ln x=1.5 \Rightarrow x=e^{1.5}$

כמובן ה-x לא יכול להיות שלילי, ולכן נקודת הפיתול היא רק כאשר $x=e^{1.5}$

x	0		$e^{1.5}$		$+\infty$
$f''(x)$		$-$	0	$+$	
$f(x)$		$\cap$		$\cup$	

$\Leftarrow$
קעורה $(-\infty,0]$ הפונקציה לא מוגדרת
קעורה $(0,e^{1.5})$ הפונקציה קעורה כלפי מטה $\cap$
נקודת פיתול $x=e^{1.5}$
וקמורה $(e^{1.5},+\infty)$ הפונקציה קעורה כלפי מעלה $\cup$

(7) $f(x)=x|x|=x\sqrt{x^2}$

$f'(x)=1\cdot\sqrt{x^2}+x\cdot\frac{2x}{2\sqrt{x^2}}=|x|+\frac{x^2}{|x|}=|x|+\left|\frac{x^2}{x}\right|=2|x|$

$f''(x)=\frac{4x}{2\sqrt{x^2}}=\frac{2x}{|x|}$

$f''(x)=0 \Rightarrow$ אין

$D_{f''}: x\neq0$

x	$-\infty$		0		$+\infty$
$f''(x)$		$-$		$+$	
$f(x)$		$\cap$		$\cup$	

$\Leftarrow$
קעורה $(-\infty,0)$ הפונקציה קעורה כלפי מטה $\cap$
נקודת $x=0$ היא נקודת פיתול, אך לא מוגדרת
קמורה $(0,+\infty)$ הפונקציה קעורה כלפי מעלה $\cup$

7
ציון

[illegible] $1\gamma - 7$ [illegible]

(ז) $f(x) = 4\cos x + \sin 2x$

$f'(x) = -4\sin x + 2\cos 2x$

$f''(x) = -4\cos x - 4\sin 2x$

$f''(x) = 0 \Rightarrow \cancel{\cos x = \sin 2x} \ldots -4\cos x - 4\sin 2x = 0 \;/ : (-4)$

$\Rightarrow \cos x(1 - 2\sin x) = 0$

$\cos x = 0$	$\sin x = \frac{1}{2}$
$x = \frac{\pi}{2} + \pi k$	$x = \frac{\pi}{6} + 2\pi k$
	$x = \pi - \frac{\pi}{6} + 2\pi k = \frac{5}{6}\pi + 2\pi k$

[illegible] $T = 2\pi$

$f(x+T) = f(x)$

$f(x+2\pi) = 4\cos(x+2\pi) + \sin(2x+4\pi) = 4\cos x + \sin 2x = f(x)$

[illegible] $[0, 2\pi]$

$f''(x) = 0 \Rightarrow x \in \left\{\frac{\pi}{6}, \frac{5\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}, \frac{3\pi}{2}\right\}$

$x + 2\pi k$	0		$\frac{\pi}{6}$		$\frac{\pi}{2}$		$\frac{5\pi}{6}$		$\frac{3\pi}{2}$		2π
$f''(x)$		+	0	−	0	+	0	−	0	+	
$f(x)$		$\cup$		$\cap$		$\cup$		$\cap$		$\cup$	

$\Leftarrow$ [illegible] $T = 2\pi$

$\cup$ [illegible] $\left(0, \frac{\pi}{6}\right) \cup \left(\frac{\pi}{2}, \frac{5\pi}{6}\right) \cup \left(\frac{3\pi}{2}, 2\pi\right]$ [illegible] $(x+2\pi k)$ [illegible]

$\cap$ [illegible] $\left(\frac{\pi}{6}, \frac{\pi}{2}\right) \cup \left(\frac{5\pi}{6}, \frac{3\pi}{2}\right)$ [illegible] $(x+2\pi k)$ [illegible]

[illegible] $(x+2\pi k) \in \left\{\frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}, \frac{3\pi}{2}\right\}$ [illegible]

(8 [illegible])

$V-1$

1) $\frac{3x^2-25x-1}{x-9}$

$x\neq 9 \Leftarrow x-9\neq 0$

$\Rightarrow D: (-\infty, 9)\cup(9, +\infty)$

$(9^+, \pm\infty)$

$$\begin{array}{l} 3x+2 \\ 3x^2-25x-1 \,\big|\, x-9 \\ 3x^2-27x \\ \hline 2x-1 \\ 2x-18 \\ \hline 17 \end{array}$$

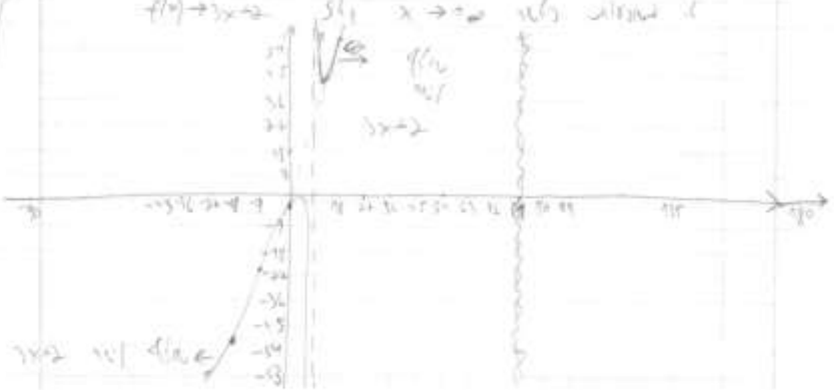
$\Rightarrow f(x)=3x+2+\frac{17}{x-9}$

$\lim_{x\to\pm\infty} f(x) = 3\left(\lim_{x\to\pm\infty} x\right)+2+\frac{17}{\lim_{x\to\pm\infty}(x-9)} = \lim_{x\to\pm\infty}(3x+2)=\pm\infty$

$\lim_{x\to 9^\pm} f(x) = \lim_{x\to 9^\pm}(3x+2)+\frac{17}{\lim_{x\to 9^\pm}(x-9)} = \pm\infty$

$f(x)\to\pm\infty$ $x\to 9^\pm$

$f(x)\to 3x+2$ $x\to\pm\infty$



$3x+2$

① $f(x)=x e^{2x}$. $D:(-\infty,+\infty)$

[illegible]

$$\lim_{x\to+\infty} f(x)=\lim_{x\to+\infty} x\cdot\left(\lim_{x\to+\infty}\right)^{2x}=+\infty$$

[illegible]

$$\cancel{\lim_{x\to-\infty} f(x)=\lim_{x\to-\infty} x\cdot e^{\left(\lim_{x\to-\infty} 2x\right)}=\lim_{x\to-\infty}\frac{e^{2x}}{\frac{1}{x}}=\left(\frac{0}{0}\right)=\frac{(e^{2x})'}{\left(\frac{1}{x}\right)'}=\frac{2e^{2x}}{-\frac{1}{x^2}}=\frac{0}{0}}$$

[illegible]

$$\lim_{x\to-\infty} f(x)=\lim_{x\to-\infty} x\cdot e^{\left(\lim_{x\to-\infty} 2x\right)}=(-\infty\cdot 0)=\lim_{x\to-\infty}\frac{x}{e^{-2x}}=\left(\frac{-\infty}{+\infty}\right)$$ [illegible]

$$=\lim_{x\to-\infty}\frac{x'}{(e^{-2x})'}=\frac{1}{-2e^{\left(-2\lim_{x\to-\infty} x\right)}}=\frac{1}{-2e^{\left(\lim_{x\to+\infty} 2x\right)}}=0^-$$

∞

[illegible] $x\to-\infty$ [illegible] $f(x)\to 0$

[illegible] | IV (6-7) | [illegible]

(1) $f(x)=\frac{e^x}{x-1}$. $D:(-\infty,1)\cup(1,\infty)$

$\lim_{x\to+\infty} f(x) = \left(\frac{\infty}{\infty}\right) = \lim_{x\to\infty}\frac{e^x}{1} = +\infty$

$\lim_{x\to-\infty} f(x) = \cancel{\left(\frac{\pm\infty}{-\infty}\right) = \lim_{x\to\infty}\frac{e^x}{1}} = \frac{\lim_{x\to-\infty} e^x}{\lim_{x\to-\infty}(x-1)} = 0^-$

$(-\infty)$

$\lim_{x\to1^{\pm}}\frac{e^x}{x-1} = \frac{e}{\lim_{x\to1}(x-1)} = \frac{e}{0} = \pm\infty$

[illegible]

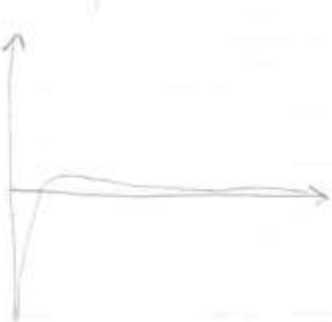
(2) $f(x)=\frac{\ln x}{x}$. $D:(0,\infty)$

$\lim_{x\to0^+}\left(\frac{\ln x}{x}\right) = \frac{\lim_{x\to0^+}\ln x}{\lim_{x\to0^+} x} = -\infty$ | $\lim_{x\to\infty}\frac{\ln x}{x} = \lim_{x\to\infty}\frac{\left(\frac{1}{x}\right)}{1} = 0^+$

$f\to0$ [illegible] $x\to\infty$ [illegible]

[illegible] $x\to0^+$ [illegible]

$f(x)\to-\infty$



[illegible] | (V-?) | [illegible]

1)

$$f(x)=2x+\sqrt{4x^2+7}$$

[illegible]

$$4x^2+7>0 \Rightarrow 4x^2>-7 \Rightarrow x\in R \Rightarrow D:(-\infty,+\infty)$$

$$\lim_{x\to+\infty} f(x)=\lim_{x\to\infty} 2x+\sqrt{\lim_{x\to\infty}(4x^2)+7}=+\infty$$

[illegible]

$$\lim_{x\to+\infty}\left(f'(x)=2+\frac{48x}{2\sqrt{4x^2+7}}\right)=2+\lim_{x\to+\infty}\frac{4x}{\sqrt{4x^2+7}}=2+\lim_{x\to+\infty}\sqrt{\frac{16x^2}{4x^2+7}}=2+\lim_{x\to+\infty}\sqrt{\frac{4x}{x+\frac{7}{x}}}$$

$$\Rightarrow \lim_{x\to+\infty} f'(x)=4$$

$$\left(\lim_{x\to+\infty}\frac{f(x)}{4x}=1 \text{ [illegible]}\right)$$

$$\lim_{x\to-\infty} f(x)=(-\infty+\infty)$$

[illegible]

$$\forall\varepsilon\in R^{+}\exists N\in R^{-}\,|\,N>x\Rightarrow|f(x)-0|<\varepsilon$$

[illegible] N [illegible] $|f(x)|<\varepsilon$

$$|2x+\sqrt{4x^2+7}|<\varepsilon$$

([illegible])

[illegible] | [illegible] | [illegible]

[illegible] (1)

$2x + \sqrt{4x^2+7}$ [illegible]

$2x + \sqrt{4x^2+7} = 0$

$\Rightarrow -2x = \sqrt{4x^2+7}$ $/()^2$ ($0 > x$ [illegible])

$4x^2 = 4x^2 + 7 \Rightarrow 0 = 7 \Rightarrow$ [illegible] $\Rightarrow f(x) > 0$

[illegible]

$2x + \sqrt{4x^2+7} < \varepsilon$

$\Rightarrow \sqrt{4x^2+7} < \varepsilon - 2x$ $/()^2$ ($\varepsilon > 2x$ [illegible])

$\Rightarrow \cancel{4x^2} + 7 < \varepsilon^2 - 4x\varepsilon + \cancel{4x^2}$

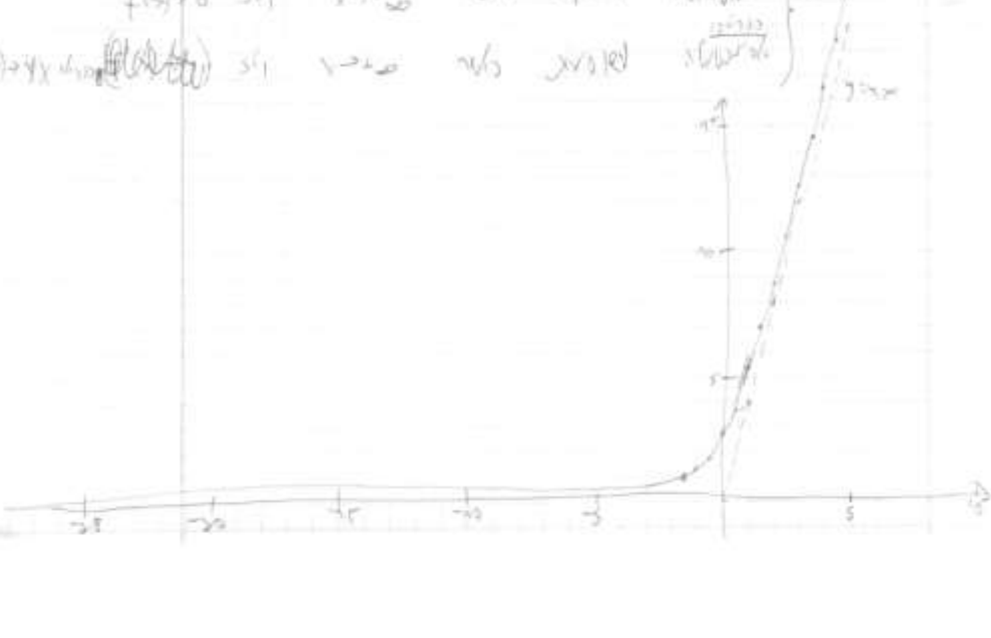
$4x\varepsilon < \varepsilon^2 - 7$

$x < \frac{\varepsilon}{4} - \frac{7}{4\varepsilon}$

$\Leftarrow$ [illegible] $N < \frac{\varepsilon}{4} - \frac{7}{4\varepsilon}$ [illegible]

$\Leftarrow$ [illegible] $x \to -\infty$ [illegible] $f(x) \to 0$

[illegible] $x \to +\infty$ [illegible] $f(x) \to 4x$ [illegible]



[illegible]

3 - I

$f(x) = x + \sqrt{x}$

[illegible]: $\sqrt{x} \Rightarrow x \geq 0 \Rightarrow D: [0, \infty)$

$f'(x) = 1 + \frac{1}{2\sqrt{x}} = \frac{2\sqrt{x}+1}{2\sqrt{x}}$

[illegible] $x > 0$

[illegible]

$x=0,\ f(0)=0 \Rightarrow (0,0)$

$f'(x)=0 \Rightarrow 2\sqrt{x}+1=0 \Rightarrow \sqrt{x}=-0.5$

[illegible]

5 - I

$f(x) = |x^2-3x| = \sqrt{(x^2-3x)^2} = \sqrt{x^4-6x^3+9x^2}$

[illegible]

$f'(x) = \frac{4x^3-18x^2+18x}{2\sqrt{(x^2-3x)^2}} = \frac{2x(2x^2-9x+9)}{|x^2-3x|} = \frac{2x(x-3)(2x-3)}{|x(x-3)|} = \frac{2x(x-3)(2x-3)}{|x(x-3)|}$

[illegible] $x=0$ [illegible] $x=3$ [illegible]

[illegible] $x=\frac{3}{2}$

[illegible] $\binom{x=0}{x=3}$ [illegible] $\left(x=\frac{3}{2}\right)$ [illegible]

x	$-\infty$	0		$\frac{3}{2}$		3	∞
$f'(x)$	$-$		$+$	0	$-$		$+$
$f(x)$	↘	$(0,0)$	↗	$\left(\frac{3}{2},\frac{9}{4}\right)$	↘	$(3,0)$	↗

[illegible] I [illegible]

(2) $f(x) = \dfrac{e^x}{x-1}$

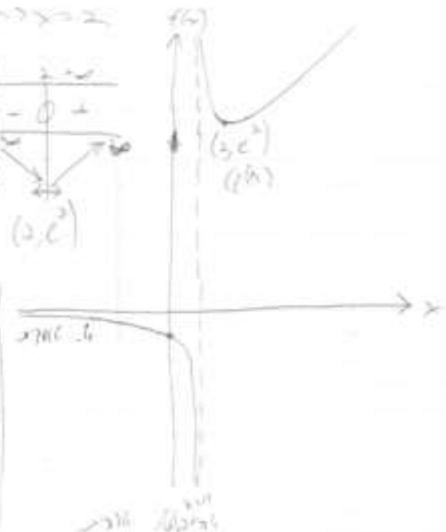
$D: (-\infty, 1) \cup (1, +\infty)$ $x \neq 1$ [illegible]

$$f'(x) = \left(\frac{U}{V}\right) = \frac{U'V - UV'}{V^2} = \frac{e^x(x-1) - e^x \cdot 1}{(x-1)^2} = \frac{e^x(x-2)}{(x-1)^2}$$

$f'(x) = 0 \Rightarrow x - 2 = 0 \Rightarrow x = 2$

x	$-\infty$	1		2	$+\infty$
$f'(x)$	$-$		$-$	0	$+$
$f(x)$	$\searrow$ $-\infty$		$\searrow$	$(2, e^2)$	$\nearrow$ $+\infty$

$(2, e^2)$



(1) $f(x) = \dfrac{\ln x}{x}$

$x > 0$ [illegible]

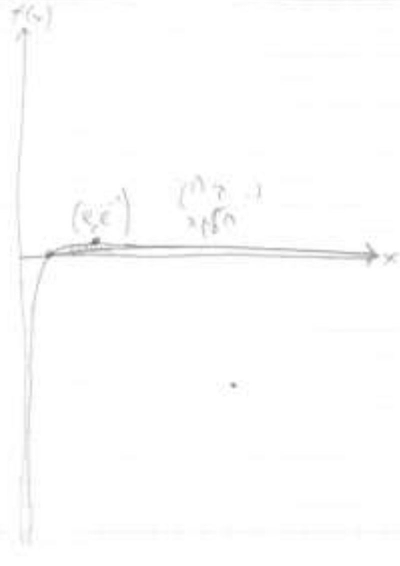
$D: (0, +\infty)$

$$f'(x) = \frac{\frac{1}{x} \cdot x - \ln x \cdot 1}{x^2} = \frac{1 - \ln x}{x^2}$$

$f'(x) = 0 \Rightarrow \ln x = 1 \Rightarrow x = e$

x	0	e	$+\infty$
$f'(x)$	$+$	0	$-$
$f(x)$	$\nearrow$ $-\infty$	(e, e^{-1})	$\searrow$ 0

(e, e^{-1})



[illegible] $\qquad$ I [illegible] $\qquad$ [illegible]

$I.\ 13)\ f(x) = \ln\left|\frac{x-1}{x+1}\right|$

[illegible]

$\frac{x-1}{x+1} \Rightarrow x+1 \neq 0 \Rightarrow x \neq -1$

$\ln\left|\frac{x-1}{x+1}\right| \Rightarrow \left|\frac{x-1}{x+1}\right| > 0 \Rightarrow \frac{x-1}{x+1} \neq 0 \Rightarrow x-1 \neq 0 \Rightarrow x \neq 1$

$\Rightarrow x \neq \pm 1 \Rightarrow D: (-\infty,-1) \cup (-1,1) \cup (1,+\infty)$

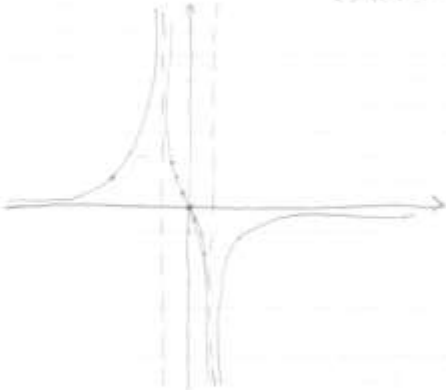
$f(x) = \ln\sqrt{\left(\frac{x-1}{x+1}\right)^2}$

$\Rightarrow f'(x) = \frac{\left(\sqrt{\left(\frac{x-1}{x+1}\right)^2}\right)'}{\left|\frac{x-1}{x+1}\right|} = \frac{\left(\left(\frac{x-1}{x+1}\right)^2\right)'}{2\left|\frac{x-1}{x+1}\right|\sqrt{\left(\frac{x-1}{x+1}\right)^2}} = \frac{\cancel{2}\left(\frac{x-1}{x+1}\right)\left(\frac{x-1}{x+1}\right)'}{\cancel{2}\left(\frac{x-1}{x+1}\right)^2} = \frac{\frac{1(x+1)-1(x-1)}{(x+1)^2}}{\frac{x-1}{x+1}}$

$\Rightarrow f'(x) = \frac{2}{x^2-1}$

[illegible]

x	$-\infty$	-1		1	$+\infty$
$f'(x)$	$+$		$-$		$+$
$f(x)$	$\nearrow$		$\searrow$		$\searrow$



[illegible]

([illegible] $x \neq \pm 1$)

[illegible]

II

([illegible])

[illegible]

(a) $[0,3]$ $f(x)=2x^3-9x^2+12x-2$

[illegible]

$f'(x)=6x^2-18x+12=6(x^2-3x+2)=$ ~~[illegible]~~

$f'(x)=0 \Rightarrow x_{1,2}=\frac{3\pm\sqrt{3^2-4\cdot1\cdot2}}{2}=\frac{3\pm1}{2} \begin{smallmatrix} 2 \\ 1 \end{smallmatrix}$

[illegible]

$f(1)=2-9+12-2=3$, $f(2)=$ [illegible] $2\cdot2^3-9\cdot2^2+12\cdot2-2$

[illegible]

$f(0)=-2$, $f(3)=2\cdot3^3-9\cdot3^2+12\cdot3-2=54-81+36-2=7$

$\Leftarrow$ [illegible]: $(0,-2)$

[illegible]: $(3,7)$

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(1) $[0.5,4]$ $f(x)=x-\ln x$

[illegible]

$f'(x)=1-\frac{1}{x}$, $f'(x)=0 \Rightarrow 1=\frac{1}{x} \Rightarrow x=1$

$f(1)=1$, $f(\frac{1}{2})=1.19\ldots$, $f(4)=2.61\ldots$

$\Leftarrow$ [illegible]: $(1,1)$

[illegible]: $(4,4-\ln 4)$ $(4,2.61\ldots)$

(b) $[-\pi,\pi]$, $f(x)=x+\sin^2 x$

$f'(x)=1+2\sin x\cos x=1+\sin 2x$

$f'(x)=0 \Rightarrow \sin 2x=-1 \Rightarrow$ ~~[illegible]~~

$\Rightarrow 2x=-\frac{\pi}{2}+2\pi k \Rightarrow x=\{-\frac{\pi}{4},\frac{3}{4}\pi\}$

$2x=\pi+\frac{\pi}{2}+2\pi k \Rightarrow x=\{\frac{3}{4}\pi,-\frac{\pi}{4}\}$

$f(-\pi)=-\pi$, $f(-\frac{\pi}{4})=\frac{\sqrt{2}}{2}-\frac{\pi}{4}=-0.285\ldots$

$f(\frac{3\pi}{4})=2.85\ldots$ $f(\pi)=\pi$

$\boxed{\begin{matrix} (-\pi,-\pi) & \text{[illegible]} \\ (\pi,\pi) & \text{[illegible]} \end{matrix}}$

(2) ~~[illegible]~~

[illegible]