1. $y = x^4 - 4x^3 + 16x$

$y' = 4(x+1)(x-2)^2$

$y'' = 12x(x-2)$

y': $-$ | -1 | $+$ | 2 | $+$

y'': $+$ | 0 | $-$ | 2 | $+$

Rel. Extrema: $f(-1) = 1 + 4 - 16 = -11$

Rel. Min @ $(-1, -11)$

Inf. Points: $f(0) = 0$

$f(2) = 16 - 32 + 32 = 16$

Inf. Pts. @ $(0,0)$ and $(2,16)$

$\boxed{x\text{-int}}$ $0 = x^4 - 4x^3 + 16x$

you'll have a nice intercept on the test

$x \approx -1.679$

a. Domain: $(-\infty, \infty)$

b. Range: $[-11, \infty)$

c. Asymptotes: None

d. Rel. Extrema: Rel. Min @ $(-1, -11)$

e. Inc on $(-1, \infty)$, Dec on $(-\infty, -1)$

f. Inf. Pts. @ $(0,0)$ & $(2,16)$

g. C.U. on $(-\infty, 0) \cup (2, \infty)$

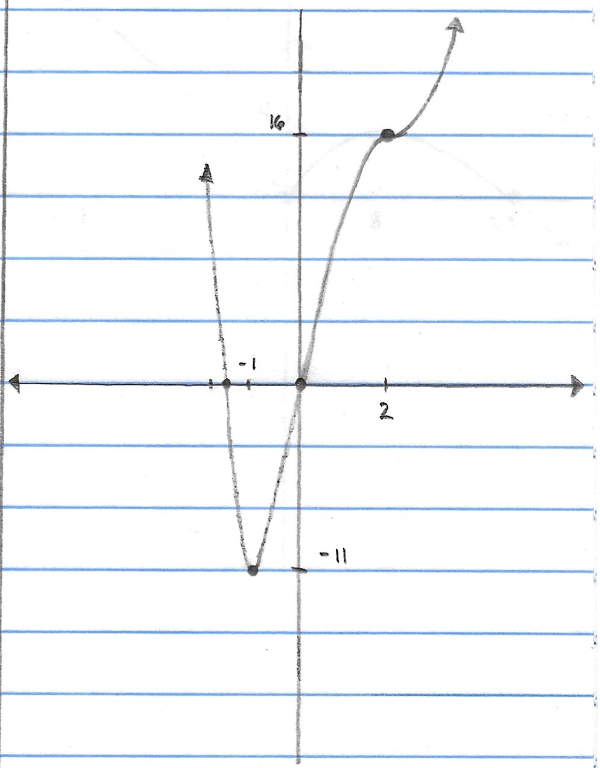
C.D. on $(0, 2)$

h. On Right

i. x-int: $(-1.679, 0)$; y-int: $(0,0)$

j. Symmetry: None

k. Critical #'s: $x = -1, 2$



2. $y = 3x^{2/3} - x$ $\qquad y' = \dfrac{2 - x^{1/3}}{x^{1/3}}$ $\qquad y'' = \dfrac{-2}{3x^{4/3}}$

Critical #'s : $2 - x^{1/3} = 0$ $2 = x^{1/3}$	$x = (2)^3$ $= 8$	y': $-$ on $(-\infty,0)$, $+$ on $(0,8)$, $-$ on $(8,\infty)$	$0 = x^{2/3}(3 - x^{1/3})$ $x = 0, 27$
P.I.P.s : $x = 0$	y'': $-$ on $(-\infty,0)$, $-$ on $(0,\infty)$	Rel. Extrema : $f(8) = 3(4) - 8 = 4$ Rel. Min @ $(0,0)$; Rel. Max @ $(8,4)$	

a. Domain : $(-\infty, \infty)$

b. Range : $(-\infty, \infty)$

c. Asymptotes : None

d. Rel. Extrema : Rel. Min @ $(0,0)$

Rel. Max @ $(8,4)$

e. Inc. on $(0,8)$, Dec. on $(-\infty,0) \cup (8,\infty)$

f. Inf. Points : None

g. C.D. on $(-\infty,0) \cup (0,\infty)$

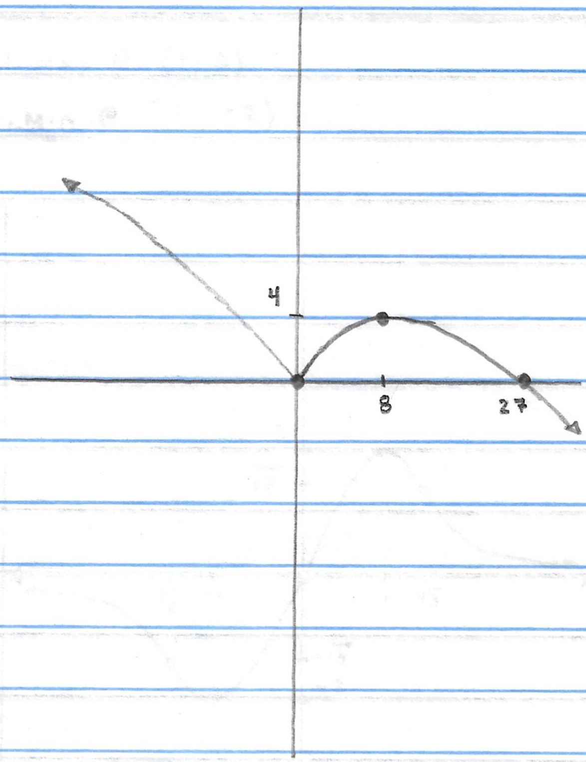
h. on Right

i. x-int : $(0,0)$, $(27,0)$

y-int : $(0,0)$

j. Symmetry : None

K. Critical #'s : $x = 0, 8$



3. $f(x) = {}^{4x}/_{x^2+1}$ $\qquad f'(x) = \dfrac{-4(x^2-1)}{(x^2+1)^2}$ $\qquad f''(x) = \dfrac{8x(x^2-3)}{(x^2+1)^3}$

y' $\quad - \quad + \quad -$ $\quad -1 \quad 1$	y'' $\quad - \quad + \quad - \quad +$ $\quad -\sqrt{3} \quad 0 \quad \sqrt{3}$	$f''(1) = +(-)$ $+$	$f''(2) = +(+)$ $f''(-2) = -(+)$

Inflection Pts : $f(-\sqrt{3}) = \dfrac{-4\sqrt{3}}{4}$	$f(0) = 0$	$f(\sqrt{3}) = \dfrac{4\sqrt{3}}{4}$

Inflection Points at : $(0,0)$, $(-\sqrt{3}, -\sqrt{3})$, and $(\sqrt{3}, \sqrt{3})$

Rel. Extrema : $f(-1) = -4/2$ $= -2$	$f(1) = 4/2$ $= 2$	Rel. Max @ $(1, 2)$ Rel. Min @ $(-1, -2)$

a. Domain : $(-\infty, \infty)$

b. Range : $[-2, 2]$

c. Asymptotes : $y = 0$

d. Rel Min @ $(-1, -2)$, Rel. Max @ $(1, 2)$

e. Inc. on $(-1, 1)$ \$ Dec. on $(-\infty, -1) \cup (1, \infty)$

f. Inf. Pts. @ $(0,0)$, $(-\sqrt{3}, -\sqrt{3})$, and $(\sqrt{3}, \sqrt{3})$

g. C.U. on $(-\sqrt{3}, 0) \cup (\sqrt{3}, \infty)$ \$

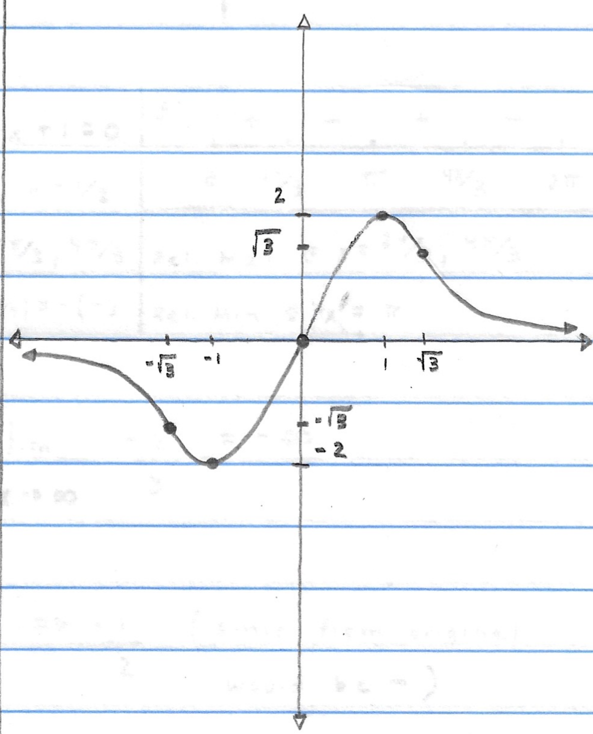
C.D. on $(-\infty, -\sqrt{3}) \cup (0, \sqrt{3})$

h. on Right

i. x \$ y-int : $(0, 0)$

j. symmetry : origin

K. critical #'s : $x = -1, 1$



1.

	x	y		
$f(x) = 3x^4 - 4x^3$				Abs. Max @
$f'(x) = 12x^3 - 12x^2$	-1	7	$f(-1) = 3 - 4(-1) = 3 + 4 = 7$	$f(2) = 16$
$= 12x^2(x-1)$	0	0	$f(0) = 0$	
C.N.: $x = 0, 1$	1	-1	$f(1) = 3 - 4 = -1$	Abs. Min @
	2	16	$f(2) = 3(16) - 4(8) = 48 - 32 = 16$	$f(1) = -1$

2. Since f is not continuous on $[-3, 0]$, MVT does not apply.
($f(-1) = \emptyset$, and $-1 \in (-3, 0)$)

3.

$f(x) = x^3/6 - 8x$	$0 = x^2/2 - 8$	f': $+$ $-$ $+$	Rel. Max @ $x = -4$
$f'(x) = 3x^2/6 - 8$	$8 = x^2/2$	-4 $\quad$ 4	Rel. Min @ $x = 4$
$= x^2/2 - 8$	$16 = x^2 \Rightarrow x = \pm 4$		

4.

$f(x) = \sin^2 x + \sin x$	$\sin x = 0$	\$ $2\cos x + 1 = 0$	f': $+$ $-$ $+$ $-$
$= (\sin x)^2 + \sin x$	$x = 0, \pi$	$\cos x = -1/2$	0 $\quad 2\pi/3$ $\quad \pi$ $\quad 4\pi/3$ $\quad 2\pi$
$f'(x) = 2\sin x \cos x + \sin x$		$x = 2\pi/3, 4\pi/3$	Rel. Max @ $x = 2\pi/3, 4\pi/3$
$= \sin x\,(2\cos x + 1)$	$f'(3\pi/4) = +(-)$	$f'(5\pi/4) = -(-)$	Rel. Min @ $x = \pi$

5. $$\lim_{x \to \infty} \frac{x^2 - x^3 + 4}{3x^2 + 4x - 1} = \lim_{x \to \infty} \frac{-x^3}{3x^2} = \lim_{x \to \infty} \frac{-x}{3} = -\infty$$

6. $$\lim_{x \to -\infty} \frac{x}{\sqrt{4x^2 - 1}} = \lim_{x \to -\infty} \frac{1*}{2*} = \frac{1}{2} \Rightarrow -\frac{1}{2}$$ (since from original would be $-$)

7. $$\lim_{x \to \infty} \frac{\left(x - \sqrt{x^2 + 9x}\right)}{1} \cdot \frac{\left(x + \sqrt{x^2 + 9x}\right)}{\left(x + \sqrt{x^2 + 9x}\right)} \quad \Bigg| \quad \lim_{x \to \infty} \frac{\cancel{x^2} - \cancel{x^2} - 9x}{x + \sqrt{x^2 + 9x}} \cdot \frac{1/x}{1/x}$$

As $x \to \infty$, $1/x = 1/\sqrt{x^2}$

$$\lim_{x \to \infty} \frac{-9}{1 + \sqrt{x^2 + 9x}/\sqrt{x^2}} = \lim_{x \to \infty} \frac{-9}{1 + \sqrt{1 + 9/x}} = \lim_{x \to \infty} \frac{-9}{1 + 1} = \frac{-9}{2}$$