

Exponential functions

1. This situation involves the use of certain numbers, which, when used as the value of "x" in  $e^x$ , cause that function to give answers that are off by a maximum of one percent.

The numbers are 0.7030975114 and  $0.995033085 \times 10E-2$ , or integer multiples of the latter number through nine, by itself, or when added to the former. These numbers are correct when used by themselves or derived as answers to expressions such as  $\ln 2.02$  ( $\ln 2.02 = 0.7030975114$ ). The idiosyncrasy is in the  $e^x$  function, not the logarithmic function.

Additionally, since  $x^y = e^{y \ln x}$ , when  $y \ln x$  equals one of the numbers above, then  $x^y$  will also be off slightly less than one percent.

To achieve a very good approximation of the proper operation with these numbers, you can simply leave off the last digit of the number to be used as "x" in  $e^x$  or  $x^y$ .

2. In  $e^x$ , when  $x = (-2291.072168 \pm 11.512924) \times 10^J$  (J can equal 0 through 96), the HP-35 will indicate overflow ( $9.999999999 \times 10E99$ ) when it should indicate underflow (0). The numbers mentioned above are beyond the dynamic range of the calculator.

Trigonometric functions

1. The HP-35 gives the following answers:

arc sine 0.0002 =  $5.729577893 \times 10E-3$   
arc cosine 0.0002 = 89.99427042  
arc tangent 0.0002 =  $5.729577893 \times 10E-3$

The correct answers are:

arc sine 0.0002 = 0.01145916  
arc cosine 0.0002 = 89.98854  
arc tangent 0.0002 = 0.01145916

2. The HP-35 gives the arc tangent of 1.00020002 as 45; the correct answer is 45.00573. This represents an error of approximately one-hundredth of one percent.

3. There is a deviation of approximately one one-hundredth of a percent in the arc sine and arc cosine of these numbers (arc tangent is correct):

0.7071774882	0.7071774884
0.7071774883	0.7071774885

The HP-35 gives 45 for the arc sine and cosine of these numbers; the arc sine should be approximately 45.005730, and the arc cosine should be approximately 44.994270.

We are confident that this list represents the range of errors in the calculator.