# Expanding Logarithms

Version 1

**Name**: _____ **Date**: _____ **Score**: _____

Direction: Simplify by expanding the logarithmic expressions. Show all your answer in the space provided.

1) $\log_3\left(27xy^2\right)$

2) $\log_2\sqrt{16x^8y^4z^2}$

3) $\log_3\left(\frac{81\sqrt{x}}{\sqrt{y}}\right)$

4) $\log_6\left(\frac{36\sqrt{x}}{\sqrt[4]{y}}\right)$

1) $$\log_3\left(27xy^2\right)=\log_3\left(3^3xy^2\right)$$
$$=\log_3\left(3^3\right)+\log_3(x)+\log_3(y^2)$$
$$=3\log_3(3)+\log_3(x)+2\log_3(y)$$
$$\log_3\left(27xy^2\right)=3+\log_3(x)+2\log_3(y)$$

2) $$\log_2\sqrt{16x^8y^4z^2}=\log_2\left(16x^8y^4z^2\right)^{\frac{1}{2}}$$
$$=\frac{1}{2}\left[\log_2(2^4)+\log_2(x^8)+\log_2(y^4)+\log_2(z^2)\right]$$
$$=\frac{1}{2}\left[4+8\log_2(x)+4\log_2(y)+2\log_2(z)\right]$$
$$\log_2\sqrt{16x^8y^4z^2}=2+4\log_2(x)+2\log_2(y)+\log_2(z)$$

3) $$\log_3\left(\frac{81\sqrt{x}}{\sqrt{y}}\right)=\log_3(81)+\log_3\left(\sqrt{x}\right)-\log_3\left(\sqrt{y}\right)$$
$$=\log_3\left(3^4\right)+\log_3\left(x^{\frac{1}{2}}\right)-\log_3\left(y^{\frac{1}{2}}\right)$$
$$\log_3\left(\frac{81\sqrt{x}}{\sqrt{y}}\right)=4+\frac{1}{2}\log_3(x)-\frac{1}{2}\log_3(y)$$

4) $$\log_6\left(\frac{36\sqrt{x}}{\sqrt[4]{y}}\right)=\log_6\left(6^2\right)+\log_6\left(x^{\frac{1}{2}}\right)-\log_6\left(y^{\frac{1}{4}}\right)$$
$$=2\log_6\left(6\right)+\log_6\left(x^{\frac{1}{2}}\right)-\log_6\left(y^{\frac{1}{4}}\right)$$
$$\log_6\left(\frac{36\sqrt{x}}{\sqrt[4]{y}}\right)=2+\frac{1}{2}\log_6\left(x\right)-\frac{1}{4}\log_6\left(y\right)$$