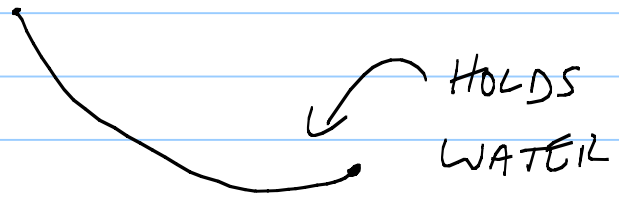
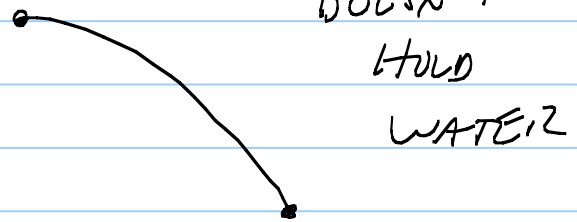
CONCAVITY

Note Title 3/14/2018

CONCAVITY – WHERE THE SECOND DERIVATIVES ARE INCREASING / DECREASING.

- $f(x)$ IS SAID TO BE CONCAVE UP IN AN INTERVAL I IFF (IF AND ONLY IF) $f''(x) > 0$
- $f(x)$ IS SAID TO BE CONCAVE DOWN IN AN INTERVAL I IFF $f''(x) < 0$





CONCAVE UP CONCAVE DOWN

$f''(x) = 0$ INFLECTION POINT

IE GRAPH $y = x^4 - 2x^2$

SOLN (1) x - INTERCEPTS

$x^4 - 2x^2 = 0$

$x^2(x^2 - 2) = 0$

$x^2 = 0 \quad x^2 - 2 = 0$

$x = 0 \quad x = \pm\sqrt{2}$

(2) y - INTERCEPT

$y = (0)^4 - 2(0)^2$

$y = 0$

(3) CP'S $y' = 4x^3 - 4x$

$4x^3 - 4x = 0$

$4x(x^2 - 1) = 0$

$4x = 0 \qquad x^2 - 1 = 0$

$x = 0 \qquad x = \pm 1$

PLUG INTO ORIGINAL FUNCTION

$\therefore \; (0,0) \; , \; (-1,-1) \; , \; (1,-1)$

	$-\infty \to -1$	-1	$-1 \to 0$	0	$0 \to 1$	1	$1 \to \infty$
$f'(x)$	$-$	0	$+$	0	$-$	0	$+$
$f(x)$	DEC	CP	INC	CP	$\downarrow$	CP	$\uparrow$

(4) IP's $y'' = 12x^2 - 4$

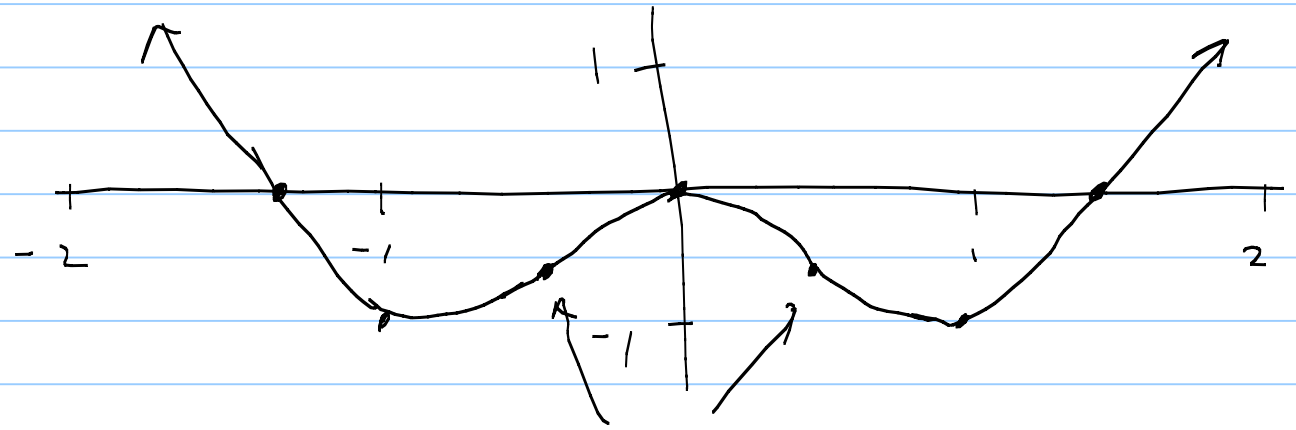
$12x^2 - 4 = 0$

$\frac{12x^2}{12} = \frac{4}{12}$

$x^2 = \frac{1}{3}$

$x = \pm\sqrt{\frac{1}{3}}$ → PLUG INTO ORIGINAL

$\left(-\sqrt{\frac{1}{3}}, \frac{-5}{9}\right)$, $\left(\sqrt{\frac{1}{3}}, \frac{-5}{9}\right)$



IP's (CONCAVITY CHANGES)

H/W p6. 198 # 1, 3, 11, 14, 19, 45