1. Expand using the properties of logarithms: $\ln\left(\sqrt{\frac{x(x-1)}{x^2+2}}\right)$ (Hint: first bring down the ½ exponent)

2. Write as a single logarithm and simplify:
$\frac{1}{2}\log_5(2x+1)+\log_5(x^2-1)-\log_5(x-1)-3\log_5(x-4)$

3. Evaluate without a calculator: $\log_5 105-\log_5 3-\log_5 7$

4. Use the Change of Base Theorem to rewrite $\log_2 0.3$ in terms of common logarithms. Then use a calculator to evaluate to four decimal places.

Challenge: Prove that $\log_a A+\log_a B=\log_a(AB)$. (Hint: Start from the LHS and rewrite as $\log_a\left(a^{\log_a A+\log_a B}\right)$.)

Q: How can half of 12 be 7?

5. Expand using the properties of logarithms: $\log_3\left(\frac{x^3}{3(y-1)(z+2)^2}\right)$

6. Expand using the properties of logarithms: $\ln\left(\frac{(x+1)\sqrt{2x-3}}{x^2-x-2}\right)$

7. Expand using the properties of logarithms: $\log\sqrt{\frac{10x^2-10x-60}{(x+1)^7}}$

8. Expand using the properties of logarithms: $\ln\left(e^5 \cdot \sqrt[3]{x} \cdot (2x^2 - 9x - 5)\right)$

9. Write as a single logarithm and simplify: $\ln(x+1) + 2\ln x - \frac{1}{2}\ln(3x-1) - 5\ln(7-x)$

10. Write as a single logarithm and simplify: $\ln\frac{x^2}{x-2} - \ln(x-2) + \ln(x^2 - x - 2)$

11. Write as a single logarithm and simplify: $2\ln(x-1)-\frac{1}{2}\ln(x^2+1)-3\ln(x^2-1)$

12. Write as a single logarithm and simplify: $9\log_2\sqrt[3]{x-1}+2\log_2(5x^3)-2\log_2 3-\log_2(x+2)^4$

13. Write as a single logarithm and simplify:
$\frac{1}{5}\log_4(1-3x)-2\log_4(x+3)+\log_4(x^2-9)-\frac{1}{2}\log_4(x^2+4)$

14. Evaluate without a calculator: $\log_5 15 + \log_5 2 - \log_5 6$

15. Evaluate without a calculator: $7^{\log_7 3 + \log_7 4}$

16. Evaluate without a calculator: $e^{2\ln 6 - \ln 2 - \ln 3}$

17. Use the Change of Base Theorem to rewrite $\log_2 e$ in terms of natural logarithms. Then use a calculator to evaluate to four decimal places.

18. Use the Change of Base Theorem to rewrite $\log_5 7$ in terms of common logarithms. Then use a calculator to evaluate to four decimal places.

Optional exercises from the Sullivan book if you'd like more practice:
5.5 (p.305) #13-21 odd, 25, 37-77 odd