PreCalc **Name: _____**
3.3 Properties of Logs **Date: _____**

Directions: Follow the directions for each section. Show any work on a separate sheet of paper.

I. Use the properties of logarithms to expand the following.

1. $\log_2 5x$

2. $\log_5 x^4$

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

4. $\ln \sqrt{z}$

5. $\log a (a-1)^2$

6. $\log_5 \frac{x^2 a^3}{b^3}$

7. $\log \left(\frac{x^2 - 4}{x} \right)^2$

8. $\log_x \frac{\sqrt{a} y^4}{z^4}$

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

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

II. Use the properties of logarithms to write the following as a single logarithm.

11. $\ln x + \ln 2$

12. $\log_4 z - \log_4 y$

13. $2 \log_2 (x + 4)$

14. $\frac{1}{3} \log_3 5x$

15. $\log_3 (x - 2) - \log_3 (x + 2)$

16. $2 \ln 8 + 5 \ln z$

17. $2 \ln a - 5 \ln b - 3 \ln c$

18. $2 [\ln(x-1) + \ln x] - \frac{1}{2} \ln(x+2)$

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

20. $\log_4 5t^6 - \log_4 t^4$

III. Given $\log_x 2 = 0.3562$, $\log_x 3 = 0.5646$, and $\log_x 5 = 0.8271$, Evaluate.

21. $\log_x 6$

22. $\log_x \frac{1}{4}$

23. $\log_x \frac{3}{2}$

24. $\log_x 15$

25. $\log_x 25$

26. $\log_x \frac{5}{3}$

27. $\log_x \sqrt{2}$

28. $\log_x 18$

29. $\log_x 40$

30. $\log_x 30$