4.3 Day 2

1. f(x)

CP $x=1$ $x=3$ inc $(3,4)$

$x-1=0$ $x-3=0$

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

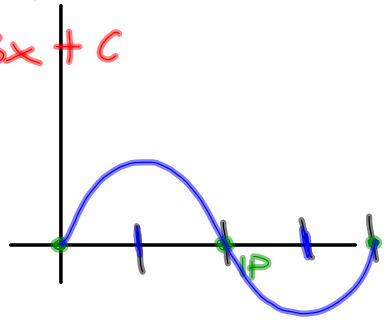
$f'(x)=x^2-4x+3$

IP $x=2$

c. down $(0,2)$

c. up $(2,4)$

$f(x)=\frac{1}{3}x^3-2x^2+3x+C$



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3. f(x)

Inc: $(0,1)\cup(3,4)$

Dec: $(1,3)$

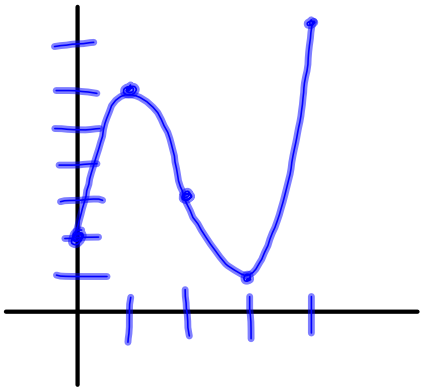
c. up: $(2,4)$

c. down: $(0,2)$

Local max: $x=1$

Local min $x=3$

IP: $x=2$



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Review

Find a CP: $f'(x) = 0$ or DNE

1. f' changes sign
2. 2^{nd} Deriv. ~~Test~~

Find an IP: $f''(x) = 0$

Inflection Point

1. $f(x)$ changes concavity
2. f'' changes sign
3. f' changes from dec to inc or inc to dec

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Second Deriv. ~~Test~~

- If $f'(c) = 0$ (CP) and $f''(c) < 0$ (c. down) then f has a local max @ $x = c$.
- If $f'(c) = 0$ (CP) and $f''(c) > 0$ (c. up) then f has a local min @ $x = c$.

1. $g(x) = -x^3 + 9x$

$g'(x) = -3x^2 + 9 = 0$

$x^2 = 3$

$x = \pm\sqrt{3}$

$g''(x) = -6x$

$g''(-\sqrt{3}) = -6(-\sqrt{3}) = +$ min @ $x = -\sqrt{3}$

$g''(\sqrt{3}) = -6\sqrt{3} = -$ max @ $x = \sqrt{3}$

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2. $f(x)=x^5-80x+100$

$f'(x)=5x^4-80=0$

$x^4=16$

$x=\pm 2$

$f''(x)=20x^3$

$f''(-2)=20(-2)^3=-$ max @ $x=-2$

$f''(2)=20(2)^3=+$ min @ $x=2$

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3. $y=xe^x$

$y'=xe^x+e^x=0$

$e^x(x+1)=0$

$e^x\neq 0$ $x+1=0$

$x=-1$

$y''=xe^x+e^x+e^x$

$=2e^x+xe^x\Big|_{x=-1}$

$2e^{-1}+(-1)e^{-1}$

$\frac{2}{e}-\frac{1}{e}=\frac{1}{e}$ +

min @ $x=-1$

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5. $f(x)$ is inc when f' is pos

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

Dec: $(-3, -1)$

extrema: when $f' = 0$

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

f' is slope of f'

c. up: $(-2, -\frac{1}{2}) \cup (1, \infty)$

down: $(-\infty, -2) \cup (-\frac{1}{2}, 1)$

$f'' = 0$ where f' has max/min

$x = -2, -\frac{1}{2}, 1$

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