4.3 Day 1

$f(x) = x^4 - 2x^3 + 2$

$f'(x) = 4x^3 - 6x^2 = 0$

$2x^2(2x-3) = 0$

$2x^2 = 0$ $\quad$ $2x - 3 = 0$

$x = 0$ $\quad$ $x = \frac{3}{2}$ min

no sign change

inc: $(\frac{3}{2}, \infty)$

dec: $(-\infty, 0) \cup (0, \frac{3}{2})$

	$(-\infty, 0)$	0	$(0, \frac{3}{2})$	$\frac{3}{2}$	$(\frac{3}{2}, \infty)$
Sign of f'	neg	0	neg	0	pos
f: inc/dec	dec	CP	dec	CP	inc

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$f(x)$: value of the fnc.

$f'(x)$: slope $\rightarrow$ where $f(x)$ is inc/dec.

$f''(x)$: concavity $\rightarrow$ up

$\rightarrow$ down

Concave Up:

$f''(x) > 0$

$f'(x)$ is inc.

Concave Down:

$f''(x) < 0$

$f'(x)$ is dec.

Inflection Point

where concavity changes

$f''(x) = 0$

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Concavity Test

$f(x) = x^4 - 2x^3 + 2$

$f'(x) = 4x^3 - 6x^2$

$f''(x) = 12x^2 - 12x = 0$

$12x(x-1) = 0$

$12x = 0 \quad x - 1 = 0$

$x = 0 \quad x = 1 \quad$ IP

c. up $(-\infty, 0) \cup (1, \infty)$

c. down $(0, 1)$

	$(-\infty, 0)$	0	$(0,1)$	1	$(1, \infty)$
Sign of f''	+	0	−	0	+
Concavity	up	IP	down	IP	up

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1. $y = \frac{1}{3}x^3 + x^2 - 3x + 2$

$y' = x^2 + 2x - 3 = 0$

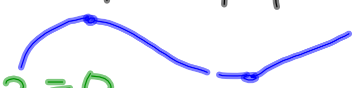
$(x-1)(x+3) = 0$

$x = -3$ max $\quad x = 1$ min

inc: $(-\infty, -3) \cup (1, \infty)$

dec: $(-3, 1)$

	$(-\infty, -3)$	−3	$(-3, 1)$	1	$(1, \infty)$
sign of f'	+	0	−	0	+
inc/dec	inc	CP	dec	CP	inc



$y'' = 2x + 2 = 0$

$x = -1$ IP

c. up $(-1, \infty)$

c. down $(-\infty, -1)$

	$(-\infty, -1)$	−1	$(-1, \infty)$
Sign of f''	−	0	+
conc	down	IP	up

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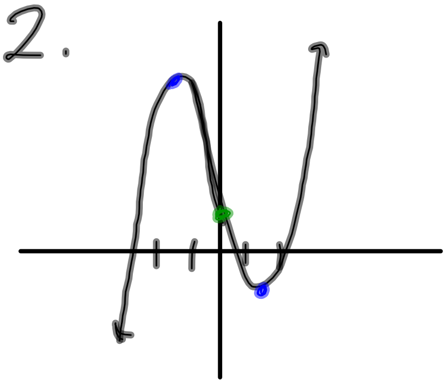
2.



a. $f'(x)=0$ $x=-1.5, 1.5$

$f'(x)>0$ $(-\infty,-1.5)\cup(1.5,\infty)$

$f'(x)<0$ $(-1.5,1.5)$

b. $f''(x)=0$ $x=0$

$f''(x)>0$ $(0,\infty)$

$f''(x)<0$ $(-\infty,0)$

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4. a. when $f(x)$ is inc, $f'(x)$ is pos

inc: $(-\infty,a)\cup(e,\infty)$

when $f(x)$ is dec, $f'(x)$ is neg

dec: $(a,c)\cup(c,e)$

b. when $f(x)$ has max/min, $f'(x)=0$

$x=a$ $x=c$ $x=e$

c. $f''(x)$ is slope of $f'(x)$

up: $(b,c)\cup(d,\infty)$ * where f' is inc.

down: $(-\infty,b)\cup(c,d)$ * where f' is dec.

d. I.P. where $f''(x)=0$, where f' has max/min

$x=b$ $x=d$ $x=c$

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