Homework 4-5:

① Random Time and false question: logical

② $f(x)=7x^3+7x$

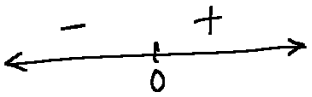
$f'(x)=21x^2+7$; then None

criticals

increasing: $(-\infty,\infty)$

decrease: $x\in\emptyset$

local min & max: None

$f''(x)=42x$; 

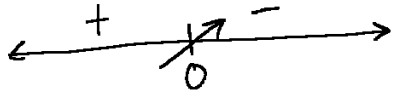
concave up: $(0,\infty)$

concave down: $(-\infty,0)$

inflection: (1)

③ $f(x)=e^{-2.5x^2}$

$f'(x)=e^{-2.5x^2}(-5x)=0$



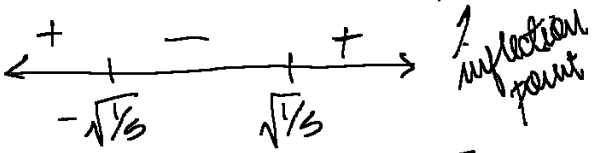
increase: $(-\infty,0)$

decrease: $(0,\infty)$

local max: 5; min: None

$f''(x)=-5e^{-2.5x^2}+25x^2e^{-2.5x^2}=0$

$f''(x)=(25x^2-5)=\pm\sqrt{1/5}$



concave up: $(-\infty,-\sqrt{\frac{1}{5}})\cup(\sqrt{\frac{1}{5}},\infty)$

concave down: $(-\sqrt{\frac{1}{5}},\sqrt{\frac{1}{5}})$

④ $f(x)=5x(x^2+4)^{-1}$; $f'(x)=5(x^2+4)^{-1}-5x(x^2+4)^{-2}(2x)$

$f'(x)=(-5x^2-20)\div(x^2-4)^2$; CP = None

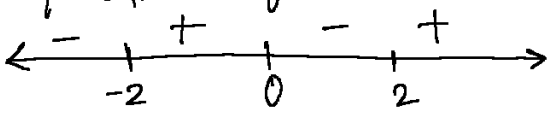
increase: none w/ VA: (±2)

decrease: $(-\infty,-2)\cup(-2,2)\cup(2,\infty)$

local min & max: None

$f''(x)=\dfrac{-10x(x^2-4)^2-(-20x^3-80x)(x^2-4)}{(x^2-4)^4}$

simplify w/ inflection = 0 & ±2 ← DNE



concave up: $(-2,0)\cup(2,\infty)$

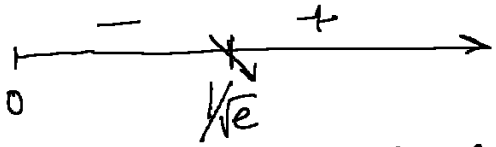
down: $(-\infty,-2)\cup(0,2)$

$\lim_{x\to\infty}\frac{5x}{x^2-4}=0$ = horizontal asymptote

$x^2-4=0$; (±2) Vertical Asy

⑤ $f(x)=3x^2\ln(x)$; $f'=6x\ln x+3x$

$6x\ln x+3x=0$; $x=e^{-1/2}$ & 0 ← DNE

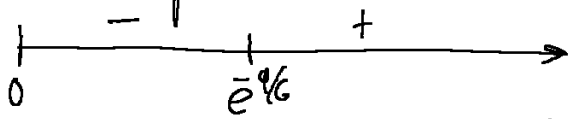


increase: $(1/\sqrt{e},\infty)$; dec: $(0,1/\sqrt{e})$

local min: $1/\sqrt{e}$; max: None

$f''(x)=6\ln x+9$; $f''(x)=\frac{-9}{6}=\ln(x)$

inflection P = $e^{-9/6}$



concave up: $(e^{-9/6},\infty)$; down: $(0,e^{-9/6})$

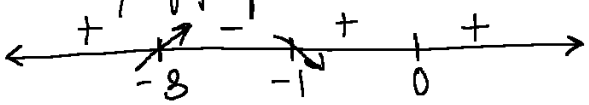
HW 4-6: Continued:

⑥ $f(x)=x^{1/3}(x+3)^{2/3}$

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

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

simplify equation: $\boxed{x=-1}$



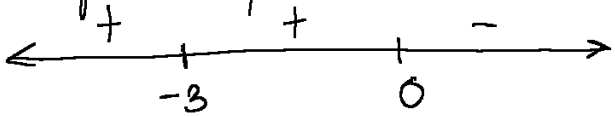
increasing: $(-\infty,-3)\cup(-1,\infty)$

decreasing: $(-3,-1)$

local max: -3 & local min: -1

$f''(x)=\frac{-2(x+3)^{2/3}}{9x^{5/3}}-\frac{2x^{1/3}}{9(x+3)^{4/3}}+\frac{4}{9x^{2/3}(x+3)^{1/3}}$

inflection point: 0 (sign change)



Concave up then: $(-\infty,-3)\cup(-3,0)$

Concave down: $(0,\infty)$