4.3 5, 7, 8, 23, 25, 26, 33, 35, 36, 39, 47, 49

5, 7, 8, 23, 25, 26 Rewrite the logarithm with no products, quotients, roots, or powers inside

5. $\log 6^{10} = 10 \cdot \log 6$

7. $\log_2 (AB^2) = \log_2 A + \log_2 B^2 = \log_2 A + 2\log_2 B$

8. $\log_6 \sqrt[4]{17} = \log_6 (17^{\frac{1}{4}}) = \frac{1}{4} \log_6 17$

23. $\log \sqrt{\dfrac{x^2+4}{(x^2+1)(x^3-7)^2}} = \log\left(\dfrac{x^2+4}{(x^2+1)(x^3-7)^2}\right)^{\frac{1}{2}}$

$= \frac{1}{2} \log\left(\dfrac{x^2+4}{(x^2+1)(x^3-7)^2}\right)$

$= \frac{1}{2}\left(\log(x^2+4) - \log\left((x^2+1)(x^3-7)^2\right)\right)$ [Don't forget the parentheses!]

$= \frac{1}{2}\left(\log(x^2+4) - \left(\log(x^2+1) + \log(x^3-7)^2\right)\right)$

$= \frac{1}{2}\left(\log(x^2+4) - \log(x^2+1) - \log(x^3-7)^2\right)$

$= \frac{1}{2}\left(\log(x^2+4) - \log(x^2+1) - 2\log(x^3-7)\right)$

$= \frac{1}{2}\log(x^2+4) - \frac{1}{2}\log(x^2+1) - \log(x^3-7)$

Remember: You can't break up addition or subtraction inside the logarithm, tempting though it may be.

25. $\ln\left(\dfrac{x^3\sqrt{x-1}}{3x+4}\right) = \ln\left(x^3\sqrt{x-1}\right) - \ln(3x+4)$

$= \ln x^3 + \ln\sqrt{x-1} - \ln(3x+4)$

$= 3\ln x + \frac{1}{2}\ln(x-1) - \ln(3x+4)$ (Since $\sqrt{x-1} = (x-1)^{\frac{1}{2}}$).

26. $\log\left(\dfrac{10^x}{x(x^2+1)(x^4+2)}\right) = \log 10^x - \log\left(x(x^2+1)(x^4+2)\right)$

$= x - \left(\log x + \log(x^2+1) + \log(x^4+2)\right)$ (Since $x = \log 10^x$).

$= x - \log x - \log(x^2+1) - \log(x^4+2)$

4.3 cont'd

33, 35, 36 Evaluate the expression (without a calculator)

33. $\ln 6 - \ln 15 + \ln 20 = \ln \frac{6}{15} + \ln 20$
$= \ln \frac{2}{5} + \ln 20$
$= \ln 20 \cdot \frac{2}{5}$
$= \ln 8$ Note: This is the exact answer

35. $10^{2\log 4} = 10^{\log 4^2} = 10^{\log 16} = 16$

36. $\log_2 8^{33} = 33 \log_2 8 = 33 \cdot 3 = 99$ (Since $\log_2 8 = 3$).

39, 47. Rewrite as a single logarithm.

39. $\log_3 5 + 5\log_3 2 = \log_3 5 + \log_3 2^5$
$= \log_3 5 \cdot 2^5$
$= \log_3 160.$

47. $\frac{1}{3}\log(2x+1) + \frac{1}{2}[\log(x-4) - \log(x^4 - x^2 - 1)] = \log(2x+1)^{\frac{1}{3}} + \frac{1}{2}\log\left(\frac{x-4}{x^4-x^2-1}\right)$
$= \log\sqrt[3]{2x+1} + \log\left(\frac{x-4}{x^4-x^2-1}\right)^{\frac{1}{2}}$
$= \log \sqrt[3]{2x+1} \cdot \sqrt{\frac{x-4}{x^4-x^2-1}}$
(You can't combine these radicals)

49. Use the Change of Base Formula and a calculator to evaluate the logarithm correct to six decimal places.
$\log_2 5 = \frac{\log_{10} 5}{\log_{10} 2} \approx 2.321928$
You could have also done:
$\log_2 5 = \frac{\ln 5}{\ln 2} \approx 2.321928$
which gets the same answer.

END OF 4.3