applications guide

Texas Instruments
electronic slide rule calculator
SR-10

Simple methods to calculate: sum of products • sum of quotients • reciprocal of the sum of reciprocals • square root of the sum of squares • quadratic equations • nth powers • nth roots • sines • cosines • tangents • arc sines • arc cosines • arc tangents • logarithms • exponentials.

BASIC OPERATIONS

Texas Instruments designed the SR-10 to perform standard calculator functions as well as the slide rule function. Thus, the SR-10 has been programmed to operate the way you think. You do *not* need to program yourself to think the way the calculator operates. The SR-10 uses what is called algebraic notations. If you want to calculate 3 plus 4 minus 5 times 6 divided by 7 (3 + 4 – 5) (6/7), you press 3 [+] 4 [–] 5 [×] 6 [÷] 7 [=] . Algebraic notation was chosen rather than reverse polish notation because it more nearly follows the way people think. In reverse polish notation, the above problem would have been done as follows: 3 [↑] 4 [+] 5 [–] 6 [×] 7 [÷] .

Since the SR-10 was designed to be so easy to operate, it almost seems unnecessary to explain how to add, subtract, multiply and divide on the SR-10. But, let's use these four basic functions to see exactly what takes place inside the SR-10 as we perform the operation:
4 + 5 – 6 X 7 ÷ 8, (4 + 5 – 6) (7/8), =

Enter	Press	Display	Register
4		4	0
	[+]	4.	4.
5		5	4.
	[–]	9.	9.
6		6	9.
	[×]	3.	3.
7		7	3
	[÷]	21.	21.
8		8	21.
	[=]	2.625	2.625

As you can see, the quantity being displayed is not always the same as the quantity in the register. Also, notice that the function keys [+] , [–] , [×] , and [÷] complete the previous calculation as well as instruct the calculator what the next operation will be.

For instance, in this example, pressing the [×] key:

1. Informed the calculator that you had completed entering the last number (6).

Jon Campbell
Texas Instruments
P.O. Box 5012, MS 84
Dallas, Texas 75222

2. Placed the decimal point at the end of the entered number (if not otherwise entered).

3. Completed the previous instruction (subtraction) between the quantity in the register (9) and the quantity on the display (now 6.).

4. Substituted the result (3.) in the register and on the display.

5. Instructed the calculator that the next operation that will be performed is multiplication.

This rather complex set of instructions that the calculator is instructed to read every time you press the function key is the reason that the SR-10 is so easy to operate.

Now you really don't need to know all this for simple calculations. All you need to do is to press the keys in the order that you would write the equation. But, to perform more complex calculations, you'll find it very useful to understand this sequence of instructions read by the calculator every time a function key is pressed.

For example, the key sequence 5 [+] 4 [√x] yields the answer 3.

Enter	Press	Display
5	[+]	5.
4	[√x]	3.

In other words, you have just calculated $\sqrt{5+4}$. If you want to calculate $5 + \sqrt{4}$, you use the sequence 4 [√x] [+] 5 [=] .

Enter	Press	Display
4	[√x] [+]	2.
5	[=]	7.

Notice that we've really rewritten the equation as $\sqrt{4} + 5$. As illustrated in the following section, you can appreciably extend the range of the SR-10 by rewriting equations into sequential operations.

Many complex problems with interim calculations can be solved easily with the SR-10 by rewriting the problem in a sequential operation. This often eliminates the necessity of writing down several interim results and then re-entering these interim results to obtain the final solution.

SUM OF PRODUCTS

You can calculate the sum of two products such as (A X B) + (C X D) without writing down any intermediate answers, if the equation is rewritten as

$$\left(\frac{A \times B}{D} + C\right) D$$

For example, $(3 \times 4) + (5 \times 6) = \left(\frac{3 \times 4}{6} + 5\right) \times 6$

Enter	Press	Display
3	×	3.
4	÷	12.
6	+	2.
5	×	7.
6	=	42.

Note that it *is* necessary to enter one of these quantities twice (6). However, this is usually easier than recording and re-entering an interim result. Also, you can select the simplest of the four quantities to enter twice.

This method can be extended to calculate the sum of any number of products. (A X B) + (C X D) + (E X F) can be rewritten as

$$\left[\frac{\left(\frac{A \times B}{D} + C\right) D}{F} + E\right] \times F$$

or

$$\left[\left(\frac{A \times B}{D} + C\right) \times \frac{D}{F} + E\right] \times F$$

For example, (3 X 4) + (5 X 6) + (7 X 8) becomes

$$\left[\left(\frac{3 \times 4}{6} + 5\right) \times \frac{6}{8} + 7\right] \times 8$$

Enter	Press	Display
3	×	3.
4	÷	12.
6	+	2.
5	×	7.
6	÷	42.
8	+	5.25
7	×	12.25
8	=	98.

The procedure can be extended to calculate the sum of as many products as desired.

SUM OF QUOTIENTS

The sum of quotients can also easily be calculated.

$$\frac{A}{B} + \frac{C}{D}$$

can be rewritten as

$$\frac{\frac{A \times D}{B} + C}{D}$$

or

$$\left(\frac{A \times D}{B} + C\right) / D$$

This calculation can also be extended to as many terms as desired

$$\frac{A}{B} + \frac{C}{D} + \frac{E}{F} = \left[\left(\frac{A \times D}{B} + C\right) \times \frac{F}{D} + E\right] / F$$

For example,

$$\frac{3}{4} + \frac{5}{6} + \frac{7}{8} = \left[\left(\frac{3 \times 6}{4} + 5\right) \times \frac{8}{6} + 7\right] /8$$

Enter	Press	Display
3	×	3.
6	÷	18.
4	+	4.5
5	×	9.5
8	÷	76.
6	+	12.666666
7	÷	19.666666
8	=	2.4583332

If you calculate these terms separately and call them up you notice that the last digit in the answer should be a 3 instead of a 2. This "error" results from the calculator truncating the quotient of 75/6 as 12.666666 (six places after the decimal, which is subsequently divided by 8 yielding an answer with seven places after the decimal). Because of the interim calculations, the answer is only correct to six places after the decimal.

RECIPROCAL OF THE SUM OF RECIPROCALS

A special case of the sum of products frequently occurs in engineering. For example, the equivalent resistance of resistors in parallel is given below.

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

For three resistors in parallel, this equation can be rewritten as

$$R_T = \frac{1}{\left[\left(\frac{R_2}{R_1} + 1\right) \times \frac{R_3}{R_2} + 1\right] \times \frac{1}{R_3}}$$

For R_1 = 10 Ohms, R_2 = 20 Ohms and R_3 = 30 Ohms

Enter	Press	Display
20	÷	20.
10	+	2.
1	×	3.
30	÷	90
20	+	4.5
1	÷	5.5
30	1/x	5.4545455

SQUARE ROOT OF SUM OF SQUARES

The square root of the sum of squares, $\sqrt{A^2 + B^2}$, can be rewritten as

$$\left[\sqrt{\left(\frac{A}{B}\right)^2 + 1}\right] \times B \quad \text{or} \quad \left[\left(\frac{A}{B}\right)^2 + 1\right]^{1/2} \times B$$

For example, $\sqrt{3^2 + 4^2} = \left[\left(\frac{3}{4}\right)^2 + 1\right]^{1/2} \times 4$

Enter	Press		Display
3	÷		3.
4	x²	+	0.5625
1	√x	×	1.25
4	=		5.

This method can also be extended to as many terms as desired. The square root of the sum of three squares $\sqrt{A^2 + B^2 + C^2}$ equals

$$\left(\left\{\left[\left(\frac{A}{B}\right)^2 + 1\right]^{1/2} \times \frac{B}{C}\right\}^2 + 1\right)^{1/2} \times C$$

Although this looks very complicated, it is very simple to perform on the SR-10.

For example, to calculate $\sqrt{3^2 + 4^2 + 12^2}$

Enter	Press		Display
3	. ÷		3.
4	x^2	+	0.5625
1	$\sqrt{x}$	×	1.25
4	÷		5.
12	x^2	+	0.1736111
1	$\sqrt{x}$	×	1.0833333
12	=		12.999999

As you know, the correct answer should be 13, which means that we are off 1 digit in the eighth place.

QUADRATIC EQUATIONS

You can easily solve quadratic equations on the SR-10. For the equation, $Ax^2 + Bx + C = 0$, the solution is normally written:

$$x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$

If this is rewritten in sequential form, we get

$$x = \frac{\pm\left[\sqrt{(B2)^{-1} \times (-4AC) + 1}\,\right] \times B - B}{2A}$$

For example, to find the root of the equation $3x^2 + 7x + 4 = 0$, using scientific notation in this example:

Enter	Press		Display	Remarks
7	EE	x^2	4.9 01	Scientific Notation
	1/x	×	2.0408163 −02	
4	+/−	×	−8.1632652 −02	
3	×		−2.4489795 −01	
4	+		−9.795918 −01	
1	$\sqrt{x}$	×	1.4285727 −01	
7	−		1.0000008 00	Intermediate Answer

7	÷		−5.9999992 00	
2	÷		−2.9999996 00	
3	=		−9.9999986 −01	Root 1
1.0000008	+/−	−	−1.0000008	Re-enter Intermediate Answer as Negative
7	÷		−8.0000008 00	
2	÷		−4.0000004 00	
3	=		−1.3333334 00	Root 2

Note that the only re-entry was to determine the root with the negative radical component. In this example, the first answer is accurate to 6 places, and the second to 7 places.

POWERS AND ROOTS

You can use the SR-10 to calculate any integer power or root of any number. To calculate any integer power, it is only necessary to use the x^2, ×, and ÷ function keys. To calculate any integer roots, an iteration process is used.

POWERS

To calculate any integer power through the tenth, you only need to enter the quantity a maximum of three times.

To Calculate	Enter	Press
A^2	A	x^2
A^3	A	x^2 ×
	A	=
A^4	A	x^2 x^2
A^5	A	x^2 x^2 ×
	A	=
A^6	A	x^2 x^2 ×
	A	×
	A	=
A^7	A	x^2 x^2 x^2 ÷
	A	=
A^8	A	x^2 x^2 x^2
A^9	A	x^2 x^2 x^2 ×
	A	=
A^{10}	A	x^2 x^2 x^2 ×
	A	×
	A	=

ROOTS

Because the SR-10 has a $\sqrt{x}$ key, you can calculate the fourth, eighth, sixteenth, etc., root without any difficulty.

To Calculate	Enter	Press
$\sqrt{N}$	**N**	$\sqrt{x}$
$\sqrt[4]{N}$	**N**	$\sqrt{x}$ $\sqrt{x}$
$\sqrt[8]{N}$	**N**	$\sqrt{x}$ $\sqrt{x}$ $\sqrt{x}$

To calculate other integer roots, it is necessary to use an iterative process based on Newton's Method.

To Calculate	Equation
$\sqrt[3]{N}$	$(N/A_1^3 + 2)\ A_1/3 = A_2$
$\sqrt[5]{N}$	$(N/A_1^5 + 4)\ A_1/5 = A_2$
$\sqrt[6]{N}$	$(N/A_1^6 + 5)\ A_1/6 = A_2$
$\sqrt[7]{N}$	$(N/A_1^7 + 6)\ A_1/7 = A_2$
$\sqrt[n]{N}$	$[N/A_1^n + (n - 1)]\ A_1/n = A_2$

To use these equations, it is necessary to make an initial approximation which is used to derive a more exact one. Fortunately, the process converges rather rapidly to the correct answer.

For example, to find the cube root of 75, we begin with an approximation of 4 ($4^3 = 64$).

$$\sqrt[3]{75} \approx 4 = A_1$$

Note: Since this method will involve taking the reciprocals of numbers between 64 and 75, maximum accuracy is maintained by having the calculator operate in scientific notation.

Enter	Press	Display	Remarks
4		4	A_1
	EE	4 00	Scientific Notation
	x^2 ×	1.6 01	A_1 Re-entered
4	=	6.4 01	Optional Check
	1/x ×	1.5625 −02	
75	+	1.171875 00	
2	×	3.171875 00	
4	÷	1.26875 01	A_1 Re-entered
3	=	4.2291666 00	A_2
	x^2 ×	1.788585 01	
4.2291666			A_2 Re-entered
	=	7.5642239 01	Optional Check
	1/x ×	1.3220126 −02	
75	+	9.9150945 −01	
2	×	2.9915094 00	
4.2291666	÷	1.2651591 01	A_2 Re-entered
3	=	4.217197 00	A_3
	x^2 ×	1.778475 01	
4.217197			A_3 Re-entered
	=	7.5001794 01	Optional Check
	1/x ×	1.3333014 −02	
75	+	9.9997605 −01	
2	×	2.999976 00	
4.217197	÷	1.2651489 01	A_3 Re-entered
3	=	4.217163 00	A_4
	x^2 ×	1.7784463 01	
4.217163	=	7.4999979 01	Check

Note the increase in accuracy with each iteration. The first approximation (or guess) was correct to 1 significant figure (4); the second, to 3 significant figures (4.22); the third, to 5 significant figures (4.2172); and the fourth, to 7 significant figures (4.217163). Also note that the method provides an optional check on the accuracy of the approximation in the beginning of the next iteration by pressing the [=] key before taking the reciprocal.

Not only are the methods for higher roots very similar (which helps in memorizing them) but they are practically no more complex. For example, to find the fifth root of 8000, we begin with an approximation of 6.

Enter	Press	Display	Remarks
6	[EE]	6 00	A_1
	[x^2] [x^2] [×]	1.296 03	
6	[=]	7.776 03	Optional Check
	[1/x] [×]	1.2860082 −04	
8000	[+]	1.0288065 00	
4	[×]	5.0288065 00	
6	[÷]	3.0172839 01	
5	[=]	6.0345678 00	A_2
	[x^2] [x^2] [×]	1.3261256 03	
6.0345678	[=]	8.0025948 03	Optional Check
	[1/x] [×]	1.2495946 −04	
8000	[+]	9.9967568 −01	
4	[×]	4.9996756 00	
6.0345678	[÷]	3.0170881 01	
5	[=]	6.0341762 00	A_3
	[x^2] [x^2] [×]	1.3257814 03	
6.0341762	[=]	7.9999985 03	Check

Note that, in this example, the accuracy increased from 1 significant figure in A_1 (6) to 4 significant figures in A_2 (6.034) and to 7 significant figures in A_3 (6.034176). In general, 7 significant figures is the maximum that can be obtained because of truncation errors. In this example, the eighth digit should be a 3 instead of a 2.

TRANSCENDENTAL FUNCTIONS

You can greatly augment the capability of the SR-10 by using tables of trigonometric and logarithmic values, such as *C.R.C. Standard Mathematical Tables* published by Chemical Rubber Publishing Co., 2310 Superior Avenue, Cleveland, Ohio 44114.

However, you can also use the SR-10 to *calculate* the value of these transcendental functions. In general, values to four or five significant figures can be calculated using the recommended expression. A more complex expression is also given for cases where additional accuracy is needed.

TRIGONOMETRIC FUNCTIONS

Sine

$$\sin a = \left[\left(\frac{a^2}{20}+1\right)^{-1} \times 10 - 7\right]\frac{a}{3} \qquad 0 < a < \frac{\pi}{4}$$

Accuracy

a in Degrees	Error in %
0 to 30°	< 0.001%
30 to 45°	< 0.006%

$$= \cos\left(\frac{\pi}{2} - a\right) \qquad \frac{\pi}{4} < a < \frac{\pi}{2}$$

Accuracy

a in Degrees	Error in %
45 to 70°	< 0.001%
70 to 90°	< 0.0001%

For greater accuracy

$$\sin a = \left\{\left[\left(\frac{a^2}{42}+1\right)^{-1} \times 21 - 11\right]\frac{a^2}{-60}+1\right\}a$$

Cosine

$$\cos a = \left[\left(\frac{a^2}{30}+1\right)^{-1} \times 5 - 3\right]\frac{a^2}{-4}+1 \qquad 0 < a < \frac{\pi}{4}$$

Accuracy

a in Degrees	Error in %
0 to 20°	< 0.0001%
20 to 45°	< 0.001%

$$= \sin\left(\frac{\pi}{2} - a\right) \qquad \frac{\pi}{4} < a < \frac{\pi}{2}$$

Accuracy

a in Degrees	Error in %
45 to 60°	< 0.006%
60 to 90°	< 0.001%

For greater accuracy

$$\cos a = \left\{\left[\left(\frac{a^2}{56} + 1\right)^{-1} X\, 28 - 13\right] \frac{a^2}{360} - .5\right\} a^2 + 1$$

Tangent

$$\tan a = \left[\left(-\frac{2}{5} a^2 + 1\right)^{-1} X\, 5 + 1\right] \frac{a}{6} \qquad 0 < a < \frac{\pi}{4}$$

Accuracy

a in Degrees	Error in %
0 to 20°	< 0.001%
20 to 35°	< 0.01%
35 to 45°	< 0.03%

$$= \tan\left(\frac{\pi}{2} - a\right)^{-1} \qquad \frac{\pi}{4} < a < \frac{\pi}{2}$$

Accuracy

a in Degrees	Error in %
45 to 55°	< 0.03%
55 to 70°	< 0.01%
70 to 90°	< 0.001%

For greater accuracy

$$\tan a = \left\{\left[\left(-\frac{17}{42} a^2 + 1\right)^{-1} X\, 84 + 1\right] \frac{a^2}{255} + 1\right\} a$$

For example to calculate sin 30°, we first convert to radians by multiplying by $\pi/180$ or 355/(113 X 180)

Enter	Press	Display	Remarks
30	[×]	30.	
355	[÷]	10650	
113	[÷]	94.247787	
180	[=]	0.5235988	a in Radians
	[x^2] [÷]	0.2741557	
20	[+]	0.0137077	
1	[1/x] [×]	0.9864776	
10	[−]	9.864776	
7	[×]	2.864776	
.5235988	[÷]	1.4999932	Re-enter a in Radians
3	[=]	0.4999977	sin a

Note that this answer is correct rounded off to five significant figures.

INVERSE TRIGONOMETRIC FUNCTIONS

Arc Sine

$$\text{arc sin a} = \left[\left(-\frac{9}{20}a^2 + 1\right)^{-1} \times 10 + 17\right]\frac{a}{27} \qquad 0 < a < \frac{1}{2}$$

Accuracy

a	Error in %
0 to 0.2	< 0.0001%
0.2 to 0.3	< 0.001%
0.3 to 0.45	< 0.01%
0.45 to 0.5	< 0.03%

$$= \frac{-4 \text{ arc sin b} + \pi}{2} \qquad \frac{1}{2} < a < 1$$

$$\text{where b} = \sqrt{\frac{1-a}{2}}$$

Accuracy

a	Error in %
0.5 to 0.65	< 0.05%
0.65 to 0.75	< 0.01%
0.75 to 0.9	< 0.001%
0.9 to 1.0	< 0.0001%

For greater accuracy

$$\text{arc sin a} = \left\{\left[\left(-\frac{25}{42}a^2 + 1\right)^{-1} \times 189 + 61\right]\frac{a^2}{1500} + 1\right\} a$$

Arc Cosine

$$\text{arc cos a} = \frac{\pi}{2} - \text{arc sin a} \qquad 0 < a < 1$$

Accuracy

Same as for arc sin

Arc Tangent

$$\text{arc tan a} = \left[\left(\frac{3a^2}{5} + 1\right)^{-1} \times 5 + 4\right]\frac{a}{9} \qquad 0 < a < 0.5$$

Accuracy

a	Error in %
0 to 0.2	< 0.0001%
0.2 to 0.3	< 0.001%
0.3 to 0.45	< 0.01%
0.45 to 0.5	< 0.02%

$$= \text{arc tan b} + 0.4636476$$

$$\text{where b} = \left[\left(\frac{2}{a} + 1\right)^{-1} \times 5 - 1\right]/2 \qquad 0.5 < a < 1$$

Accuracy

a	Error in %
0.5 to 0.85	< 0.0001%
0.85 to 1	< 0.001%

$$= \frac{-2\,\text{arc tan}\left(\frac{1}{a}\right) + \pi}{2} \qquad a > 1$$

Accuracy

Same as above for $\frac{1}{a}$

For greater accuracy,

$$\text{arc tan a} = \left\{\left[\left(\frac{5a^2}{7} + 1\right)^{-1} \times 21 + 4\right]\frac{a^2}{-75} + 1\right\} a$$

To calculate arc tan 0.75,

Enter	Press	Display	Remarks
2	[÷]	2.	
.75	[+]	2.6666666	
1	[1/x] [×]	0.2727272	
5	[−]	1.363636	
1	[÷]	0.363636	
2	[=]	0.181818	b
	[x^2] [×]	0.0330577	
.6	[+]	0.0198346	
1	[1/x] [×]	0.9805511	
5	[+]	4.9027555	
4	[×]	8.9027555	
.181818	[÷]	1.6186811	Re-enter b
9	[+]	0.1798534	
.4636476	[=] [×]	0.643501	a in Radians
180	[×]	115.83018	
113	[÷]	13088.81	
355	[=]	36.869887	

This answer is correct to 6 places; the last two digits should be 97 instead of 87.

LOGARITHMIC AND EXPONENTIAL FUNCTIONS

$$\ln a = \left[\left(-\frac{3}{5}b^2 + 1\right)^{-1} \times 5 + 4\right]\frac{2b}{9} \qquad 0.7 < a < 1.6$$

$$\text{where } b = \frac{a-1}{a+1} = (a+1)^{-1} \times (-2) + 1$$

This expression yields values with an error of less than 0.0003% over the range of a from 0.7 to 1.6. For values of a outside this range, use the expression $\ln a = \ln(2^n C)$ where the power of 2 is chosen so that $0.7 < C < 1.6$. Then

$$\ln a = \ln C + 0.6931472n$$

This can be done in a single operation

$$\ln a = \left\{\left[\left(-\frac{3}{5}b^2+1\right)^{-1} \times 5+4\right]\frac{2b}{9n} + 0.6931472\right\} n \qquad 0.7 < \frac{a}{2^n} < 1.6$$

$$\text{where } b = \frac{\frac{a}{2^n}-1}{\frac{a}{2^n}+1} = \left(\frac{a}{2^n}+1\right)^{-1} \times (-2)+1$$

Since

$$\log a = \frac{\ln a}{\ln 10}$$

$$= \frac{\ln a}{2.3025851}$$

$$\log a = \left\{\left[\left(-\frac{3}{5}b^2+1\right)^{-1} \times 5+4\right]\frac{2b}{9n} + 0.6931472\right\}$$

$$\times \frac{n}{2.3025851}$$

$$\text{where } b = \left(\frac{a}{2^n}+1\right)^{-1} \times (-2)+1$$

To calculate ln 35, we first divide 35 by 2^5 or 32

Enter	Press		Display	Remarks
35	÷		35.	
32	+		1.09375	$35/2^5$
1	1/x	×	0.4776119	
2	+/-	+	−0.9552238	
1	=		0.0447762	b
	x^2	×	0.0020049	
3	+/-	÷	−0.0060147	
5	+		−0.0012029	
1	1/x	×	1.0012043	
5	+		5.0060215	
4	×		9.0060215	
2	×		18.012043	
.0447762	÷		0.8065108	Re-enter b
9	÷		0.0896123	
5	+		0.0179224	
.6931472	×		0.7110696	
5	=		3.5553483	

This answer is correct to 7 places; the final digit should be a 1 instead of a 3.

$$e^a = \left\{\left[\left(\frac{a^2}{60} + 1\right)^{-1} \times (-5) + 6\right]/a - 0.5\right\}^{-1} + 1 \quad 0 < a < 1$$

Accuracy

a	Error in %
0 to 0.6	<0.00001%
0.6 to 0.75	<0.0001%
0.75 to 1.0	<0.001%

For values of a greater than unity, use this expression for the fractional part of a and multiply by e raised to the integer part of a. For example, $e^{2.7} = e^2 \times e^{0.7}$. An approximation for $e \approx 193/71 \approx 2.7183098$. The error in this approximation is less than 0.001% or 1 part in 100,000.

To calculate $e^{0.4}$

Enter	Press	Display
.4	x^2 ÷	0.16
60	+	0.0026666
1	1/x ×	0.9973404
5	+/- +	−4.986702
6	÷	1.013298
.4	−	2.533245
.5	1/x +	0.4918246
1	=	1.4918246

This answer is correct to 7 places; the eighth digit should be a 7 instead of an 8. For value of a between 0 and 0.6, this method yields answers within ±1 in the eighth place. For values of a approaching unity you can use the expression $e^a = (e^{.5a})^2$.

A comparison of the series for e^a and y^a reveals a simple method to calculate y^a.

$$e^a = 1 + a + \frac{a^2}{2!} + \frac{a^3}{3!} + \frac{a^4}{4!} + \ldots$$

$$y^a = 1 + (a \ln y) + \frac{(a \ln y)^2}{2!} + \frac{(a \ln y)^3}{3!} + \frac{(a \ln y)^4}{4!} + \ldots$$

$$\therefore y^a = e^{a \ln y} = e^b$$

To calculate y^a, we first calculate ln y, multiply this by a to determine b, and then calculate e^b using the method previously illustrated.

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