1) Stat, Edit
2) Stat, Calc, 0: ExpReg

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Algebra I

Exponential Regression Equations

1. The accompanying table shows the number of bacteria present in a certain culture over a 5-hour period, where x is the time, in hours, and y is the number of bacteria.

x	y
0	1,000
1	1,049
2	1,100
3	1,157
4	1,212
5	1,271

Write an exponential regression equation for this set of data, rounding all values to *four decimal places*. Using this equation, determine the number of whole bacteria present after 6.5 hours.

ExpReg
$y=a(b)^x$
$y=999.9725(1.0493)^x$
$y=999.9725(1.0493)^{6.5}$
$y=1367$

2. The accompanying table shows the amount of water vapor, y, that will saturate 1 cubic meter of air at different temperatures, x.

Amount of Water Vapor That Will Saturate 1 Cubic Meter of Air at Different Temperatures

Air Temperature (x) (°C)	Water Vapor (y) (g)
–20	1
–10	2
0	5
10	9
20	17
30	29
40	50

Write an exponential regression equation for this set of data, rounding all values to the *nearest thousandth*. Using this equation, predict the amount of water vapor that will saturate 1 cubic meter of air at a temperature of 50°C, and round your answer to the *nearest tenth of a gram*.

ExpReg
$y=a(b)^x$
$y=4.144(1.068)^x$
$y=4.144(1.068)^{50}$
$y=112.5$

3. Jean invested \$380 in stocks. Over the next 5 years, the value of her investment grew, as shown in the accompanying table.

Years Since Investment (x)	Value of Stock, in Dollars (y)
0	380
1	395
2	411
3	427
4	445
5	462

Write the exponential regression equation for this set of data, rounding all values to *two decimal places*. Using this equation, find the value of her stock, to the *nearest dollar*, 10 years after her initial purchase.

ExpReg
$y=a(b)^x$
$y=379.92(1.04)^x$
$y=379.92(1.04)^{10}$
$y=562$

4. The table below shows the number of new stores in a coffee shop chain that opened during the years 1986 through 1994.

ExpReg

$y=a(b)^x$

$y=10.596(1.586)^x$

$y=10.596(1.586)^{16}$

$y=16982$

Year	Number of New Stores
1986 1	14
1987 2	27
1988 3	48
1989 4	80
1990 5	110
1991 6	153
1992 7	261
1993 8	403
1994 9	681

2001 16

Using $x = 1$ to represent the year 1986 and y to represent the number of new stores, write the exponential regression equation for these data. Round all values to the *nearest thousandth.*

Use your equation to determine the number of new stores in the year 2001 rounded to the nearest unit.

$x=16$

5. A population of single-celled organisms was grown in a Petri dish over a period of 16 hours.

The number of organisms at a given time is recorded in the table below.

Determine the exponential regression equation model for these data, rounding all values to the *nearest ten-thousandth.*

Using this equation, predict the number of single-celled organisms, to the *nearest whole number*, at the end of the 18th hour.

Time, hrs (x)	Number of Organisms (y)
0	25
2	36
4	52
6	68
8	85
10	104
12	142
16	260

ExpReg

$y=a(b)^x$

$y=27.2025(1.1509)^x$

$y=27.2025(1.1509)^{18}$

$y=341$

6. Using a microscope, a researcher observed and recorded the number of bacteria spores on a large sample of uniformly sized pieces of meat kept at room temperature. A summary of the data she recorded is shown in the table below.

Using these data, write an exponential regression equation, rounding all values to the *nearest thousandth*. The researcher knows that people are likely to suffer from food-borne illness if the number of spores exceeds 100. Using the exponential regression equation, determine the maximum amount of time, to the *nearest quarter hour*, that the meat can be kept at room temperature safely.

Hours (x)	Average Number of Spores (y)
0	4
0.5	10
1	15
2	60
3	260
4	1130
6	16,380

7. A runner is using a nine-week training app to prepare for a "fun run." The table below represents the amount of the program completed, A, and the distance covered in a session, D, in miles.

Based on these data, write an exponential regression equation, rounded to the *nearest thousandth*, to model the distance the runner is able to complete in a session as she continues through the nine-week program. After how much of the program is completed will the runner complete 2.5 miles? Round your answer to the *nearest hundredth*.

A	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{6}{9}$	$\frac{8}{9}$	1
D	2	2	2.25	3	3.25

8. The following table represents the amount of student loan debt Dr. Ross has x years after 2010.
Write an exponential regression equation to represent the amount of debt Ross will have left have left after x years. Round all coefficients to the *nearest thousandth*.
Assuming the pattern continues, in what year will Ross have $10,000 left in debt?

x	y
0	120,000
1	112,541
3	88,897
4	76,441
6	53,289

ExpReg

$y=a(b)^x$

$y=126565.191(.874)^x$

$10{,}000=126565.191(.874)^x$

$\frac{10{,}000}{126565.191} = \frac{126565.191(.874)^x}{126565.191}$

log .079... log .874^x

$\frac{\log .079...}{\log .874} = \frac{x \log .874}{\log .874}$

$18.84=X$

2010 + 18 = 2028

9. The table below shows the average yearly balance in a savings account where interest is compounded annually. No money is deposited or withdrawn after the initial amount is deposited.
Write an exponential regression equation to represent this situation. Round all coefficients to the *nearest ten-thousandth.* Use your equation to determine to the *nearest tenth of a year*, how long it will take for the balance to reach $1,000,000.

Year	Balance, in Dollars
0	380.00
10	562.49
20	832.63
30	1232.49
40	1824.39
50	2700.54

ExpReg

$y=a(b)^x$

$y=379.9996(1.0400)^x$

$1{,}000{,}000=379.9996(1.0400)^x$

$\frac{1{,}000{,}000}{379.9996} = \frac{379.9996(1.0400)^x}{379.9996}$

log 2631... log 1.0400^x

$\frac{\log 2631...}{\log 1.0400} = \frac{x \log 1.0400}{\log 1.0400}$

200.8 = X