3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

3) $f(x) = 2 - 15x + 9x^2 - x^3$

A. D: $\mathbb{R}$

B. y-int: $f(0) = 2$
x-int: $f(x) = 0$
$f(x) = -(x-2)(x^2 - 7x + 1)$
$x = 2,\ .15,\ 6.85$

C. No Symmetry

D. No Asymptote

E. $f'(x) = -15 + 18x - 3x^2$
$= -3(5 - 6x + x^2)$
$= -3(x-5)(x-1)$
crit numb $x = 1, 5$

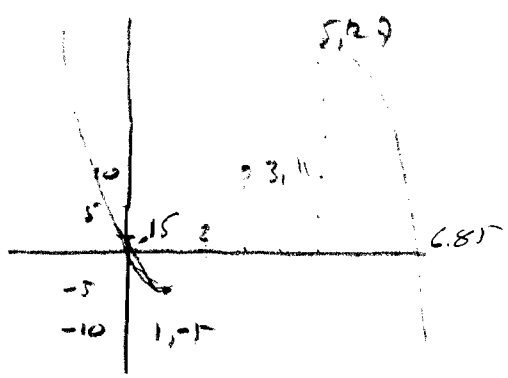
	-3	$x-5$	$x-1$	f'
$x < 1$	$-$	$-$	$-$	$-$
$1 < x < 5$	$-$	$-$	$+$	$+$
$x > 5$	$-$	$+$	$+$	$-$

Decreasing $(-\infty, 1), (5, \infty)$
Increasing $(1, 5)$

F. min $(1, -5)$
max $(5, 27)$

G. $f''(x) = 18 - 6x$
$= -6(x-3)$

	f''		
$x < 3$	$+$	CU	$(-\infty, 3)$
$x > 3$	$-$	CD	$(3, \infty)$
		IP	$(3, 11)$



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3-0137 — 200 SHEETS — FILLER
COMET

5) $y = x^4 + 4x^3 = x^3(x+4)$

A. $D: \mathbb{R}$

B. $f(0) = 0$ y-int at 0

$f(x) = 0$ when $x = 0$ & $x = -4$

C. No Sym

D. no Asymp $\lim_{x\to\infty} f(x) = \infty$ $\lim_{x\to-\infty} f(x) = \infty$

E. $f'(x) = 4x^3 + 12x^2 = 4x^2(x+3)$

$f'(x) = 0$ at $x = 0, -3$ critical numbers

	$4x^2$	$x+3$	f'
$x < -3$	+	−	−
$-3 < x < 0$	+	+	+
$x > 0$	+	+	+

dec $(-\infty, -3)$
inc $(-3, 0), (0, \infty)$

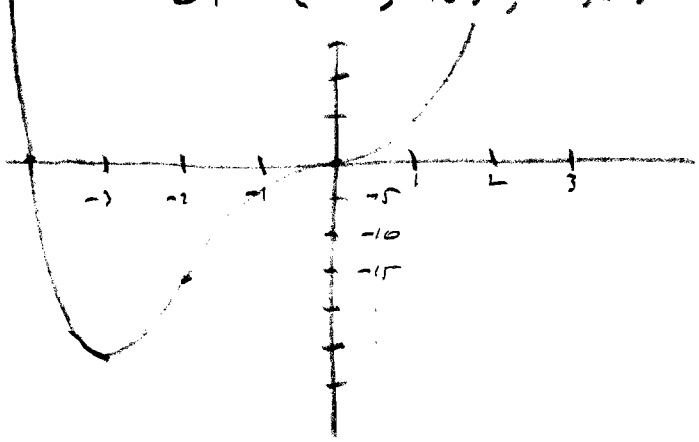
F. local min at $x = -3$ of -27 $(81 - 108)$
$x = 0$ is neither min or max

$\begin{array}{r} 27 \\ 4 \\ \hline 108 \end{array}$

G. $f''(x) = 12x^2 + 24x = 12x(x+2)$
$f''(x) = 0$ at $x = 0$, $x = -2$

	$12x$	$x+2$	f''
$-2 < x$	−	−	+
$-2 < x < 0$	−	+	−
$x > 0$	+	+	+

CU $(-\infty, -2), (0, \infty)$
CD $(-2, 0)$
IP $(-2, -16), (0, 0)$



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COMET

9) $f(x) = \frac{x}{x-1}$

A. D: $\{x \mid x \neq 1\} = (-\infty, 1), (1, \infty)$

B. $f(0) = 0$ ∴ y-int at 0
$f(x) = 0$ at 0 ∴ x int at 0

C. $f(-x) = \frac{-x}{-x-1} = \frac{x}{x+1}$ ∴ no symmetry

D. $\lim_{x \to \pm\infty} \frac{x}{x-1} = 1$ ∴ horizontal asymptote at $y=1$

$\lim_{x \to 1^+} \frac{x}{x-1} = \infty \quad \lim_{x \to 1^-} \frac{x}{x-1} = -\infty$

∴ vertical asymptote at $x=1$

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

$f(x)$ dne at $x=1$ ∴ critical number $x=1$

	-1	$(x-1)^2$	f'
$x<1$	$-$	$+$	$-$
$x>1$	$-$	$+$	$-$

dec $(-\infty, 1), (1, \infty)$

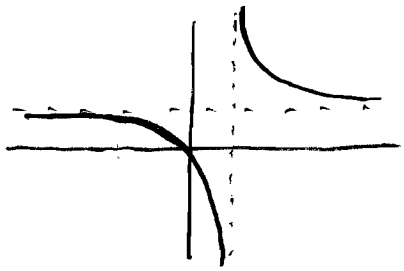
F. No min or max at $x=1$, horizontal asymptote at $x=1$ from D above.

G. $f''(x) = \frac{2}{(x-1)^3}$

f'' dne at x 1

	$(x-1)^3$	f''
$x<1$	$-$	$-$
$x>1$	$+$	$+$

CD $(-\infty, 1)$
CU $(1, \infty)$
No IP at $x=1$ because vert asymptote at $x=1$



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COMET

12) $f(x) = \dfrac{x}{x^2-9}$

A: $D = \{x \mid x \neq \pm 3\}$

B: $f(0)=0$, y-int at 0

$f(x)=0$ at $x=0$ ∴ x-int at $x=0$

C. $f(-x) = \dfrac{-x}{(-x)^2-9} = -\dfrac{x}{x^2-9} = -f(x)$ ∴ odd

D. $\lim\limits_{x\to\pm\infty} \dfrac{x}{x^2-9} = 0$ ∴ horizontal asymptote at $y=0$

$\lim\limits_{x\to 3^-} f(x) = -\infty$ $\lim\limits_{x\to 3^+} f(x) = \infty$ $\lim\limits_{x\to -3^-} f(x) = -\infty$ $\lim\limits_{x\to -3^+} f(x) = \infty$

∴ vert asymptotes at $x=-3$, $x=3$

E. $f'(x) = \dfrac{(x^2-9) - x(2x)}{(x^2-9)^2} = -\dfrac{x^2+9}{(x^2-9)^2}$

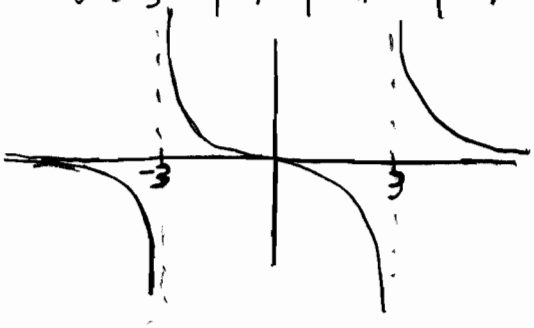
	$-(x^2+9)$	$(x^2-9)^2$	f'
$-3<x$	−	+	−
$-3<x<3$	−	+	−
$x>3$	−	+	−

decreasing: $(-\infty,-3)$, $(-3,3)$, $(3,\infty)$

F. no min or max

G. $f''(x) = -\dfrac{2x(x^2-9)^2 - (x^2+9)\cdot 2(x^2-9)(2x)}{(x^2-9)^4}$

$f''(x) = \dfrac{2x(x^2+27)}{(x^2-9)^3}$ $f''=0$ at $x=0$
f'' DNE $x=\pm 3$

	$2x$	x^2+27	$(x^2-9)^3$	f''
$x<-3$	−	+	+	−
$-3<x<0$	−	+	−	+
$0<x<3$	+	+	−	−
$x>3$	+	+	+	+

CU: $(-3,0)$, $(3,\infty)$
CD: $(-\infty,-3)$, $(0,3)$
IP: $(0,0)$
No IPs at $x=\pm 3$ because of vert asympt.