

28.5 More Logarithms

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Example #1. Find x without using a calculator.

(a) $x = \log_2 8$ (b) $x = \log_3 81$

Solution:

(a) $2^x = 2^{\log_2 8}$, $2^x = 8$, $x = \log_2 8 = 3 \leftarrow$

(b) $3^x = 3^{\log_3 81}$, $3^x = 81$, $x = \log_3 81 = 4 \leftarrow$

Example #2. Evaluate the logarithms with your calculator.

(a) $\log_9 500$ (b) $\log_3 240$

Solution:

(a) $\log_9 500 = 2.8284 \leftarrow$ (b) $\log_3 240 = 4.9887 \leftarrow$

Common and Natural Logarithms

$\log_{10} x \equiv \log x \equiv$ the common logarithm

$\log_e x \equiv \ln x \equiv$ the natural logarithm ($e = 2.71828 \dots \equiv$ Euler's constant)

Example #3. Evaluate the logarithms with your calculator.

(a) $\log 150$ (b) $\ln 20$

Solution:

(a) $\log 150 = 2.1761 \leftarrow$ (b) $\ln 20 = 2.9957 \leftarrow$

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Example #4. Solve for x .

(a) $56^x = 420$

(b) $2^{2x-3} = 200$

SOLUTION:

(a) $\log_{56} 56^x = \log_{56} 420$, $x = \log_{56} 420 = 1.5006 \leftarrow$

(b) $\log_2 2^{2x-3} = \log_2 200$, $2x-3 = \log_2 200$, $2x = 3 + \log_2 200$,

$x = \frac{1}{2} (3 + \log_2 200) = 5.3219 \leftarrow$

Example #5. Solve for x .

(a) $\log_3 (2x-5) = 2$

(b) $\ln(9x-4) = 3$

(c) $\log(4x+1) = 2$

SOLUTION:

(a) $3^{\log_3 (2x-5)} = 3^2$, $2x-5 = 3^2 = 9$, $2x = 14$, $x = 7 \leftarrow$

(b) $e^{\ln(9x-4)} = e^3$, $9x-4 = e^3$, $9x = e^3 + 4$, $x = \frac{1}{9} (e^3 + 4) = 2.6762 \leftarrow$

(c) $10^{\log(4x+1)} = 10^2$, $4x+1 = 10^2 = 100$, $4x = 99$, $x = 25\frac{1}{4} \leftarrow$