CALC I Homework Sec 5.1
pg 321 SOLUTIONS



(43) $f(x) = \ln(3x) \Rightarrow f'(x) = \boxed{\frac{1}{(3x)}(3)}$

DO NOT SIMPLIFY ON THE EXAM!!

(45) $f(x) = \ln(x^2+3)$

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

OR $\boxed{\frac{2x}{x^2+3}}$

EITHER IS OK

(47) $y = (\ln(x))^4 \Rightarrow f'(x) = \boxed{4(\ln(x))^3\left(\frac{1}{x}\right)}$

(49) $y = \ln(t+1)^2 \Rightarrow y' = \boxed{\frac{1}{(t+1)^2}(2(t+1)(1))}$

OR

Rewrite: $y = 2\ln(t+1) \Rightarrow y' = \boxed{2\left(\frac{1}{t+1}\right)(1)}$

(51) $y = \ln(x\sqrt{x^2+1})$

Rewrite

$y = \ln(x \cdot (x^2+1)^{1/2}) \Rightarrow y' = \boxed{\frac{1}{x(x^2+1)^{1/2}}\left(x\left(\frac{1}{2}(x^2+1)^{-1/2}(2x)\right) + (x^2+1)^{1/2}(1)\right)}$

OR

Rewrite:

$y = \ln(x) + \ln(x^2+1)^{1/2}$

$= \ln(x) + \frac{1}{2}\ln(x^2+1)$ ← use properties of Logs

$\Rightarrow y' = \boxed{\frac{1}{x} + \frac{1}{2} \cdot \frac{1}{x^2+1}(2x)}$

(53) $f(x) = \ln\left(\frac{x}{x^2+1}\right)$

$\Rightarrow$ Rewrite:

$f(x) = \ln(x) - \ln(x^2+1)$

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

$= \boxed{\frac{1}{x} - \frac{2x}{x^2+1}}$

(55) $g(t) = \frac{\ln(t)}{t^2}$

Rewrite

$g(t) = t^{-2} \cdot \ln(t) \Rightarrow g'(t) = \boxed{(t^{-2})\left(\frac{1}{t}\right) + \ln(t)(-2t^{-1})}$

(57) $y = \ln(\ln(x^2))$

$\Rightarrow y' = \boxed{\frac{1}{\ln(x^2)} \cdot \frac{1}{(x^2)}(2x)}$ or Rewrite $y = \ln(2\ln(x))$

$\Rightarrow y' = \boxed{\left(\frac{1}{2\ln(x)}\right)\left(\frac{2}{x}\right)}$

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(59) $y = \ln\left(\sqrt{\frac{x+1}{x-1}}\right)$ this is Much Easier if you re-write

Rewrite $y = \ln\left(\frac{x+1}{x-1}\right)^{1/2} = \frac{1}{2}\ln\left(\frac{x+1}{x-1}\right) = \frac{1}{2}[\ln(x+1) - \ln(x-1)]$

so $y' = \boxed{\frac{1}{2}\left[\frac{1}{(x+1)} - \frac{1}{(x-1)}\right]}$

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(61) $f(x) = \ln\left(\frac{\sqrt{4+x^2}}{x^2}\right)$ AGAIN Rewrite using properties of logs

$\Rightarrow f(x) = \ln((4+x^2)^{1/2}) - \ln(x^2)$

$= \frac{1}{2}\ln(4+x^2) - 2\ln(x)$

so $f'(x) = \boxed{\frac{1}{2} \cdot \frac{1}{(4+x^2)}(2x) - \frac{2}{x}}$

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(67). $y = \ln(x^4)$ $(1,0) \Rightarrow y - 0 = \underline{\quad}(x-1)$

need slope

Re-write

$y = 4\ln(x) \Rightarrow y' = 4 \cdot \frac{1}{x}$

so $\left[y'\right]_{x=1} = \left[\frac{4}{x}\right]_{x=1} = \frac{4}{1} = 4 \Rightarrow y - 0 = 4(x-1)$

$\Rightarrow \boxed{y = 4x - 4}$

(69). $f(x) = 3x^2 - \ln(x)$ $(1,3) \Rightarrow y - 3 = \underline{\quad}(x-1)$

$\Rightarrow f'(x) = 6x - \frac{1}{x} \Rightarrow f'(1) = 6(1) - \frac{1}{(1)}$

$= 6 - 1 = 5$

so

$y - 3 = 5(x-1)$

$\Rightarrow y - 3 = 5x - 5$

$\Rightarrow \boxed{y = 5x - 2}$

(73). $y = x^3 \cdot \ln(x^4)$ $(-1,0) \Rightarrow y - 0 = \underline{\quad}(x-(-1))$

$\Rightarrow y' = (x^3)\left(\frac{1}{(x^4)}(4x^3)\right) + (\ln(x^4))(3x^2)$

$\Rightarrow \left[y'\right]_{x=-1} = \left((-1)^3\right)\left(\frac{1}{(-1)^4}\right)\left(4(-1)^3\right) + \left(\ln(-1)^4\right)\left(3(-1)^2\right)$

$= (-1)(1)(-4) + (0)(3)$

$= 4$

so

$y - 0 = 4(x+1)$

$\Rightarrow \boxed{y = 4x + 4}$