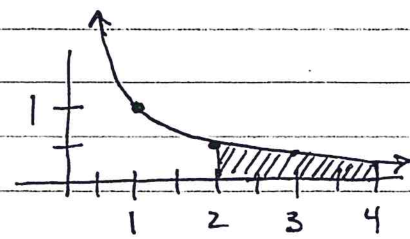
CH. 5 AP 5-1

2\. a) $f(x) = \frac{1}{x}$ $g(x) = \ln|x|$

$\int_2^4 f(x)\,dx$ GRAPHICALLY



REPRESENTS AREA UNDER CURVE ABOVE X-AXIS FROM $x=2$ to $x=4$

$g(4) - g(2) = \ln(4) - \ln(2) = \ln\left(\frac{4}{2}\right) = \ln 2$

$\int_2^4 f(x)\,dx = g(4) - g(2)$ so both equal $\ln 2$

b) $g(3)$ HAS THE GREATEST VALUE

$f(4) = \frac{1}{4}$ $\int_1^2 f(x)\,dx = .693147$

$g(3) = \ln 3 \approx 1.098612$ $g'(2) = \frac{1}{2}$

c) $f(x) = \frac{1}{x}$

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

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

3\. a) $f(x) = e^x - x$ $f'(x) = e^x - 1$ C.V.

$e^x = 1$

$f''(x) = e^x$ $x = 0$

$f''(0) = 1$ C.U. $\therefore$ at $x=0$ local min

b) $f'(1)$ has lesser value $\int_{-1}^1 f(x)\,dx = 2.3504$

$f'(1) = e - 1 \approx 1.71828$

c) $a = 0$ $\int_0^a f(x)\,dx = f'(a)$

$e^x - \frac{1}{2}x^2 \Big]_0^a = e^a - 1$

$e^a - \frac{1}{2}a^2 - e^0 + 0 = e^a - 1$

$-\frac{1}{2}a^2 = 0$ $a = 0$

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Problem Solving

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4. $f(x) = \sin(\ln x)$

a) $(0, \infty)$ $\therefore$ this is the domain of $\ln x$

b) $x = e^{\pi/2}$ and $x = e^{\frac{5\pi}{2}}$

$\sin(\ln x) = 1$

$\sin\theta = 1$ so $\ln x = \frac{\pi}{2}$

$\theta = \frac{\pi}{2}, \frac{5\pi}{2}, \ldots$ $x = e^{\frac{\pi}{2}}$

c) $x = e^{3\pi/2}$ and $x = e^{7\pi/2}$

$\sin(\ln x) = -1$

$\sin\theta = -1$ so $\ln x = \frac{3\pi}{2}$

$\theta = \frac{3\pi}{2}, \frac{7\pi}{2}, \ldots$ $x = e^{\frac{3\pi}{2}}$

d) $[-1, 1]$ $f(\theta) = \sin\theta$ Range is $-1 \le y \le 1$

e) MAX is 1 when $x = e^{\pi/2}$

$f'(x) = \dfrac{\cos(\ln x)}{x}$ $\cos\frac{\pi}{2} = 0$ $\therefore$ C.V. $x = e^{\pi/2}$

$f(1) = 0$

$f(e^{\frac{\pi}{2}}) = 1$

$f(10) = .74$

7. $c = e - 1$

M.V.T. $f(x) = \ln x$ $[1, e]$

① is con't $[1, e]$

② is diff $(1, e)$ $f'(x) = \frac{1}{x}$

so $f'(c) = \dfrac{f(b) - f(a)}{b - a}$

$\dfrac{1}{x} = \dfrac{\ln e - \ln 1}{e - 1}$

$\dfrac{1}{x} = \dfrac{1 - 0}{e - 1}$ $\therefore$ $x = e - 1$