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

20) $y = 2\sqrt{x} - x$

A. Domain: $\{x \mid x \geq 0\}$

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

x-int: $2\sqrt{x} - x = 0 \rightarrow 2\sqrt{x} = x \rightarrow 4x = x^2 \rightarrow 4x - x^2 = 0$

$x(4-x) = 0 \quad \therefore$ x-int at $x = 0, 4$

C. No symmetry

D. $\lim_{x \to \infty} 2\sqrt{x} - x = \infty - \infty$

$= \lim_{x \to \infty} \sqrt{x}(2 - \sqrt{x}) = \infty \cdot (-\infty) = -\infty$

$\therefore$ No Horizontal Asymptotes

No Vertical Asymptotes

E. Inc / Dec

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

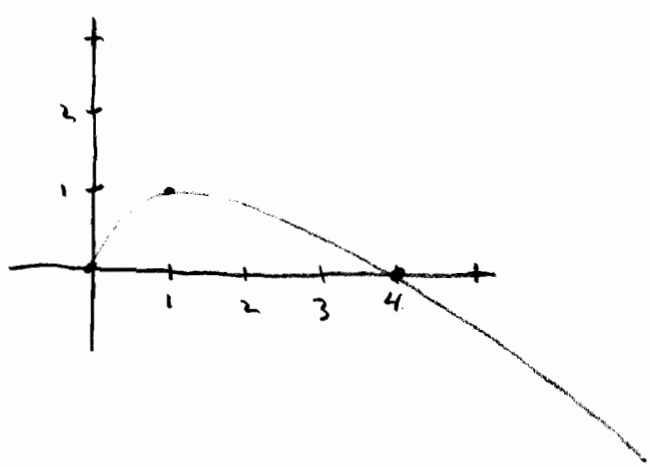
$\frac{1}{\sqrt{x}} - 1 = 0 \quad \frac{1}{\sqrt{x}} = 1 \quad x = 1 \quad \therefore$ critical number of $x = 1$

	$\frac{1}{\sqrt{x}} - 1$	
$0 \leq x < 1$	+	increasing $[0, 1)$
$x > 1$	−	decreasing $(1, \infty)$

F. local max at $x = 1$ $(1, 1)$

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

f'' DNE when $x = 0$, $f'' < 0$ for $x > 0$, $\therefore$ CD $(0, \infty)$



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COMET

29) $y = \sqrt[3]{x^2-1}$

A. Domain: $\mathbb{R}$

B. y-int: $f(0) = \sqrt[3]{-1} = -1$

x-int $f(x) = 0$ when $x = \pm 1$

C. Symmetry: $f(-x) = \sqrt[3]{(-x)^2-1} = \sqrt[3]{x^2-1} = f(x)$

$\therefore$ even

D. $\lim_{x \to \pm\infty} \sqrt[3]{x^2-1} = \infty$ $\therefore$ no asymptotes

E. Inc / Dec: $f(x) = (x^2-1)^{1/3}$

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

$$= \frac{2x}{3\sqrt[3]{(x^2-1)^2}}$$

Critical Numbers: $f' = 0$ at $x = 0$

f' DNE at $x = \pm 1$

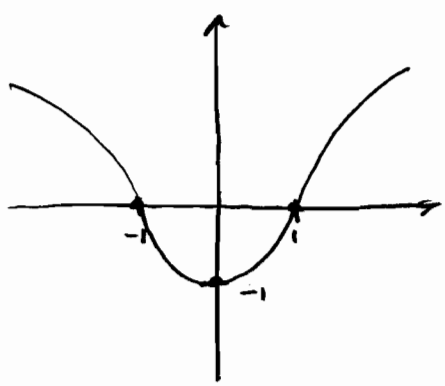
	$2x$	$\sqrt[3]{(x^2-1)^2}$	f'	
$x < -1$	$-$	$+$	$-$	decreasing $(-\infty, 0)$
$-1 < x < 0$	$-$	$+$	$-$	
$0 < x < 1$	$+$	$+$	$+$	increasing $(0, \infty)$
$x > 1$	$+$	$+$	$+$	

F. local min at $x = 0$ of -1 $(0, -1)$

G. $f''(x) = -\dfrac{2(x^2+3)}{9(x^2-1)^{5/3}}$ $\quad f'' \overset{?}{=} 0$ never

f'' DNE at $x = \pm 1$

	-1	x^2+3	$(x^2-1)^{5/3}$	f''	
$x < -1$	$-$	$+$	$+$	$-$	CD $(-\infty, -1)$, $(1, \infty)$
$-1 < x < 1$	$-$	$+$	$-$	$+$	CU $(-1, 1)$
$x > 1$	$-$	$+$	$+$	$-$	IP at $(-1, 0)$ & $(1, 0)$



31) $y = f(x) = 3\sin x - \sin^3 x$

Will Add Solution Later

COMET
3-0235 — 50 SHEETS — 5 SQUARES
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COMET

47) $y = \ln(\sin x)$

A. Domain: $\{x \mid \sin x > 0\}$
: $\ldots (-4\pi, -3\pi) \cup (-2\pi, -\pi) \cup (0, \pi) \cup (2\pi, 3\pi) \ldots$

B. No y-int
x-int occur when $f(x) = 0$

$$\ln(\sin x) = 0$$
$$\sin x = e^0$$
$$\sin x = 1$$
$$\therefore x = 2\pi n + \frac{\pi}{2}$$

C. f is periodic with period 2π

D. No Horizontal Asymptotes

Vertical Asymptotes: ln goes to $-\infty$ when its argument approaches zero. This occurs when $\sin x = 0$, or $x = \pi n$
$\therefore$ vertical asymptotes at $\ldots -2\pi, -\pi, 0, \pi, 2\pi \ldots$

$$\lim_{x \to (2n\pi)^+} f(x) = -\infty \qquad \lim_{x \to (2n+1)\pi^-} f(x) = -\infty$$

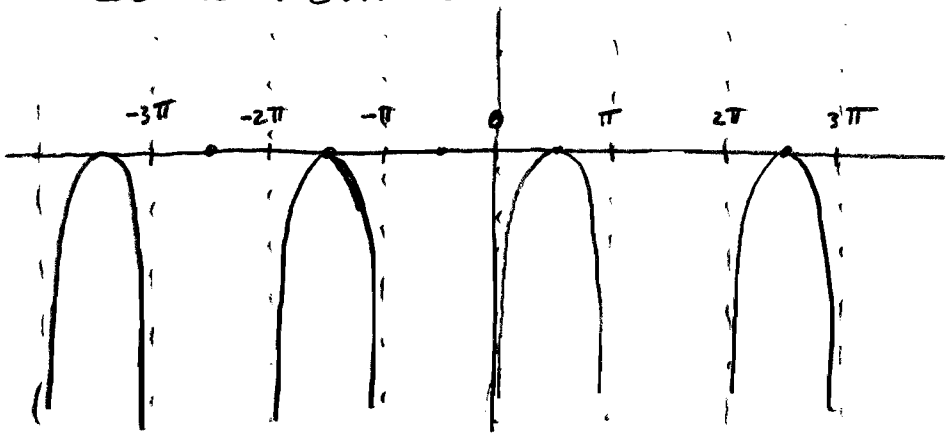
E. $f'(x) = \dfrac{\cos x}{\sin x}$ $\therefore$ crit numbers $x = 2n\pi + \dfrac{\pi}{2}$

$f'(x) > 0$ $\quad 2n\pi < x < 2n\pi + \pi/2$ $\quad$ increasing

$f'(x) < 0$ $\quad 2n\pi + \pi/2 < x < (2n+1)\pi$ $\quad$ decreasing

F. local <u>max</u> values at $x = 2n\pi + \dfrac{\pi}{2}$

$$f\left(2n\pi + \frac{\pi}{2}\right) = 0$$

G. $f''(x) = -\csc^2 x = -\dfrac{1}{\sin^2 x}$

Since the domain is x, such that $\sin x > 0$, $-\dfrac{1}{\sin^2 x}$ is < 0,
$\therefore$ CD across entire domain.