9.2 Logarithmic Functions
$f(x)=\log _{a} x \rightarrow \log _{a}$ withmic function with base a.

Furthermore, $y=\log _{a} x$ if and only if

$$
x=a^{y}
$$

Convert to logarithmic form:

$$
\begin{aligned}
& \text { Ex: } 2^{4}=16 \quad x=a^{y} \\
& y=\log _{a} x \\
& 16=\log _{2} 4 \\
& \text { Ex: } 4 a^{\frac{1}{2}}=7 \\
& y=\log _{a} x \\
& 7=\log _{4} \frac{1}{2}
\end{aligned}
$$

Convert to Exponential Form:

$$
\begin{aligned}
& \text { Ex: } \begin{array}{l}
\log _{4} 64=3 \quad y=\log _{a} x \\
a^{y}=x \\
4^{3}=64 \\
E x:-1=\log _{3} \frac{1}{3} \\
a^{y}=x \\
3^{-1}=\frac{1}{3}
\end{array} \$=\text { and }
\end{aligned}
$$

Evaluating $\log 5$

- Change to exponential form.

Evaluate:

$$
\begin{gathered}
\log _{3} 27 \\
a^{y}=x \\
3^{y}=27 \\
y=3 \\
\text { Ex: } \log _{2} 2 \\
a^{y}=x \\
2^{y}=2
\end{gathered}
$$

(1)

$$
\log _{5} 1
$$

$$
5^{y}=1
$$

$$
E x: \log _{4} 0
$$

$$
\begin{aligned}
& 4^{y}=0 \\
& \text { N.S }
\end{aligned}
$$

Natural logarithmic Function

$$
\begin{aligned}
& f^{\prime}(x)=\log _{e} x=\ln x \\
& \text { Ex: Evaluate } \ln 7=1.95 \\
& E_{x:} \log _{0} 5
\end{aligned}
$$

To evaluate any $\log$, we vie the change of base formula:

$$
\begin{aligned}
\log _{a} x & =\frac{\ln x}{\ln a} \\
E_{x: \log _{4} 9} & =\frac{\ln 9}{\ln 4}=1.58
\end{aligned}
$$

$$
\begin{aligned}
& \text { p. } 604 \\
& 2-50,78-82,102-112 \\
& \text { evens }
\end{aligned}
$$

