HP 12c Financial Calculator - Logarithm and Exponential Functions

Basic logarithm and exponential relationships

Exponential and logarithm are related functions as expressed by $b = a^x$, where 'x' is unknown power, 'a' is the base (known), and 'b' is the value resulting from a^x (b>0). The expression that isolates 'x' so 'x' can be computed when 'a' and 'b' are known is:

$$x = \frac{\log(b)}{\log(a)} \qquad (b > 0, a > 0, a \neq 1)$$

The restriction a ≠ 1 applies because if a = 1 then the log(a) = 0 generating an undefined value for 'x'. Some of the properties related to logarithms and exponents are shown in the examples below.

Logarithm and exponential functions on the HP 12c

There are two exponent-related and one logarithm-related functions in the HP 12c, and the keys related to these functions are [y^x], [g] [e^x] and [g] [LN]. [y^x] computes 'y' raised to the 'x' power while [g] [e^x] computes 'e' raised to the power of the number in the display ('e' is the Napier's number 2.718281828...). [g] [LN] computes the natural logarithm of the number in the display.

Practice solving logarithm and exponential problems

Example 1

Continuous compounding is often encountered in conversions from a nominal to an effective interest rate. The following expression is used:

Figure : Expression for calculating the effective interest rate

$$\text{EFF} = e^{\text{NOM}} - 1$$

What is the effective annual rate equivalent to a nominal rate of 6%, compounded continuously?

Solution

The expression below represents the problem:

Figure : Entering the values in the expression

$$\text{EFF} = e^{0.06} - 1$$

The following keystroke sequence can be used to compute the effective rate:

[0] [•] [0] [6] [g] [e^x] [1] [−]

Answer

A nominal interest rate of 6%, compounded continuously is equivalent to an effective interest rate of 6.18%.

Example 2

When continuous compounding is considered in conversions from effective to nominal interest rate, the following expression is used:

Figure : Expression for calculating the nominal interest rate

$$\text{NOM} = \ln(\text{EFF} + 1)$$

What is the nominal interest rate, compounded continuously, equivalent to an effective interest rate of 6.18%?

Solution

The expression below represents the problem:

Figure : Entering the values in the expression

$$\text{NOM} = \ln(0.0618 + 1)$$

The following keystroke sequence can be used to compute the effective rate:

[0] [•] [0] [6] [1] [8] [ENTER] [1] [+] [g] [LN]

Answer

An effective interest rate of 6.18% is equivalent to a nominal interest rate of 6%, compounded continuously.

Example 3

Evaluate the following expressions and find x:

$x = \sqrt[-4]{81}$ (1) $x = \log_{10}(200)$ (2) $x = \log_3(20) - \log_3(5)$ (3)

Solution

The original expression in (1) can be rewritten like this:

$$\sqrt[-4]{81} = 81^{-(1/4)}$$

To find the solution, press:

Keystroke	Display
8 1 ENTER 4 1/x CHS y^x	Figure : Calculating 'x' using expression 1 0.33

In expression (2), one of the basic logarithm properties can be applied:

Figure : Expression using basic logarithm properties

$$\log_a(b) = \frac{\ln(b)}{\ln(a)}$$

So expression (2) is rewritten:

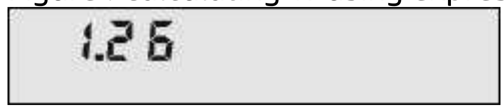
Figure : Entering the values in the expression

$$\log_{10}(200) = \frac{\ln(200)}{\ln(10)}$$

To find the solution, press:

Keystroke	Display
2 0 0 g LN 1 0 g LN ÷	Figure : Calculating 'x' using expression 2 2.30

In expression (3), the following sequence can be used:

Keystroke	Display
2 0 g LN 3 g LN ÷ 5 g LN 3 g LN ÷ −	Figure : Calculating 'x' using expression 3 

Answer

The answers are:

$x = \sqrt[-4]{81} \Rightarrow x = 0.33$;

$x = \log_{10}(200) \Rightarrow x = 2.30$;

$x = \log_3(20) - \log_3(5) \Rightarrow x = 1.26$