9–18

(a) Find the intervals on which f is increasing or decreasing. → f'

(b) Find the local maximum and minimum values of f.

(c) Find the intervals of concavity and the inflection points. → f''

17. $f(x) = (\ln x)/\sqrt{x}$

$$f' = \frac{\sqrt{x}\cdot\frac{1}{x} - \frac{1}{2\sqrt{x}}\ln x}{(\sqrt{x})^2} = \frac{\left(\frac{1}{\sqrt{x}} - \frac{\ln x}{2\sqrt{x}}\right)2\sqrt{x}}{(x)2\sqrt{x}}$$

$$\frac{\sqrt{x}}{x} = \frac{1}{\sqrt{x}}$$

$$= \frac{2 - \ln x}{2x^{3/2}}$$

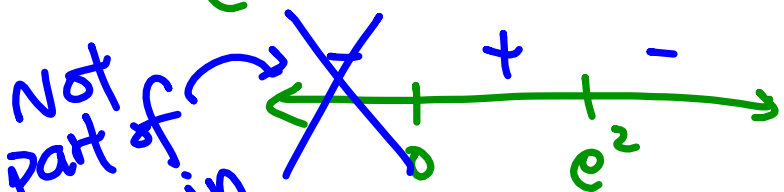
$2 - \ln x = 0$ $\quad 2x^{3/2} = 0$

$2 = \ln x$ $\quad x = 0$

$x = e^2$

f inc. $(0, e^2)$

Not part of Domain.



f dec (e^2, ∞)

$$\frac{2 - \ln e}{2e^{3/2}} = \frac{2-1}{2e^{3/2}}$$

b) $x=e^2$ has L. max
b/c f' goes from + to −
as x increases.

c) $f'=\dfrac{2-\ln x}{2x^{3/2}}$

$f''=\dfrac{-\frac{1}{x}(2x^{3/2})-(2-\ln x)3x^{\frac{1}{2}}}{4x^3}$ ($x^{\frac{1}{2}}$)

$=\dfrac{-2\sqrt{x}-3\sqrt{x}(2-\ln x)}{4x^3}$

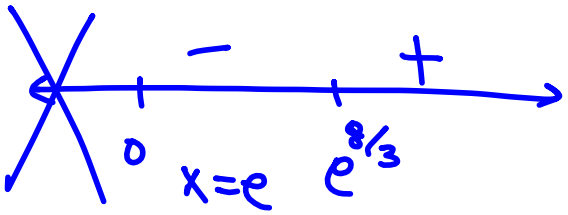
$=\dfrac{-\sqrt{x}(2+6-3\ln x)}{4x^3}$

$=\dfrac{-\sqrt{x}(8-3\ln x)}{4x^3}$

$x=0$

$8-3\ln x=0$

$\frac{8}{3}=\ln x \rightarrow x=e^{\frac{8}{3}}$



f concave dn: $(0, e^{8/3})$

f concave up: $(e^{8/3}, \infty)$

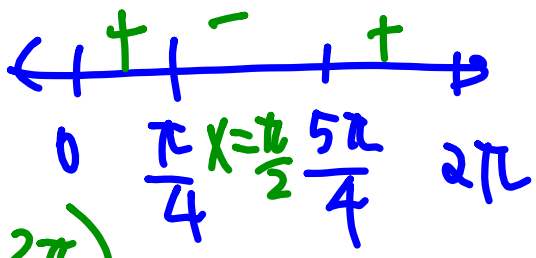
P.I when $x=e^{8/3}$

13. $f(x) = \sin x + \cos x, \quad 0 \leq x \leq 2\pi$

$f' = \cos x - \sin x = 0$

$\cos x = \sin x$

$1 = \frac{\sin x}{\cos x} = \tan x.$ → $x = \frac{\pi}{4}, \frac{5\pi}{4}$



f inc: $(0, \frac{\pi}{4}) \cup (\frac{5\pi}{4}, 2\pi)$

f dec: $(\frac{\pi}{4}, \frac{5\pi}{4})$

L. max: $x = \frac{\pi}{4}$

L. min: $x = \frac{5\pi}{4}$

$$f'' = -\sin x - \cos x = 0$$

$$\frac{\sin x}{\cos x} = -1 = \tan x$$

$$x = \frac{3\pi}{4}, \frac{7\pi}{4}$$