1. Solve for $x$ :
a) $\log _{5} x+\log _{8} x=4$

$$
\begin{gathered}
\text { a) } \log _{5} x+\log x=4 \\
\frac{\log x}{\log 5}+\frac{\log x}{\log 8}=4\left\{\begin{array} { l } 
{ \operatorname { l o g } x ( \operatorname { l o g } 5 + \operatorname { l o g } 8 ) = 4 \operatorname { l o g } 5 \operatorname { l o g } 8 } \\
{ \frac { \operatorname { l o g } 8 \operatorname { l o g } x + \operatorname { l o g } 5 \operatorname { l o g } x } { \operatorname { l o g } 5 \operatorname { l o g } 8 } = 4 }
\end{array} \left\{^{4 \log 5 \log 8}\right.\right. \\
\log 40
\end{gathered}
$$

$$
\text { b) } \frac{1}{2} \log _{4}(x+4)+\frac{1}{2} \log _{4}(x-4)=\log _{4} 3
$$

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

$$
\left.\begin{array}{l}
\log _{4}[(x+4)(x-4)]=2 \log _{4} 3 \\
\log _{4}\left[x^{2}-16\right]=\log _{4} 9
\end{array}\right\} \begin{aligned}
& x^{2}-16=9 \\
& x^{2}=25 \\
& x= \pm 5
\end{aligned}
$$

c) $2^{3 x}=5^{3 x+1}$

$$
\begin{aligned}
& 3 \times \log 2=(3 x+1) \log 5 \\
& 3 x \log 2=3 \times \log 5+\log 5 \\
& 3 x \log 2-3 x \log 5=\log 5 \\
& x(3 \log 2-3 \log 5)=\log 5
\end{aligned}\left\{\begin{array}{l}
3 \log 2-3 \log 5 \\
\log
\end{array}\right.
$$

2. Express $\log \frac{x^{2}}{10 y^{3}}$ in terms of $\log x$ and $\log y$.

$$
\left\{\begin{array}{l}
3\left(2^{x+1}\right)=6^{x} \\
\log \left[3\left(2^{x+1}\right)\right]=x \log 6 \\
\log 3+\log \left(2^{x+1}\right)=x \log 6 \\
\log 3+(x+1) \log 2=x \log 6 \\
\log 3+x \log 2+\log 2=x \log 6 \\
\log 3-\log 2=x \log 6-x \log 2 \\
\log \left(\frac{3}{2}\right)=x(\log 6-\log 2)
\end{array}\right]=\frac{\log \left(\frac{3}{2}\right)}{\log 6-\log 2}
$$

$$
\begin{aligned}
& =\log x^{2}-\log 10-\log y^{3} \\
& =2 \log x-1-3 \log y
\end{aligned}
$$

3. Determine the Richter scale reading for an earthquake that is 5 times more intense than another earthquake that measures 4.0 on the Richter scale.

$$
\begin{aligned}
& \frac{10^{x}}{10^{4}}=5 10^{x}=5 \cdot 10^{4} \\
& x \log 10=\log (50000) \\
& x=4.7
\end{aligned}
$$

4. If $\log 5=m$ and $\log 3=n$, then what is $\log 135$ in terms of $m$ and $n$ ?

$$
\left.\begin{array}{l}
\log 135 \\
=\log \left(5 \times 3^{3}\right)
\end{array} \begin{array}{l}
=\log 5+\log 3^{3} \\
=\log 5+3 \log 3
\end{array}\right\}==
$$

5. Determine the value of $\log _{n}\left(a^{3} b\right)$ if $\log _{n} a=3$ and $\log _{n} b=4$

$$
\begin{aligned}
& \log _{n}\left(a^{3} b\right) \\
= & \log _{n} a^{3}+\log _{n} b \\
= & 3 \log _{n} a+\log _{n} b
\end{aligned} \quad=\begin{aligned}
& =3(3)+4 \\
& = \\
& =
\end{aligned}
$$

6. Write $\log _{2} x+\log _{4} y$ as a single log.

$$
\begin{aligned}
& \begin{array}{l}
=\frac{\log x}{\log 2}+\frac{\log y}{\log 4} \\
=\frac{2 \log x}{2 \log 2}+\frac{\log y}{\log 4}=\frac{2 \log x}{\log 4}+\frac{\log y}{\log 4} \\
\log 4+\log y \\
\log y
\end{array}=\frac{\log x^{2}+\log y}{\log x^{2} y}=1 \log _{4}\left(x^{2} y\right) \\
& \text { 7. Simplify } \frac{\log _{a} x}{\log _{a b} x}-\frac{\log _{a} x}{\log _{b} x} \\
& \begin{array}{c}
\frac{\log x}{\log a} \\
\frac{\log x}{\log a b}-\frac{\log x}{\log a} \\
\log x \\
\log a b-\log b
\end{array}>\frac{\log a b}{\log a}-\frac{\log b}{\log a} \quad \frac{\log a}{\log a} \\
& =\frac{\log a b-\log b}{\log a}=1 \\
& \left.=\frac{\log x}{\log a} \times \frac{\log a b}{\log x}-\frac{\log x}{\log a} \times \frac{\log b}{\log x}\right)=\frac{\log \left(\frac{a b}{b}\right)}{\log a}
\end{aligned}
$$

