Sinusoidal, or trigonometric, regression is much more complicated than either linear or exponential. It should be used in situations that appear periodic in nature.

cyclical

The soil's temperature beneath the ground varies in a periodic manner. A temperature probe was left 3 feet underground and recorded the temperature as a function of the number of days since January 1st (x = 0). The temperatures for 14 days throughout the year are shown below.

L_1 x Day	5	36	57	94	127	153	192
L_2 y Temp (°F)	41	37	36	40	48	64	68
Day	226	241	262	289	305	337	356
Temp (°F)	66	61	58	49	44	42	40

(a) Find a best fit sinusoidal function for this data set in the form y = a sin (bx + c) + d. Round all parameters to the nearest *hundredth*.

$y = 15.21 \sin(.02x - 2.59) + 52.03$

(b) Based on the model from (a) what are the highest and lowest temperatures reached in the soil?

Highest $= 52.03 + 15.21 = 67.24$
Lowest $= 52.03 - 15.21 = 36.82$

(c) What is the average soil temperature?

52.03

(midline or vert. shift)

Source for questions: www.emathinstruction.com

If it says SOLVE ALGEBRAICALLY - No other method will be accepted for full credit. Check on calculator with intersect when possible.

Solve the following system of equations algebraically:

$$5 = y - x$$
$$4x^2 = -17x + y + 4$$

Determine algebraically the x-coordinate of all points where the graphs of $xy = 10$ and $y = x + 3$ intersect.

$y = \frac{10}{x}$

$(\cancel{x})\frac{10}{\cancel{x}} = (x+3)x$

$10 = x^2 + 3x$

$0 = x^2 + 3x - 10$

$0 = (x+5)(x-2)$

$x+5=0$	$x-2=0$
$x=-5$	$x=2$

$P = -10$
$S = 3$
$5, -2$

$\{-5, 2\}$

Regents Review #3 - Exponents and Logarithms

Exponential Growth & Decay

Exponential Function: $y = b^x$

$y = 2^x$ $b>1$ $0<b<1$

Exponential growth or decay?

$(2^{-1})^x = \left(\frac{1}{2}\right)^x$

$y = 2^{-x} = \frac{1}{2^x} = \left(\frac{1}{2}\right)^x$

Exponential growth or decay?

Word Problems:

$$A(t) = a\left(1 \pm \frac{r}{n}\right)^{nt}$$ where:

growth → +
decay → −

$A(t) = a(1 \pm r)^t$

$A(t)$ → ending Amt.
a → starting amt.
n → # of compound/year
ex: quarterly → $n=4$
r → rate (as a decimal)
t → time
$(1 \pm r)$ → growth/decay factor

$$A(t) = Pe^{rt}$$ where:

"compounded continuously"

$A(t)$ →
P → principle (starting amt.)
r →
t →

Example:

\$200 is deposited in a bank account. The interest is compounded monthly at a rate of 4.25%. How much money is in the account after 5 years, to the nearest dollar?

$n=12$ $r=.0425$ $t=5$

$$A(5) = 200\left(1+\frac{.0425}{12}\right)^{5\cdot 12} = 247.26 \quad \$247$$

Example:

Last year the total revenue for Wegmans increased by 6.25% over the previous year. If this trend were to continue, which expression could the company's chief financial officer use to approximate their monthly percent increase in revenue? (Let m represent months.)

~~1.~~ $(1.0625)^m$
~~2.~~ $(1.0625)^{12/m}$
3. $(1.00506)^m$
~~4.~~ $(1.00506)^{m/12}$

$(1.0625)^y$

$(1.0625)^{m/12} = \left(1.0625^{\frac{1}{12}}\right)^m$

Solving exponential equations using logs or natural logs (ln)