Algebra 2/Trigonometry
8.5 Properties of Logarithms

Name _____
Date _____ Block _____

Section 1: Use the properties of logarithms to expand the following.

1. $\log_2 5x =$

$\log_2 5 + \log_2 x$

2. $\log_8 x^4 =$

$4 \log_8 x$

3. $\log_3 \frac{5}{x} =$

$\log_3 5 - \log_3 x$

4. $\ln \sqrt{z} =$

$\frac{1}{2} \ln z$

5. $\ln \sqrt{z}(z-1)^2 =$

$\frac{1}{2} \ln z + 2 \ln (z-1)$

6. $\log_7 \frac{x^2}{y^2 z^3} =$

$2 \log_7 x - 2 \log_7 y - 3 \log_7 z$

or

$2 \log_7 x - (2 \log_7 y + 3 \log_7 z)$

7. $\log_x \frac{\sqrt{a}\, y^4}{z^4} =$

$\frac{1}{2} \log_x a + 4 \log_x y - 4 \log_x z$

8. $\log \left(\frac{x^2 - 1}{x^3} \right)^3 =$

$3 \log (x+1) + 3 \log (x-1) - 9 \log x$

or

$3 (\log (x+1) + \log (x-1) - \log x)$

9. $\ln \frac{x}{\sqrt{x^2+1}} =$

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

10. $\log (x^2 - 8x + 15) =$

$\log (x-5) + \log (x-3)$

Section 2: Use the properties of logarithms to rewrite the following as a single logarithm.

11. $\ln x + \ln 2 =$

$\ln (2x)$

12. $2 \ln 8 + 5 \ln z =$

$\ln (64 z^5)$

13. $\log_4 z - \log_4 y =$

$\log_4\left(\frac{z}{y}\right)$

14. $3\ln x + 2\ln y - 4\ln z =$

$\ln\left(\frac{x^3y^2}{z^4}\right)$

15. $2\log_2(x+4) =$

$\log_2(x+4)^2$

$\log_2(x^2+8x+16)$

16. $4[\ln z + \ln(z+5)] - 2\ln(z-5) =$

$\ln\left(\frac{(z(z+5))^4}{(z-5)^2}\right)$ or $\ln\frac{z^4(z+5)^4}{(z-5)^2}$

17. $\frac{1}{3}\log_3 5x =$

$\log_3 \sqrt[3]{5x}$

18. $\ln x - 2[\ln(x+2) + \ln(x-2)] =$

$\ln\left(\frac{x}{(x^2-4)^2}\right)$

19. $\log_3(x-2) - \log_3(x+2) =$

$\log_3\left(\frac{x-2}{x+2}\right)$

20. $\frac{3}{2}\log_4 5t^6 - \frac{3}{4}\log_4 t^4 =$

$\log_4 5t^6\sqrt{5}$

21. $\log_8 6 + \log_8 x - \log_8 5 + \log_8 y - \log_8 z =$

$\log_8\left(\frac{6xy}{5z}\right)$

22. $1 - 2(\log x + 3\log y) + \frac{1}{2}\log z =$

[Hint: all terms must be logarithms in order to condense. Think properties of logs.]

$\log\frac{10\sqrt{z}}{x^2y^6}$