***FitAll*'s Built-in Functions**

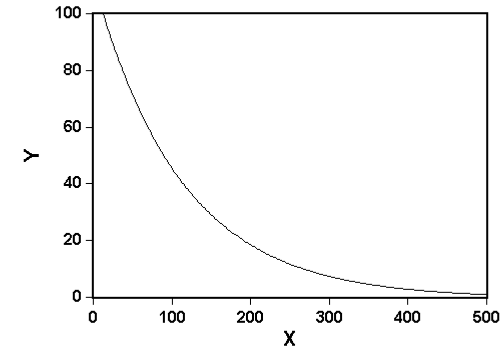
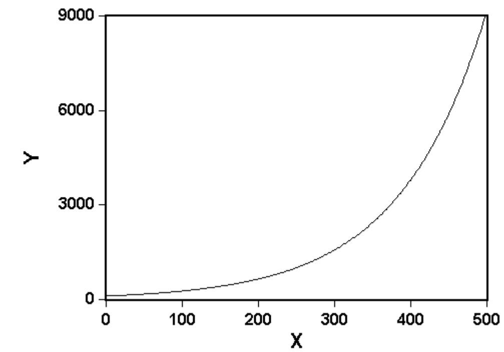
The following contains a description of the functions that are available in ***FitAll***'s standard Function Libraries.

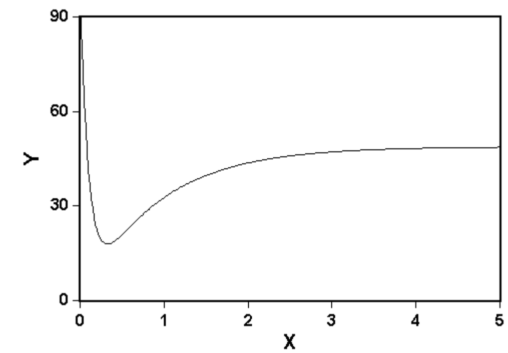
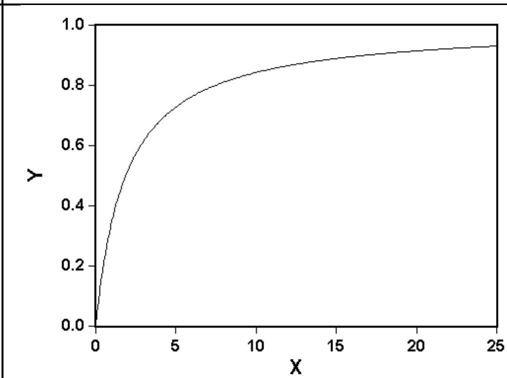
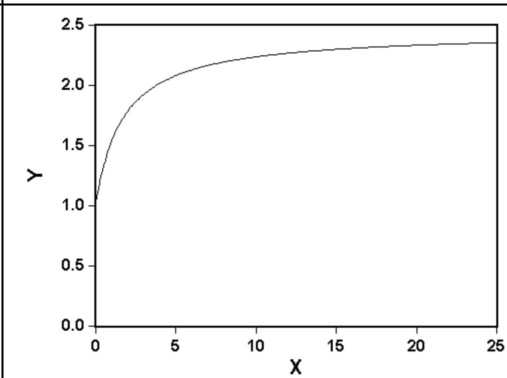
The example graph is presented as an illustration of what a graph of the function may look like. With different parameter values the function's graph could look substantially different from the one illustrated in this document.

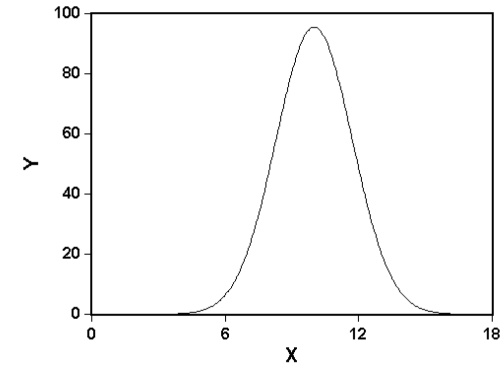
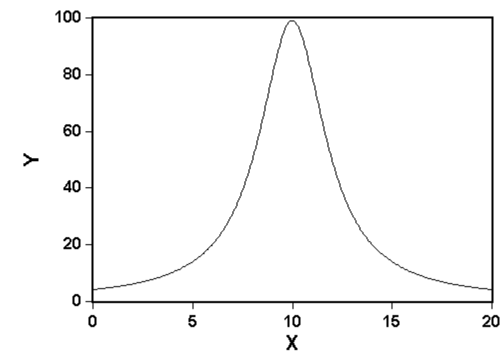
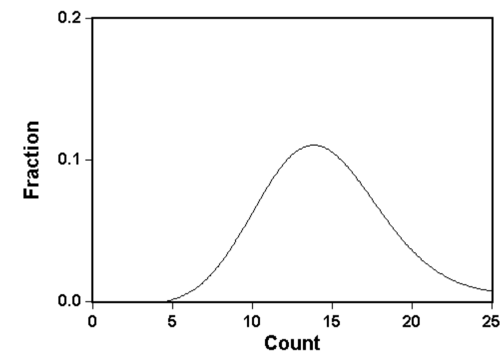
In the function definitions:

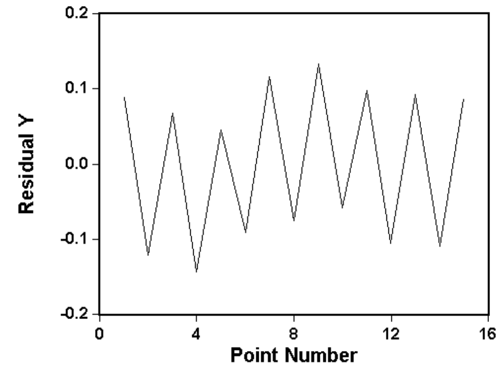
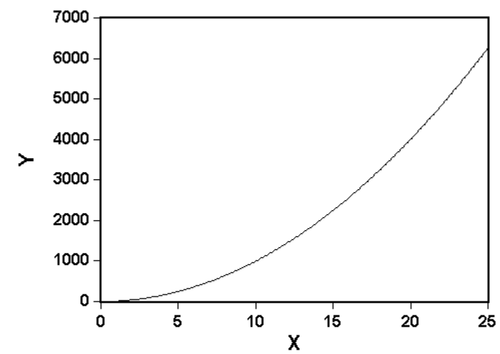
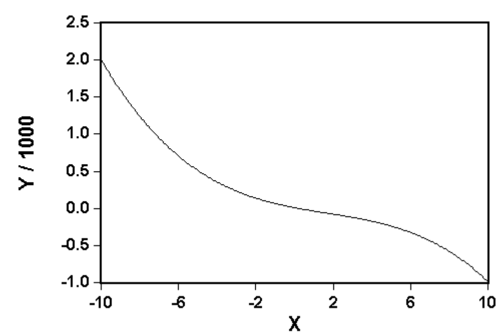
1. Y is the dependent variable.
2. The X's are the independent variables.
3. The K's are constants, the values of which can be changed at runtime.
4. The P's are the parameters that are resolved / determined.

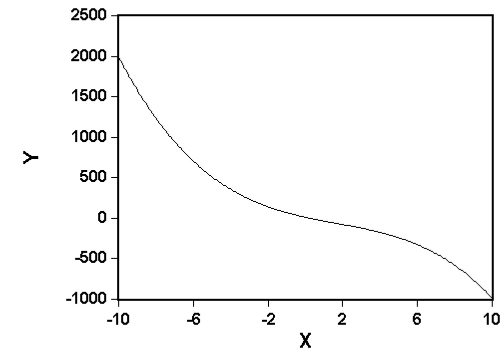
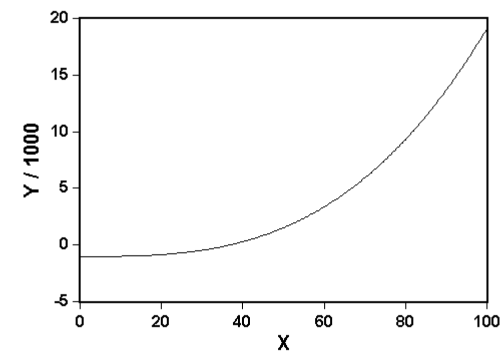
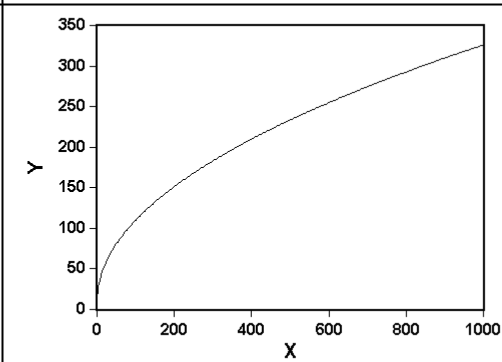
Basic
FitAll Function Library

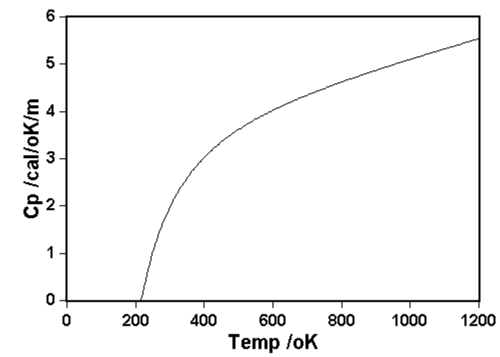
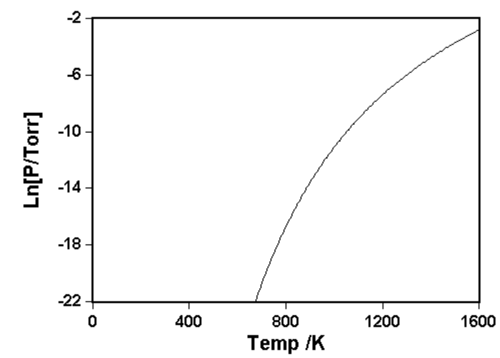
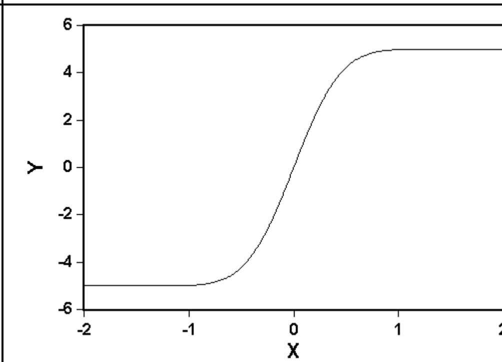
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0001	First Order Exponential with Background Correction Number of variations: 4	$Y = P1 * e^{(-P2 * K1 * X)} + \sum_{i=0}^{n} \left(P_{3+i} * X^i\right)$, for example, $Y = P1 * e^{-(P2 * K1 * X)} + P3 + P4 * X$	 or 

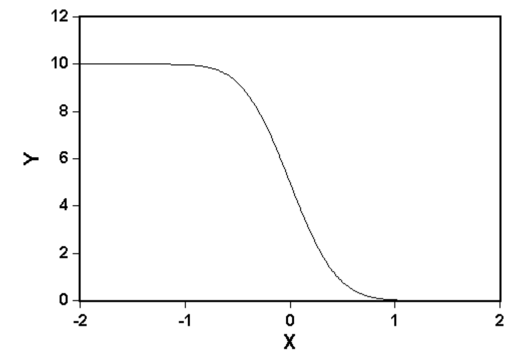
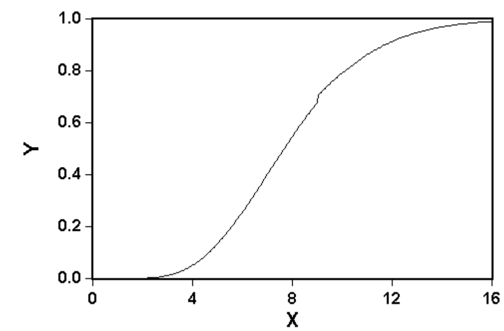
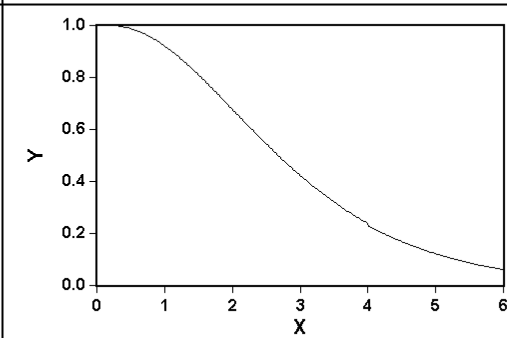
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0002	Sum of First Order Exponentials Number of variations: 5	$$Y = P1 + \sum_{i=1}^{n}\left[P_{2i} * e^{-(P_{2i+1} * K_i * X)}\right],$$ for example, $$Y = P1 + P2 * e^{-(P3 * K1 * X)} + P4 * e^{-(P5 * K2 * X)}$$	
0003	Langmuir Adsorption Isotherm Number of variations: 1	$$Y = \frac{P1 * X}{(1 + P1 * X)}$$	
0004	Saturation Curve, Non-zero origin Number of variations: 1	$$Y = \frac{(P1 + P2 * P3 * X)}{(1 + P2 * X)}$$	

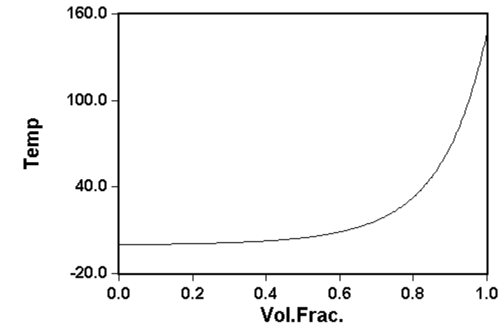
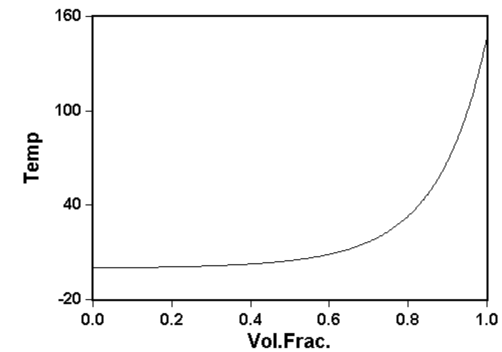
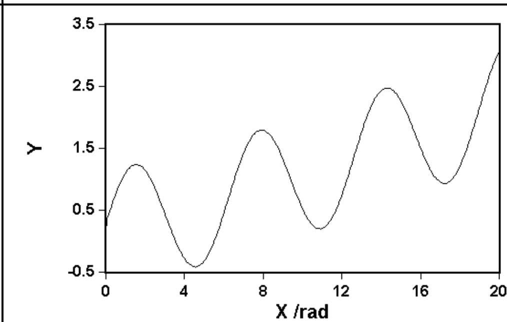
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0005	Gaussian With Offset Number of variations: 2	$$Y = P1 * e^{\left[-2.77*\left(\frac{(X - P2)}{P3}\right)^2\right]} + P4$$	
0006	Lorentzian With Offset Number of variations: 2	$$Y = \frac{P1 * P3^2}{\left[4 * (X - P2)^2 + P3^2\right]} + P4$$	
0007	Poisson With Offset Number of variations: 2	$$Y = P2 * e^{[X * Ln(P1) - P1 - Ln(X!)]} + P3$$	

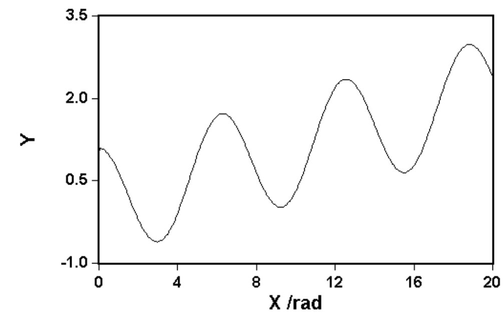
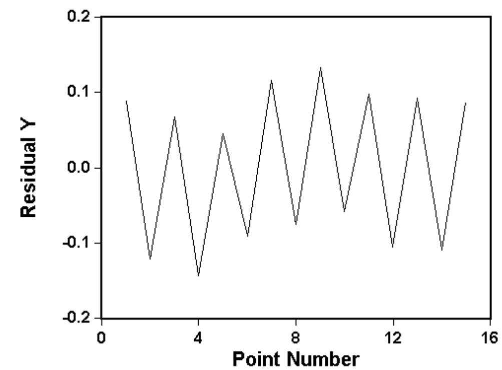
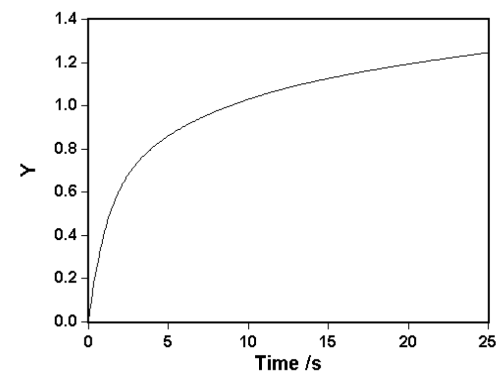
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0008	Multiple Linear Number of variations: more than 100 Note: The function used to generate the example graph has two independent variables, X1 and X2. The residual graph rather than the fit graph is displayed.	$Y = Po + \sum_{i=1}^{n} Pi * Xi$, for example, $Y = P0 + P1*X1 + P2*X2 + P3*X3$	
0009	Power Curve Number of variations: 1	$Y = P1 * X^{P2}$	
0010	Rational Function Number of variations: more than 10	$Y = \dfrac{PN0 + \sum_{i=1}^{n1} \left(PN_i * X^i\right)}{1 + \sum_{j=1}^{n2} \left(PD_j * X^j\right)}$, for example, $Y = \dfrac{PN0}{(1 + PD1 * X)}$	

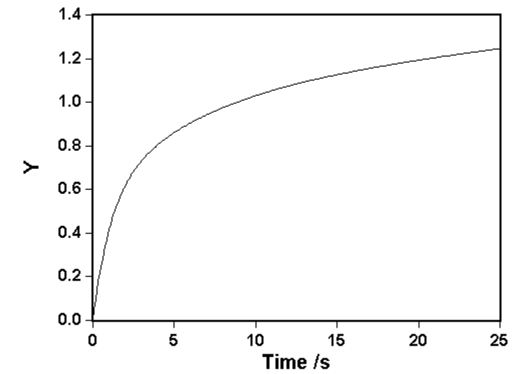
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0011	Polynomial_1 Number of variations: more than 10	$Y = \sum_i P_i * X^i, \quad \text{for } -10 <= i <= 10$, for example, $Y = P0 + P1*X + P2*X^2$	
0012	Polynomial_2 Number of variations: more than 10	$Y = \sum_{i=1}^{n} \left(P_i * \lvert X \rvert^{K_i} \right)$, for example, $Y = P0 + P1*\lvert X\rvert^{-0.5} + P2*X$	
0012	Square Root Number of variations: 1	$Y = P1 + P2 * \sqrt{\lvert X \rvert}$	

Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0014	Y = P1 + P2 * X + P3 / X^2 Number of variations: 1	$$Y = P1 + P2 * X + \frac{P3}{X^2}$$	
0015	Y = P1 + P2 / X + P3 * Ln|X| Number of variations: 1	$$Y = P1 + \frac{P2}{X} + P3 * Ln\|X\|$$	
0016	Error Function (Erf) With Background Correction Number of variations: 4	$$Y = P1 * erf(P2 * X) + P3 + P4 * X + P5 * X^2$$	

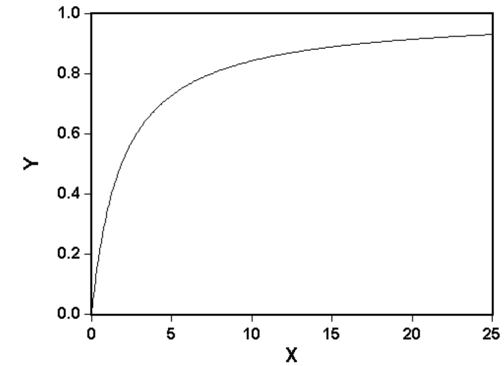
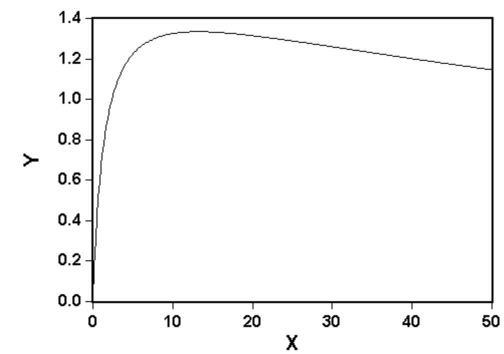
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0017	Complementary Error Function With Background Correction Number of variations: 4	$Y = P1 * erfC(P2 * X) + P3 + P4 * X + P5 * X^2$	
0018	Incomplete Gamma Function (GammaP) With Background Correction Number of variations: 4	$Y = P1 * GammaP(P2, X) + P3 + P4 * X + P5 * X^2$	
0019	Complementary Incomplete Gamma Function (GammaQ) With Background Correction Number of variations: 4	$Y = P1 * GammaQ(P2, X) + P3 + P4 * X + P5 * X^2$	

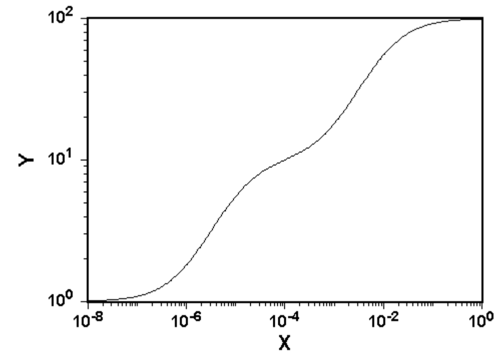
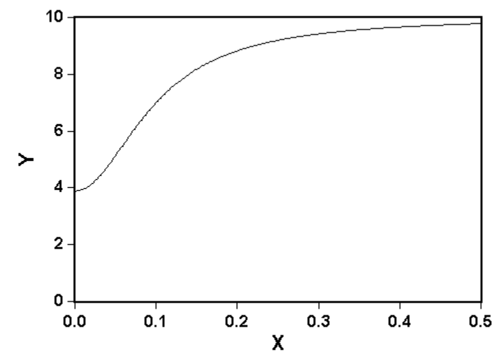
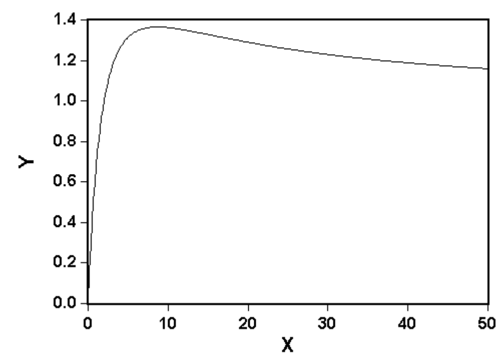
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0020	Boiling Curve_1 Number of variations: 1	$$Y = e^{\left[P1*X^{K1} + P2*X^{K2}\right]} - 1$$	
0021	Boiling Curve_2 Number of variations: 1	$$Y = e^{\left[P1 * X^{P3} + P2 * X^{P4}\right]} - 1$$	
0022	Sine With Background Correction Number of variations: 4	$$Y = P1 * \mathrm{Sin}(P2 * X + P3) + \sum_{i} Ai * X^{i}$$	

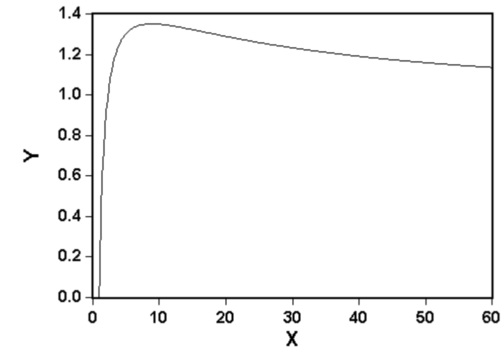
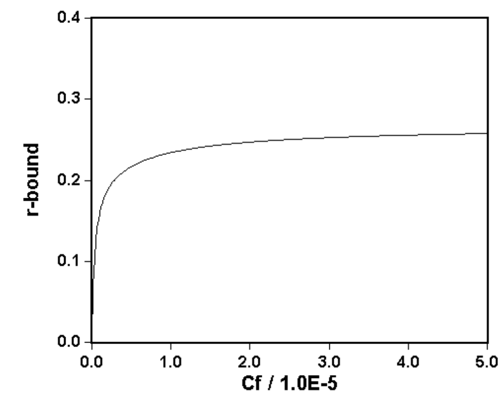
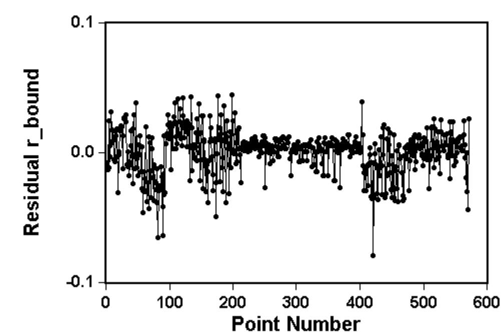
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0023	Cosine With Background Correction Number of variations: 4	$Y = P1 * \mathrm{Cos}(P2 * X + P3) + \sum_i Ai * X^i$	
0024	Multiple Linear_2 – **MULTI-FIT** Number of variations: more than a **million** Note: The function used to generate the example graph has three independent variables, X1, X2 and X3. The residual graph, rather than the fit graph, is displayed.	$Y = \sum_j P_j * X_{K[j]}$	
0025	**New in version 7** Sum of Exponentials Number of variations: 20 Note: Previously available only in the ST1 custom FFL.	$Y = P_1 * X + \sum_{j=1}^{n}\left[P_{2j} * \left(1 - e^{-P_{2j+1} * X}\right)\right]$ or $Y = P_1 * (X - Xo) + \sum_{j=1}^{n}\left[P_{2j} * \left(1 - e^{-P_{2j+1} * (X - Xo)}\right)\right]$	

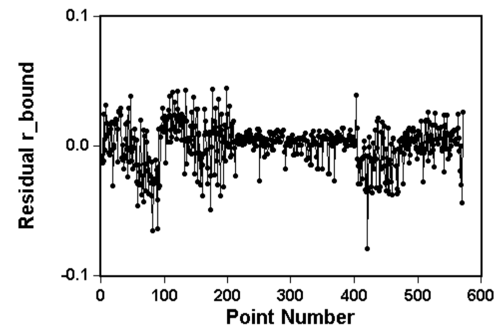
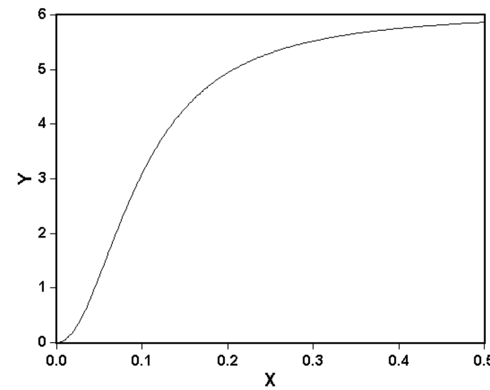
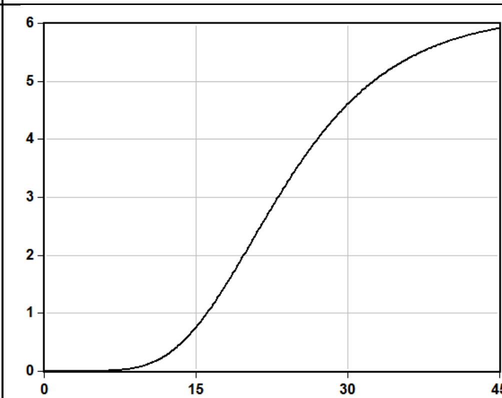
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0026	**New in version 7** Sum of Exponentials Number of variations: 20 Note: Previously available only in the ST1 custom FFL.	$Y = \sum_{j=1}^{n} \left[P_{2j-1} * \left(1 - e^{-P_{2j} * X} \right) \right]$ or $Y = \sum_{j=1}^{n} \left[P_{2j-1} * \left(1 - e^{-P_{2j} * (X - Xo)} \right) \right]$	

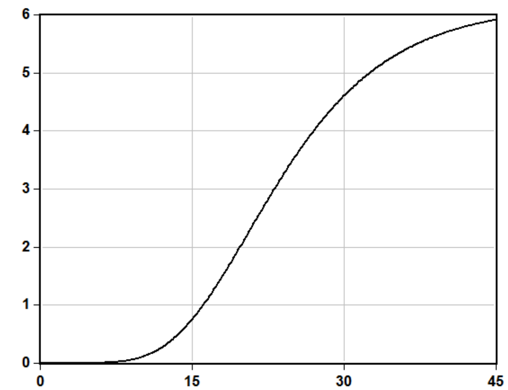
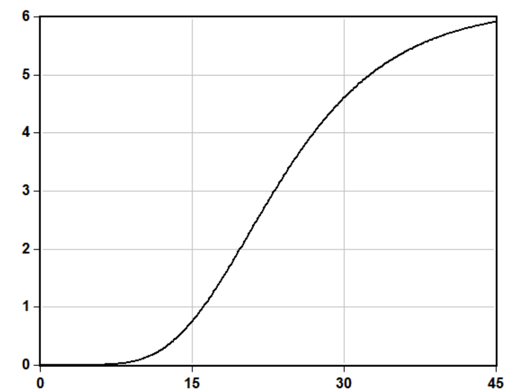
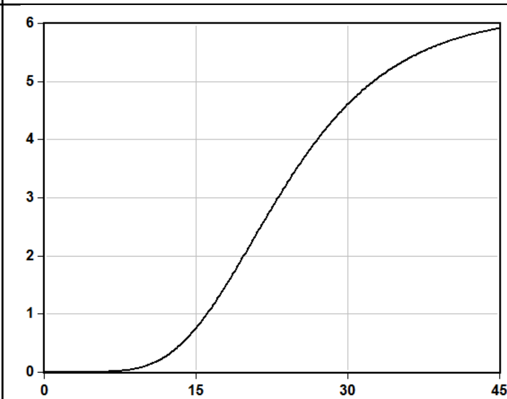
Binding & Growth Curves
FitAll Function Library

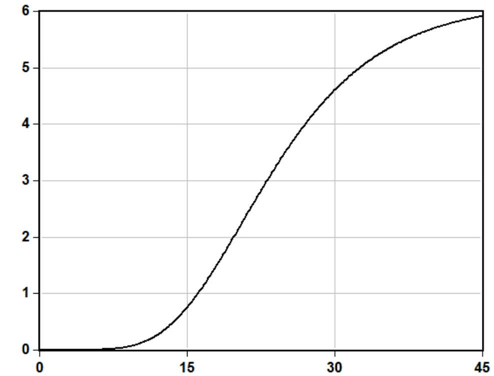
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0201	Langmuir Adsorption Isotherm Number of variations: 1	$Y = \frac{P1 * X}{(1 + P1 * X)}$	
0202	Coupled Saturation Curves (Zero Origin) Number of variations: 10	$Y = \frac{\sum_{i=1}^{n} \left(X^{i} * P_{2i} * \prod_{j=1}^{i} P_{2j-1} \right)}{1 + \sum_{i=1}^{n} \left(X^{i} * \prod_{j=1}^{i} P_{2j-1} \right)}$, for example, $Y = \frac{(P1 * P2 * X + P1 * P3 * P4 * X^{2})}{(1 + P1 * X + P1 * P3 * X^{2})}$	

Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0203	Coupled Saturation Curves (Non Zero Origin) Number of variations: 10	$Y = \frac{P1 + \sum_{i=1}^{n}\left(X^{i} * P_{2i+1} * \prod_{j=1}^{i} P_{2j}\right)}{1 + \sum_{i=1}^{n}\left(X^{i} * \prod_{j=1}^{i} P_{2j}\right)}$, for example, $Y = \frac{(P1 + P2 * P3 * X + P2 * P4 * P5 * X^{2})}{(1 + P2 * X + P2 * P4 * X^{2})}$	
0204	Cooperative Saturation Curve (Non zero Origin) Number of variations: 1	$Y = \frac{(P3 + P2 * P1 * X^{P4})}{(1 + P1 * X^{P4})}$	
0205	Uncoupled Saturation Curves (Zero Origin) Number of variations: 10	$Y = \sum_{i=1}^{n}\left(\frac{P_{2i-1} * P_{2i} * X}{[1 + P_{2i-1} * X]}\right)$, for example, $Y = \frac{P1 * P2 * X}{(1 + P1 * X)} + \frac{P3 * P4 * X}{(1 + P3 * X)}$	

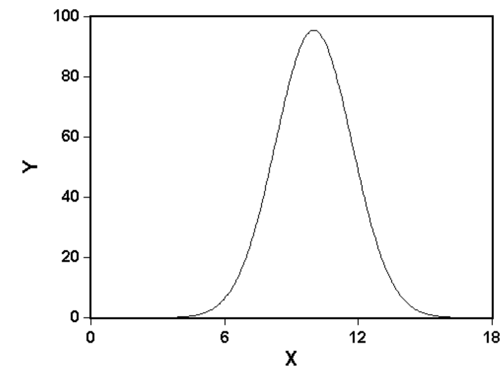
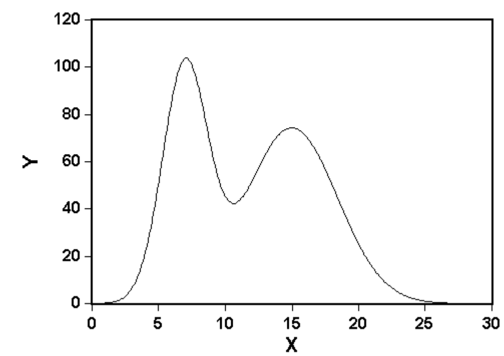
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0206	Uncoupled Saturation Curves (Non zero Origin) Number of variations: 10	$$Y = P_1 + \sum_{i=1}^{n} \left(\frac{P_{2i} * P_{2i+1} * X}{[1 + P_{2i} * X]} \right),$$ for example, $$Y = P1 + \frac{(P2 * P3 * X)}{(1 + P2 * X)} + \frac{(P4 * P5 * X)}{(1 + P4 * X)}$$	
0207	DNA-DRUG Binding: Multi-Site, Single Experiment; f's as parameters Number of variations: 10 Note: Previously available only in the JC2 custom edition.	$$Y = \frac{1}{2} * \sum_{j=1}^{n} \left(\frac{\lvert P_{2j-1} \rvert * \lvert P_{2j} \rvert * X}{[1 + \lvert P_{2j-1} \rvert * X]} \right)$$	
0208	DNA-DRUG Binding: Multi-Site, Multi-Experiment; f's as independent variables Number of variations: Several million. Notes: 1. Residuals graph is shown. 2. Previously available only in the JC2 custom edition.	$$Y = \frac{1}{2} * \sum_{j=1}^{n} \left(\frac{A_j * \lvert P_j \rvert * X}{[1 + \lvert P_j \rvert * X]} \right)$$ for example, $$Y = \frac{A1 * \lvert P1 \rvert * X}{2 * (1 + \lvert P1 \rvert * X)} + \frac{A2 * \lvert P2 \rvert * X}{2 * (1 + \lvert P2 \rvert * X)}$$	

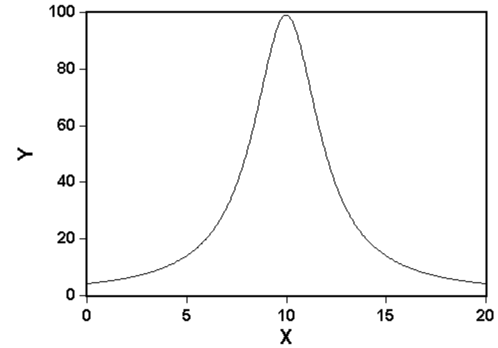
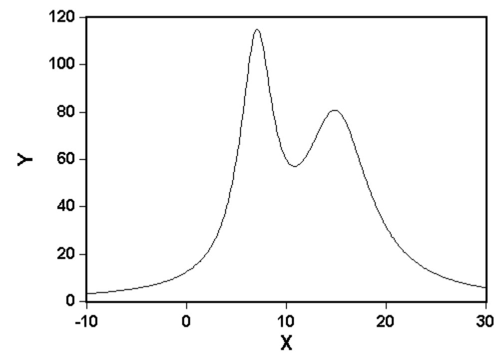
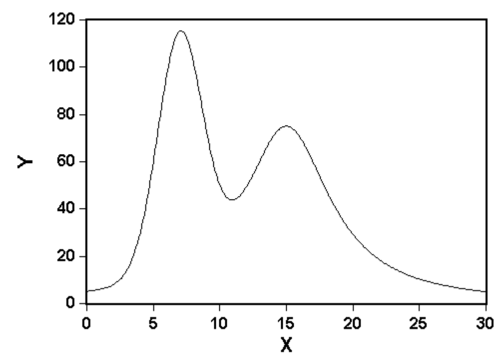
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0209	DNA-DRUG Binding: Multi-Site, Multi-Experiment; f's as constants Number of variations: Several million. Notes: 1. Residuals graph is shown. 2. Previously available only in the JC2 custom edition.	$Y = \frac{1}{2} * \sum_{j=1}^{n} \left(\frac{A_j * \lvert P_j \rvert * X}{[1 + \lvert P_j \rvert * X]} \right)$ for example, $Y = \frac{A1 * \lvert P1 \rvert * X}{2*(1+\lvert P1 \rvert * X)} + \frac{A2 * \lvert P2 \rvert * X}{2*(1+\lvert P2 \rvert * X)}$	
0214	**New in version 9** Cooperative Saturation Curve with zero origin. Number of variations: 1	$Y = \frac{P1 * P2 * X^{P3}}{(1 + P1 * X^{P3})}$	
0221 0222 0223	**New in version 9** Gompertz Curve	$Y=P1*e^{[P2*e^{(-P3*X)}]}$, $Y=P1*e^{\left[P2*e^{\left(-P3*X-P4*X^2\right)}\right]}$, $Y=P1*e^{\left[P2*e^{\left(-P3*X-P4*X^2-P5*X^3\right)}\right]}$	

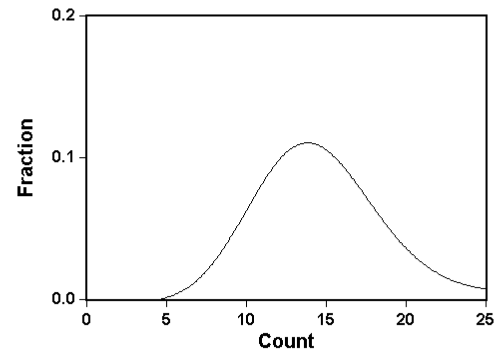
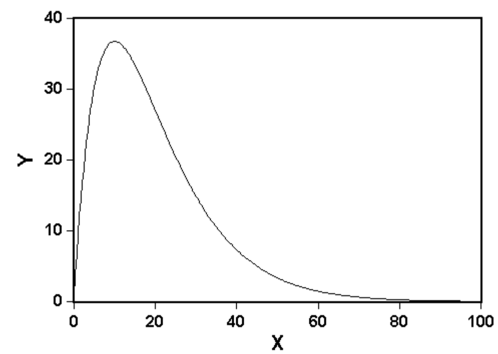
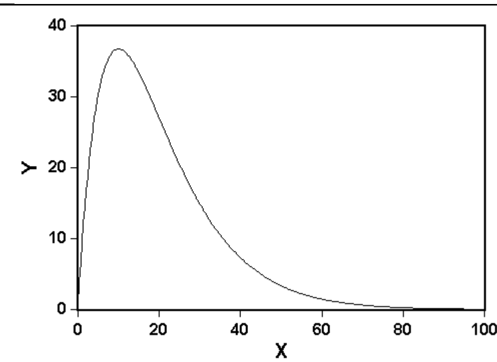
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0225 0226	**New in version 9** **Logistic**	$$Y=\frac{P1}{[1+P2*e^{-P3*X}]}$$, $$Y=\frac{P1}{\left[1+\left(\frac{P1-P2}{P2}\right)*e^{-P3*X}\right]}$$	
0228 0229	**New in version 9** Weibull	$$Y = P1 - P2*e^{-\lvert P3\rvert *X^{P4}}$$, $$Y = P1 - (P1 - P2)*e^{-\lvert P3\rvert *X^{P4}}$$	
0232	**New in version 9** Chapman-Richards	$$Y = P1*[1-P2*e^{-P3*X}]^{1/(1-P4)}$$	

Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
233	**New in version 9** Richards	$$Y=\frac{P1}{[1 + P2^*e^{-P3^*X}]^{1/P4}}$$	

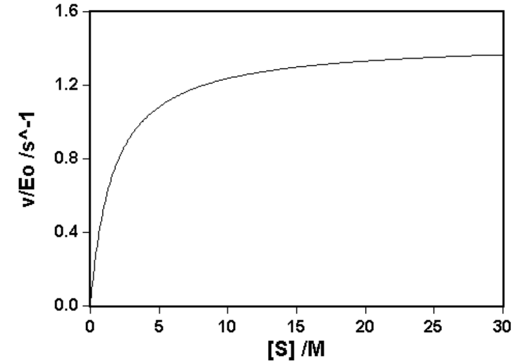
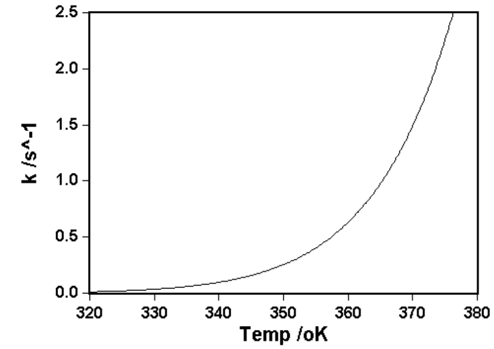
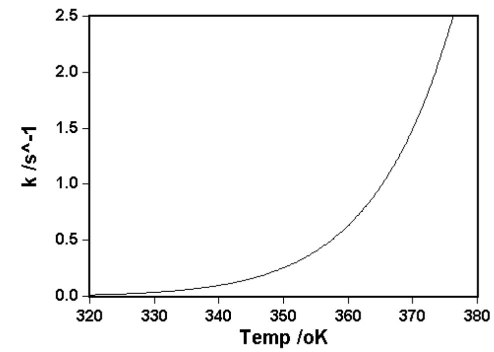
Peaks
FitAll Function Library

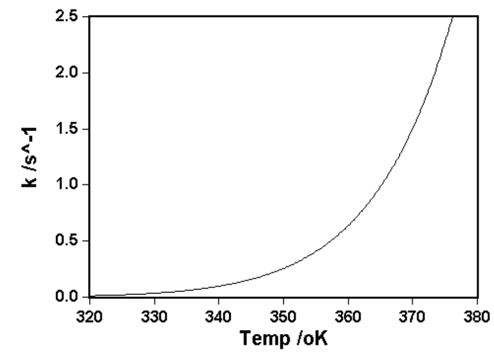
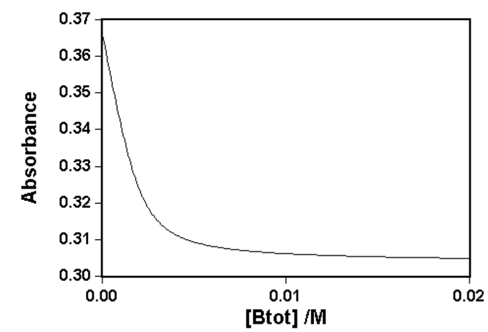
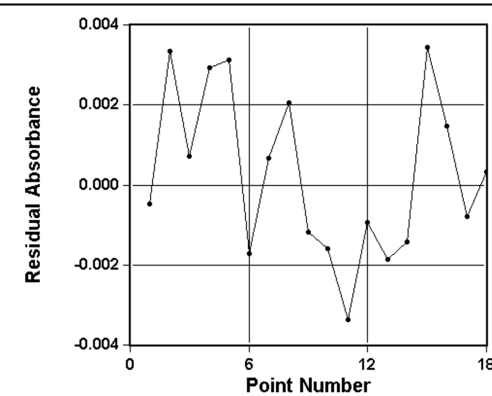
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0301	Gaussian With Background Correction Number of variations: 4	$Y = P1 * e^{\left[-2.77*\left(\frac{(X - P2)}{P3}\right)^{2}\right]} + \sum_{i=0} Ai * X^{i}$ for example, $Y = P1 * e^{\left[-2.77*\left(\frac{(X - P2)}{P3}\right)^{2}\right]} + P4 + P5 * X$	
0302	Sum of Gaussians With Background Correction Number of variations: 20	$Y = \sum_{i=1}^{n} \left(P_{3i-2} * e^{\left[-2.77*\left(\frac{X - P_{3i-1}}{P_{3i}}\right)^{2}\right]} \right) + \sum_{j=0}^{n2} \left(P_{3n+1+j} * X^{j} \right)$, for example, $Y = P1 * e^{\left[-2.77*\left(\frac{X - P2}{P3}\right)^{2}\right]} + P4 * e^{\left[-2.77*\left(\frac{X - P5}{P6}\right)^{2}\right]}$	

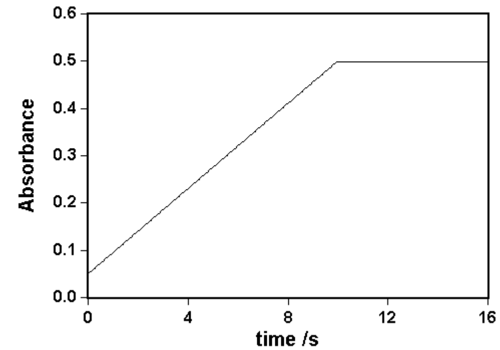
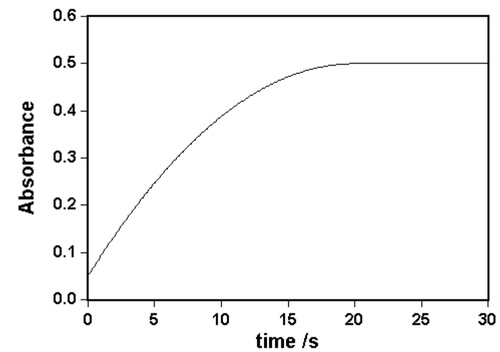
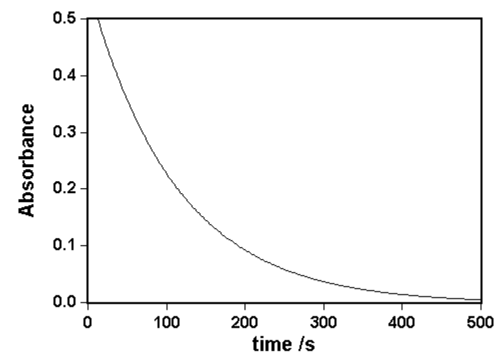
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0303	Lorentzian With Background Correction Number of variations: 4	$Y = \frac{P1 * P3^2}{\left[4 * (X - P2)^2 + P3^2\right]} + \sum_i Ai * X^i$ for example, $Y = \frac{P1 * P3^2}{\left[4 * (X - P2)^2 + P3^2\right]} + P4 + P5 * X + P6 * X^2$	
0304	Sum of Lorentzians With Background Correction Number of variations: 20	$Y = \sum_{i=1}^{n} \left(\frac{P_{3i-2} * P_{3i}^2}{\left[4 * (X - P_{3i-1})^2 + P_{3i}^2\right]} \right) + \sum_{j=0}^{n2} \left(P_{3n+1+j} * X^j \right)$ for example, $Y = \frac{P1 * P3^2}{[4 * (X - P2)^2 + P3^2]} + \frac{P4 * P6^2}{[4 * (X - P5)^2 + P6^2]}$	
0305	Sum of Gaussians and Lorentzians With Background Correction Number of variations: > 20	The simplest form of the function is: $Y = P1 * e^{\left[-2.77 * \left(\frac{X - P2}{P3}\right)^2\right]} + \frac{P4 * P6^2}{[4 * (X - P5)^2 + P6^2]}$	

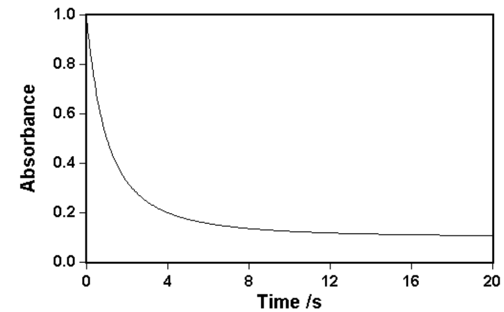
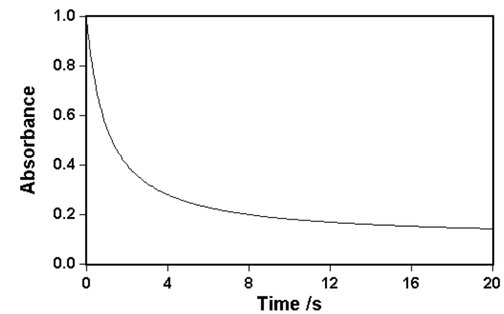
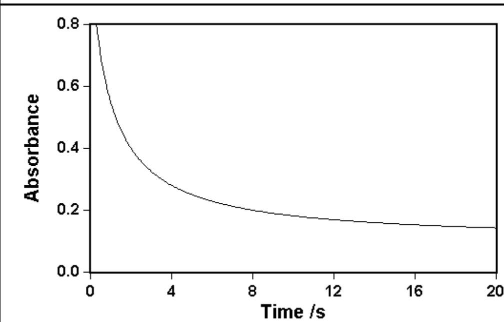
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0306	Poisson With Background Correction Number of variations: 4	$Y = P2 * e^{[X*Ln(P1)-P1-Ln(X!)]} + \sum_{i=0}^{n} \left(A_i * X^i\right)$ for example, $Y = P2 * e^{[X*Ln(P1)-P1-Ln(X!)]} + P3 + P4 * X$	
0307	Impulse: Linear or exponential Growth Coupled with Exponential Decay Number of variations: 12.	$Y = P1*(X - P3)^{P4} * e^{[-P2*K1*(X-P3)]} + \sum_{i=0}^{n} \left(A_i * X^i\right)$ for example, $Y = P1 * (X - P3)^{P4} * e^{[-P2*K1*(X-P3)]}$	
0308	Impulse_2: Linear or exponential Growth Coupled with Exponential Decay Same as function 0307 except that parameter P3, the X offset, is assumed to be zero. Number of variations: 8.	$Y = P1*X^{P3} * e^{[-P2*K1*X]} + \sum_{i=0}^{n} \left(A_i * X^i\right)$ for example, $Y = P1*X^{P3} * e^{[-P2*K1*X]}$	

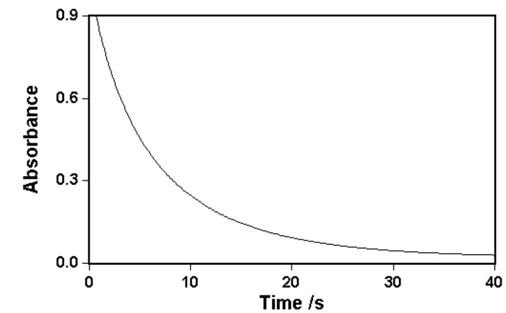
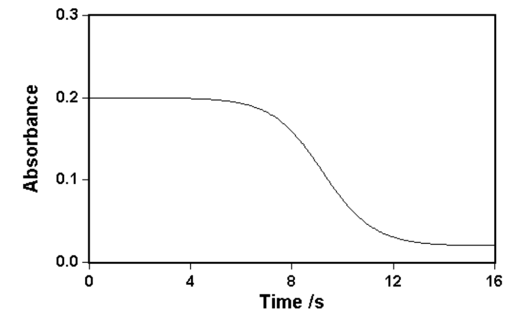
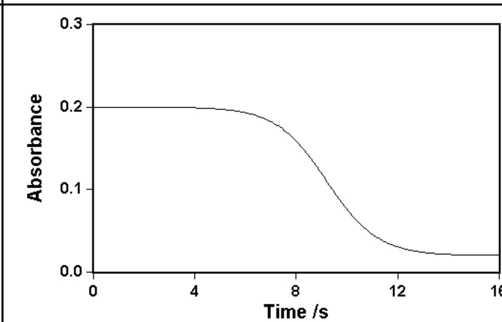
Chemistry
FitAll Function Library

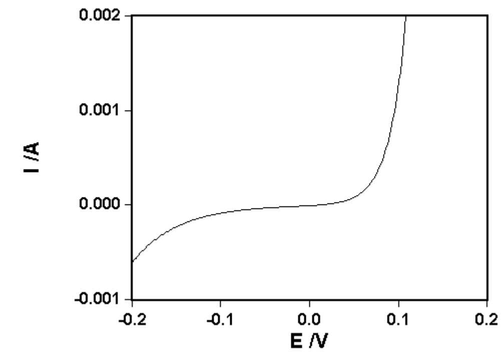
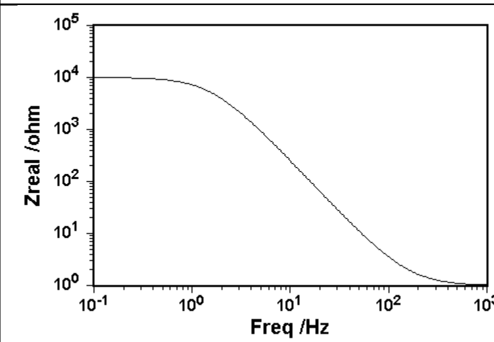
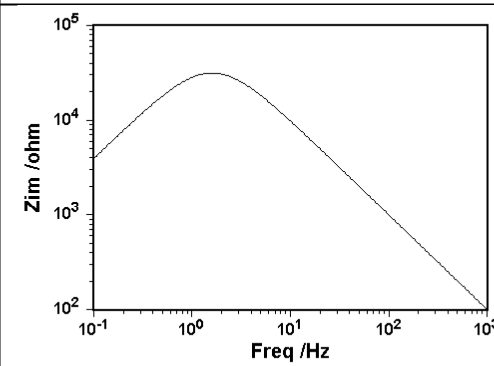
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0401	Michaelis-Menton Kinetics Number of variations: 3	$$Y = \frac{P1 * X}{(P2\ +\ X)}$$ or $$Y = \frac{P1 * X}{(P2\ +\ X)} + \frac{P3 * X}{(P4\ +\ X)}$$	
0402	Arrhenius Activation Energy Number of variations: 1	$$Y\ =\ P1 * e^{\left[\frac{-P2}{(K1*X)}\right]}$$	
0403	Activation Enthalpy and Entropy Number of variations: 1	$$Y\ =\ K1 * X * e^{\left[\frac{-P1}{(K2*X)} + \frac{P2}{K2}\right]}$$	

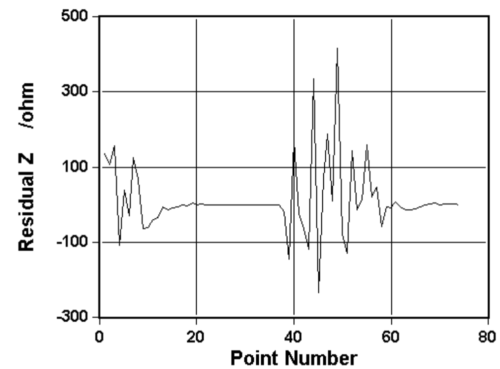
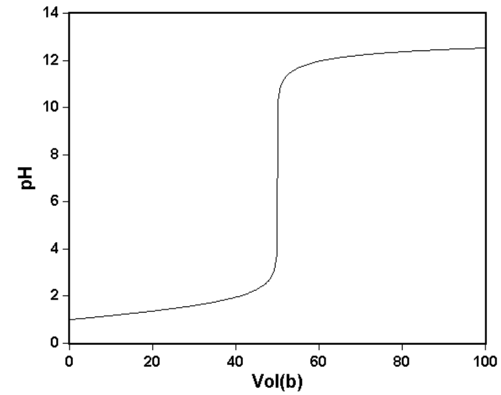
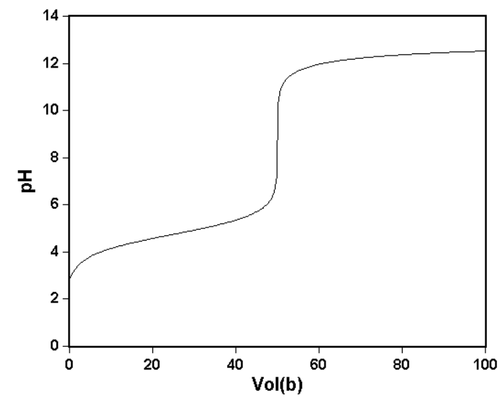
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0404	Equilibrium Enthalpy and Entropy Number of variations: 1	$Y = e^{\left[\frac{-P1}{(K1 * X)} + \frac{P2}{K1}\right]}$	
0405	Reversible Chemical Equilibrium_1: A + B = C, X1 = Btot, K1 = Atot Number of variations: 3	$Y = P2 * \left\{ \frac{P1 * (K1 + X1) + 1 - \sqrt{\left(\left[P1 * (K1 + X1) + 1 \right]^2 - 4 * P1^2 * K1 * X1 \right)}}{2 * P1} \right\}$	
0406	Reversible Chemical Equilibrium_2: A + B = C, X1 = Btot, X2 = Atot Number of variations: 3 Note: This function has two independent variables, X1 and X2.	$Y = P2 * \left\{ \frac{P1 * (X2 + X1) + 1 - \sqrt{\left(\left[P1 * (X2 + X1) + 1 \right]^2 - 4 * P1^2 * X2 * X1 \right)}}{2 * P1} \right\}$	

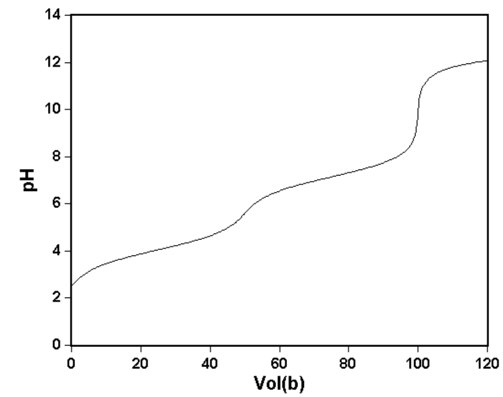
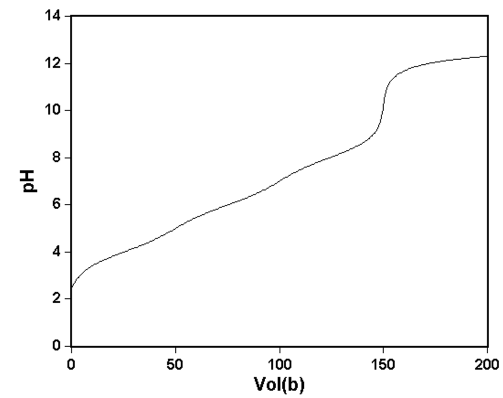
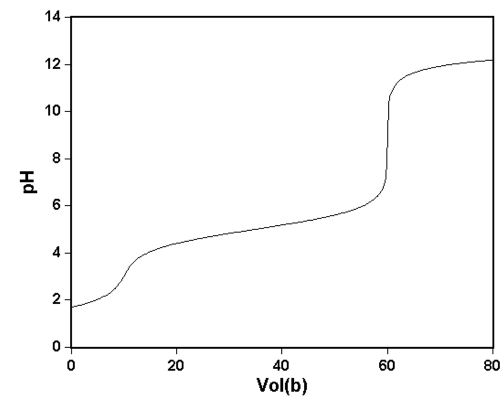
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0407	Chemical Kinetics: Zero-Order Rxn: A -> B, -dA/dt = k Number of variations: 2	$Y = \begin{cases} P2 * K1, & \text{for } X < 0 \\ P2 * K1 + (P3 - P2) * P1 * X, & \text{for } 0 \leq X \leq \frac{K1}{P1} \\ P3 * K1, & \text{for } X > \frac{K1}{P1} \end{cases}$	
0408	Chemical Kinetics: Half-Order Rxn: A -> B, dA/dt = k*A^(1/2) Number of variations: 2	$Y = \begin{cases} P2 * K1, & \text{for } X < 0 \\ P2 * K1 + (P3 - P2) * P1 * X * \frac{4 * \sqrt{K1} - P1 * X}{4}, & \text{for } 0 \leq X \leq \frac{2 * \sqrt{K1}}{P1} \\ P3 * K1, & \text{for } X > \frac{2 * \sqrt{K1}}{P1} \end{cases}$	
0409	Chemical Kinetics: First-Order Rxn: A -> B, dA/dt = k*A Number of variations: 2	$Y = K1 * [P2 + (P3 - P2) * (1 - e^{-P1 * X})]$ or $Y = K1 * P2 * e^{-P1 * X}$	

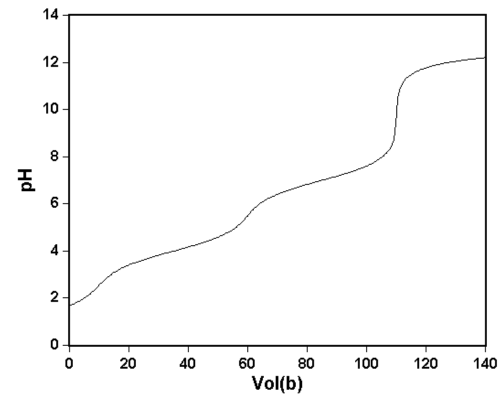
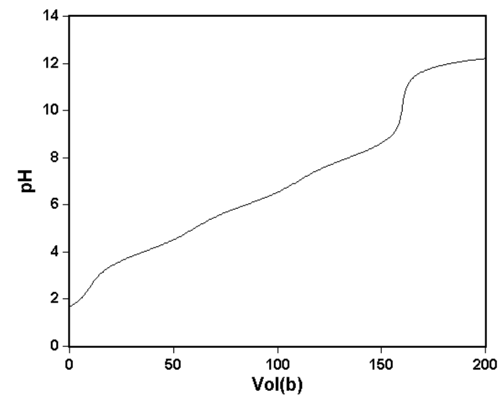
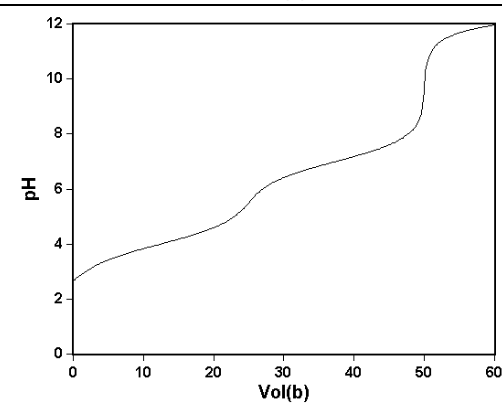
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0410	Chemical Kinetics: (3/2)-Order Rxn: A -> B, dA/dt = k*A^(3/2) Number of variations: 2	$Y = K1 * P2 + (P3 - P2) * K1 * \left(1 - \frac{4}{(2 + P1 * \sqrt{K1} * X)^2}\right)$	
0411	Chemical Kinetics: Second-Order (equal) Rxn_1: A -> B, dA/dt = k*A^2 Number of variations: 2	$Y = K1 * P2 + \frac{(P3 - P2) * P1 * K1^2 * X}{(1 + P1 * K1 * X)}$	
0412	Chemical Kinetics: Second-Order (equal) Rxn_2: 2A -> B, dA/dt = k*A^2 Number of variations: 2	$Y = K1 * P2 - \frac{P2 * P1 * K1^2 * X}{(1 + P1 * K1 * X)}$	

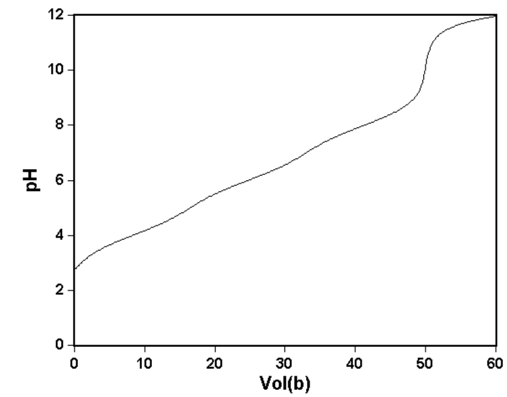
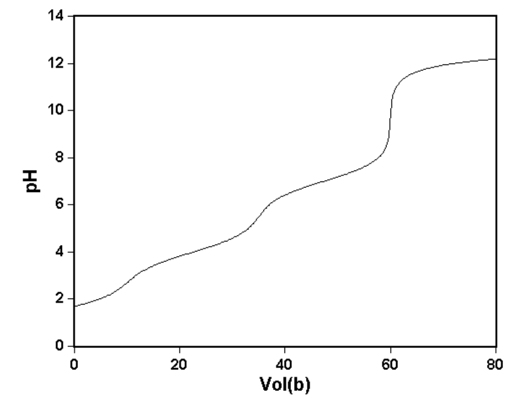
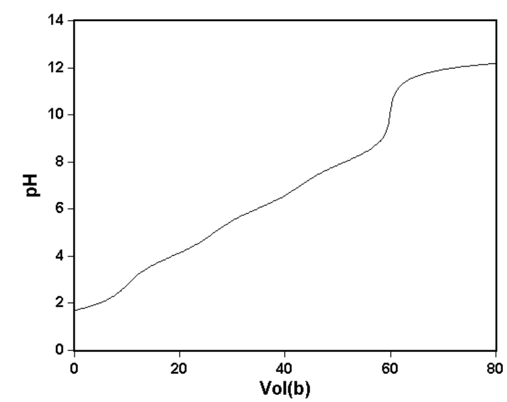
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0413	Chemical Kinetics: Second-Order (unequal) Rxn: A + B -> C, dA/dt = k*A*B Number of variations: 2	$Y = K1*P2 + K2*P3 - \frac{(P3+P2)*K1*K2*[1-e^{(K2-K1)*P1*X}]}{K1-K2*e^{(K2-K1)*P1*X}}$	
0414	Chemical Kinetics: Autocatalysis_1: A -> B, dA/dt = k*A*B, Bo Known Number of variations: 2	$Y = K1*P2 - \frac{P2*K1*K2*\left(1-e^{[(K2-K1)*P1*X]}\right)}{K2+K1*e^{[(K2-K1)*P1*X]}}$	
0415	Chemical Kinetics: Autocatalysis_2: A -> B, dA/dt = k*A*B, Bo UnKnown Number of variations: 2	$Y = K1*P3 - \frac{P3*K1*P2*\left(1-e^{[(P2-K1)*P1*X]}\right)}{P2+K1*e^{[(P2-K1)*P1*X]}}$	

Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0416	Current - Over Potential Number of variations: 2	$Y = P1 * \left\{ e^{\left[\frac{K1*(X-P4)}{P2}\right]} - e^{\left[\frac{-K1*(X-P4)}{P3}\right]} \right\}$ or $Y = P1 * \left\{ e^{\left[\frac{K1*(X-P4-Y*P5)}{P2}\right]} - e^{\left[\frac{-K1*(X-P4-Y*P5)}{P3}\right]} \right\}$	
0417	Real Impedance of a Parallel RC+Rs Circuit Number of variations: 2	$Y = \frac{P1}{\left[1+(2*\pi*P1*P2*X)^2\right]}$ or $Y = \frac{P1}{\left[1+(2*\pi*P1*P2*X)^2\right]} + P3$	
0418	Imaginary Impedance of a Parallel RC or RC+Rs Circuit Number of variations: 1	$Y = \frac{-(2*\pi*P1)^2*P2*X}{\left[1+(2*\pi*P1*P2*X)^2\right]}$	

Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0419	Real and Imaginary Impedance of a Parallel RC+Rs Circuit Number of variations: 2 Note: This function has two independent variables, X1and X2.	$$Y = \begin{cases} \dfrac{P1}{\left[1 + (2 * \pi * P1 * P2 * X1)^2\right]} + P3, & \text{for } X2 = 0 \\ \dfrac{-(2 * \pi * P1)^2 * P2 * X1}{\left[1 + (2 * \pi * P1 * P2 * X1)^2\right]}, & \text{for } X2 \neq 0 \end{cases}$$	
0421 0422 0423	**New in version 9** Titration of a strong acid with a strong base.	Depending on which function is used the following are determined: • Concentration of the strong acid, Cso • Concentration of the strong acid, Cso and pKw. • pKw.	
0425 0426 0427	**New in version 9** Titration of a weak monoprotic acid with a strong base.	Depending on which function is used the following are determined: • Acid dissociation constant, pKa, of the weak monoprotic acid. • Acid dissociation constant, pKa, of the weak monoprotic acid and its concentration, Cbo. • Acid dissociation constant, pKa, of the weak monoprotic acid, its concentration, Cbo, and pKw.	

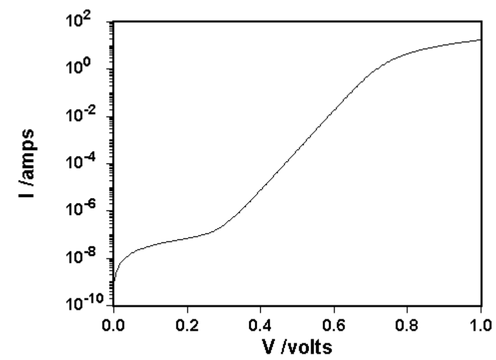
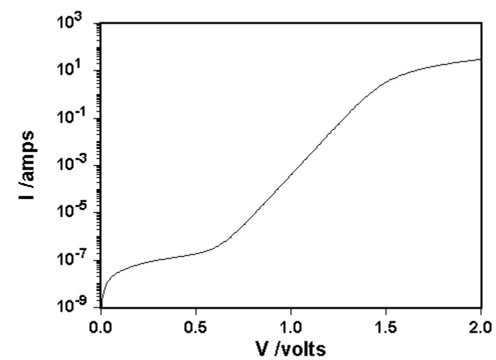
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0430 0431 0432	**New in version 9** Titration of a weak diprotic acid with a strong base.	Depending on which function is used the following are determined: • Acid dissociation constants, pKa1 & pKa2, of the weak diprotic acid. • Acid dissociation constants, pKa1 & pKa2, of the weak diprotic acid and its concentration, Cbo. • Acid dissociation constants, pKa1 & pKa2, of the weak diprotic acid, its concentration, Cbo, and pKw.	
0435 0436 0437	**New in version 9** Titration of a weak triprotic acid with a strong base.	Depending on which function is used the following are determined: • Acid dissociation constants, pKa1, pKa2 & pKa3, of the weak triprotic acid. • Acid dissociation constants, pKa1, pKa2 & pKa3, of the weak triprotic acid and its concentration, Cbo. • Acid dissociation constants, pKa1, pKa2 & pKa3, of the weak triprotic acid, its concentration, Cbo, and pKw.	
0445 0446 0447	**New in version 9** Titration of a strong acid and a weak monoprotic acid with a strong base.	Depending on which function is used the following are determined: • Acid dissociation constant, pKa, of the weak monoprotic acid, and the concentration of the strong acid, Cso. • Acid dissociation constant, pKa, of the weak monoprotic acid, the concentration of the strong acid, Cso, and the concentration of the weak monoprotic acid, Cao. • Acid dissociation constant, pKa, of the weak monoprotic acid, the concentration of the strong acid, Cso, the concentration of the weak monoprotic acid, Cao, and pKw.	

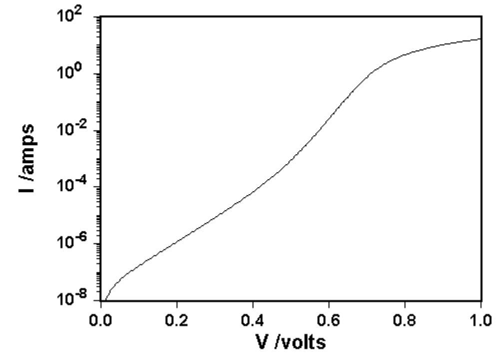
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0450 0451 0452	**New in version 9** Titration of a strong acid and a weak diprotic acid with a strong base.	Depending on which function is used the following are determined: • Acid dissociation constants, pKa1 & pKa2, of the weak diprotic acid, and the concentration of the strong acid, Cso. • Acid dissociation constants, pKa1 & pKa2, of the weak diprotic acid, the concentration of the strong acid, Cso, and the concentration of the weak diprotic acid, Cao. • Acid dissociation constants, pKa1 & pKa2, of the weak diprotic acid, the concentration of the strong acid, Cso, the concentration of the weak diprotic acid, Cao, and pKw.	
0455 0456 0457	**New in version 9** Titration of a strong acid and a weak triprotic acid with a strong base.	Depending on which function is used the following are determined: • Acid dissociation constants, pKa1, pKa2 & pKa3, of the weak triprotic acid, and the concentration of the strong acid, Cso. • Acid dissociation constants, pKa1, pKa2 & pKa3, of the weak triprotic acid, the concentration of the strong acid, Cso, and the concentration of the weak triprotic acid, Cao. • Acid dissociation constants, pKa1, pKa2 & pKa3, of the weak triprotic acid, the concentration of the strong acid, Cso, the concentration of the weak triprotic acid, Cao, and pKw.	
0465 0466 0467	**New in version 9** Titration of a mixture of two weak monoprotic acids with a strong base.	Depending on which function is used the following are determined: • Acid dissociation constants, pKa1 & pKa2, of the two weak monoprotic acids. • Acid dissociation constants, pKa1 & pKa2, of the two weak monoprotic acids and the concentrations of the two weak monoprotic acids, Ca1o & Ca2o. • Acid dissociation constants, pKa1 & pKa2, of the two weak monoprotic acids, the concentrations of the two weak monoprotic acids, Ca1o & Ca2o, and pKw.	

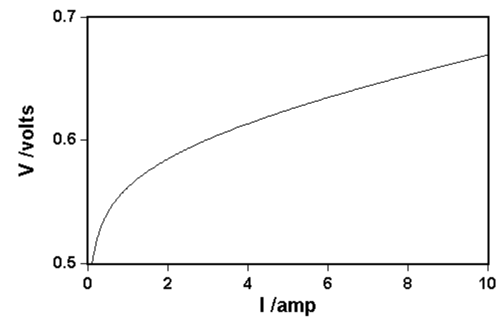
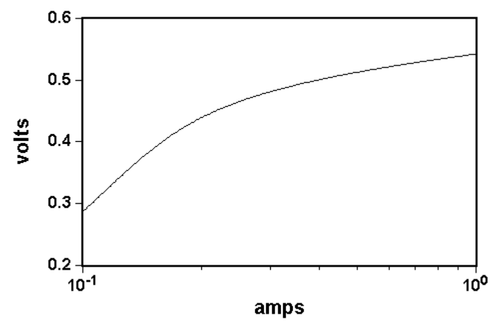
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Graph
0470 0471 0472	**New in version 9** Titration of a mixture of three weak monoprotic acids with a strong base.	Depending on which function is used the following are determined: • Acid dissociation constants, pKa1, pKa2 & pKa3, of the three weak monoprotic acids. • Acid dissociation constants, pKa1, pKa2 & pKa3, of the three weak monoprotic acids and the concentrations of the three weak monoprotic acids, Ca1o, Ca2o & Ca3o. • Acid dissociation constants, pKa1, pKa2 & pKa3, of the three weak monoprotic acids and the concentrations of the three weak monoprotic acids, Ca1o, Ca2o & Ca3o, and pKw.	
0485 0486 0587	**New in version 9** Titration of a strong acid and a mixture of two weak monoprotic acids with a strong base.	Depending on which function is used the following are determined: • Acid dissociation constants, pKa1 & pKa2, of the two weak monoprotic acids and the concentration of the strong acid, Cso. • Acid dissociation constants, pKa1 & pKa2, of the two weak monoprotic acids, the concentration of the strong acid, Cso, and the concentrations of the two weak monoprotic acids, Ca1o & Ca2o. • Acid dissociation constants, pKa1 & pKa2, of the two weak monoprotic acids, the concentration of the strong acid, Cso, the concentrations of the two weak monoprotic acids, Ca1o & Ca2o, and pKw.	
0490 0491 0492	**New in version 9** Titration of a strong acid and a mixture of three weak monoprotic acids with a strong base.	Depending on which function is used the following are determined: • Acid dissociation constants, pKa1, pKa2 & pKa3, of the three weak monoprotic acids and the concentration of the strong acid, Cso. • Acid dissociation constants, pKa1, pKa2 & pKa3, of the three weak monoprotic acids and the concentration of the strong acid, Cso, and the concentrations of the three weak monoprotic acids, Ca1o, Ca2o & Ca3o. • Acid dissociation constants, pKa1, pKa2 & pKa3, of the three weak monoprotic acids and the concentration of the strong acid, Cso, the concentrations of the three weak monoprotic acids, Ca1o, Ca2o & Ca3o, and pKw.	

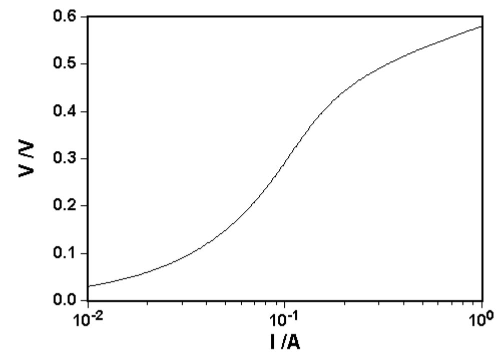
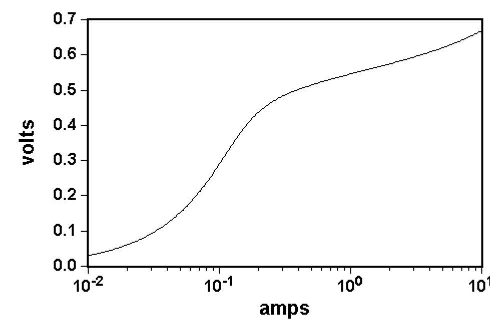
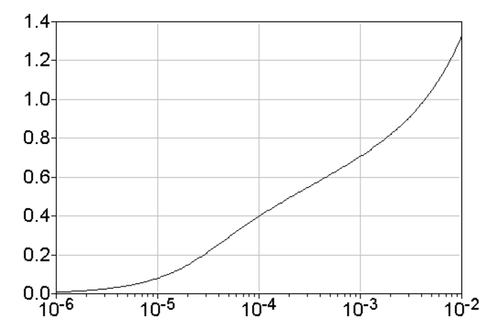
Solar Cell
FitAll Function Library

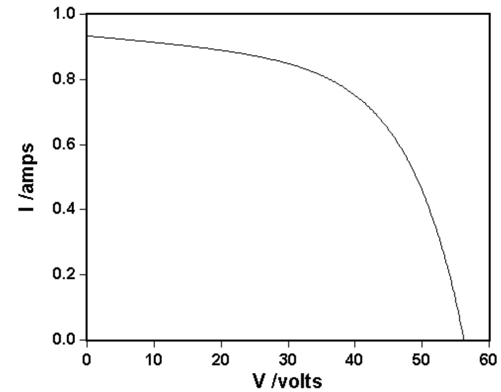
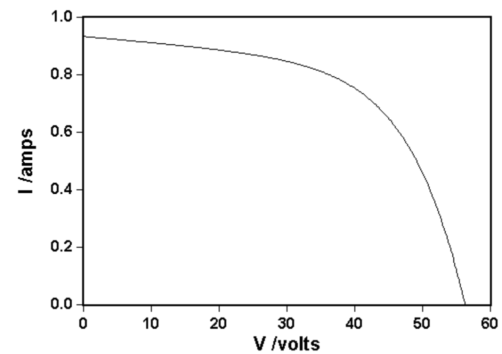
NOTE:
FitAll v8 has been extended so that all of the solar cell functions can be directly used to analyze IV data obtained from solar cells, cell-strings, modules, module-strings and PV Systems.

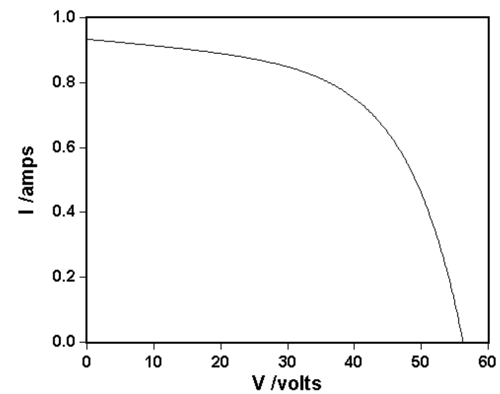
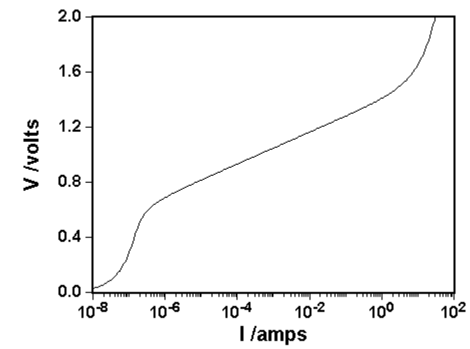
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Fit Graph
0501	Solar Cell: Dark Current-Voltage: Ideal Number of variations: 2	$Y = K4 * \left(P2 * \left\{ e^{\left[\frac{K1*X}{K3*(273.15+K2)}\right]} - 1 \right\} + \frac{X}{(K3*P1)} \right)$ or $Y = K4 * \left(P2 * \left\{ e^{\left[\frac{K1*(X/K3-Y*P3/K4)}{(273.15+K2)}\right]} - 1 \right\} + \frac{(X/K3 - Y*P3/K4)}{P1} \right)$	
0502	Solar Cell: Dark Current-Voltage: Non-Ideal Number of variations: 2	$Y = K4 * \left(P2 * \left\{ e^{\left[\frac{K1*X}{(K3*(273.15+K2)*P3)}\right]} - 1 \right\} + \frac{X}{K3*P1} \right)$ or $Y = K4 * \left(P2 * \left\{ e^{\left[\frac{K1*(X/K3-Y*P4/K4)}{((273.15+K2)*P3)}\right]} - 1 \right\} + \frac{(X/K3 - Y*P4/K4)}{P1} \right)$	

Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Fit Graph
0503	Solar Cell: Dark Current-Voltage: Sum of Ideal and Non-Ideal: Number of variations: 2	$Y = K4*\left(P2*\left\{e^{\left[\frac{K1*X}{K3*(273.15+K2)}\right]}-1\right\} + P3*\left\{e^{\left[\frac{K1*X}{K3*(273.15+K2)*P4}\right]}-1\right\}+\frac{X}{K3*P1}\right)$ or $Y = K4*\left(P2*\left\{e^{\left[\frac{K1*(X/K3-Y*P5/K4)}{(273.15*K2)}\right]}-1\right\} + P3*\left\{e^{\left[\frac{K1*(X/K3-Y*P5/K4)}{((273.15+K2)*P4)}\right]}-1\right\}+\frac{(X/K3-Y*P5/K4)}{P1}\right)$	

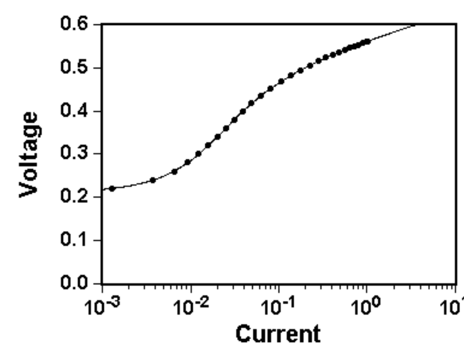
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Fit Graph
0504	Solar Cell: Dark I-V: Model 1: High I-range Number of variations: 1	$Y = K3*\left(\frac{K5*(273.15+K2)}{K1}*Ln\left\|\frac{(X/K4+P1)}{P1}\right\|+X*P2/K4\right)$	
0505	Solar Cell: Dark I-V: Model 2: Mid I-range Number of variations: 1	$Y = K3*P1*\left(X/K4 - P2*\left\{ e^{\left[\frac{K1*Y}{K3*(273.15+K2)}\right]} - 1 \right\} - P3*\left\{ e^{\left[\frac{K1*Y}{K3*P4*(273.15+K2)}\right]} - 1 \right\} \right)$	

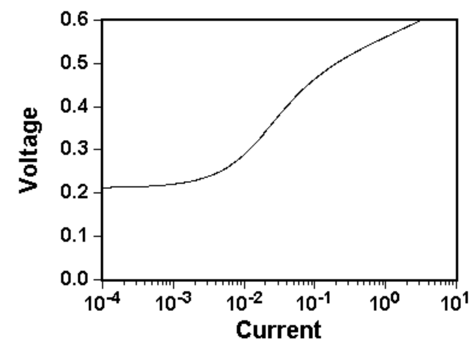
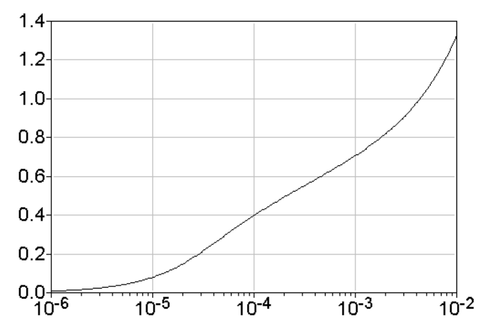
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Fit Graph
0506	Solar Cell: Dark I-V: Model 3: Low I-range Number of variations: 1	$Y = K3*P1*\left(X/K4 - P2*\left\{ e^{\left[\frac{K1*Y}{K3*(273.15+K2)}\right]} - 1 \right\} - P3*\left\{ e^{\left[\frac{K1*Y}{K3*P4*(273.15+K2)}\right]} - 1 \right\} \right)$	
0507	Solar Cell: Dark I-V: Model 4: Full I-range Number of variations: 1	$Y = K3*\left[P1*\left(X/K4 - P2*\left\{ e^{\left[\frac{K1*(Y/K3 - X*P5/K4)}{(273.15+K2)}\right]} - 1 \right\} - P3*\left\{ e^{\left[\frac{K1*(Y/K3 - X*P5/K4)}{(P4*(273.15+K2))}\right]} - 1 \right\} \right) + X*P5/K4 \right]$	
0508	**New in version 10.0.3** Solar Cell: Dark I-V: Model 4E: Full I-range Number of variations: 1	$Y = K3*\left[P1*\left[X/K4 - P2*\left\{ e^{\left[\frac{K1*(Y/K3 - X*P4/K4)}{(P3*(273.15+K2))}\right]} - 1 \right\} \right] + X*P4/K4 \right]$	

Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Fit Graph
0509	Solar Cell: Light I-V: Rs = 0 Rsh = ∞ Number of variations: 1	$Y = P3*\{A\}$ In which $A = \frac{e^{k_o*P2} - e^{k_o*X/K4}}{e^{k_o*P2} - 1}$, $k_o = \frac{K1}{P1*(273.15+K2)}$	
0510	Solar Cell: Light I-V: Rs <> 0 Number of variations: 1	$Y = K3*\left(P4*\{A\} + [(P4*P2 - P3)*\{A\} + P3 - X/K4 - Y*P2/K3]* \left[\frac{P6 - P4*\{B\}}{(P4*P2 - P3)*\{B\} + P3 - P5 - P6*P2}\right] \right)$ in which $A = \frac{e^{k_o*P3} - e^{k_o(X/K4+Y*P2/K3)}}{e^{k_o*P3} - e^{k_o*P4*P2}}$, $B = \frac{e^{k_o*P3} - e^{k_o*(P5+P6*P2)}}{e^{k_o*P3} - e^{k_o*P4*P2}}$, $k_o = \frac{K1}{P1*(273.15+K2)}$	

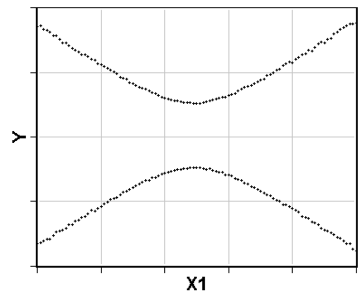
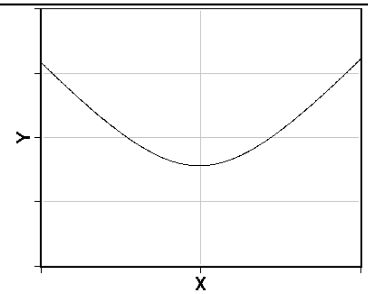
Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Fit Graph
0511	Solar Cell: Light I-V: Rs = 0 Number of variations: 1	$Y = K3*\left(P4*\{A\}+\left[\left(-P3\right)*\{A\}+P3-X/K4\right]/P2\right)$ in which $A = \dfrac{e^{k_o*P3}-e^{k_o*X/K4}}{e^{k_o*P3}-1}$, $B = \dfrac{e^{k_o*P3}-e^{k_o*(P5+P6*P2)}}{e^{k_o*P3}-e^{k_o*P4*P2}}$	
0512	Solar Cell: Dark Current-Voltage: Non-Ideal Number of variations: 2	Same as function 0502 except that the definitions of the dependent and independent variables are switched. That is, the meanings of X and Y are interchanged. $Y = K3*\left[P1*\left(X/K4 - P2*\left\{e^{\left[\frac{K1*(Y/K3 - X*P4/K4)}{P3*(273.15+K2)}\right]}-1\right\}\right)+X*P4/K4\right]$	
0513	Solar Cell: Dark I-V: Model 1: High I-range Number of variations: 1	Same of function 0503 except that it contains a voltage offset parameter, P3. $Y = K3*\left(\frac{K5*(273.15+K2)}{K1}*Ln\left\|\frac{(X/K4+P1)}{P1}\right\|+X*P2/K4\right)+P3$	

Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Fit Graph
0514	Solar Cell: Dark I-V: Model 1: High I-range Number of variations: 1	Same as function 0504 except that the diode's ideality factor is treated as a parameter rather than as an adjustable constant. $Y = K3*\left(\frac{P3*(273.15+K2)}{K1}*Ln\left\vert\frac{(X/K4+P1)}{P1}\right\vert+X*P2/K4\right)$	
0515	Solar Cell: Dark I-V: Model 2: Mid I-range Number of variations: 1	Same as function 0505 except that both diodes in the equivalent circuit are assumed to be non-ideal and their ideality factors are treated as parameters. $Y = K3*P1*\left(X/K4 - P2*\left\{e^{\left[\frac{K1*Y}{K3*P5*(273.15+K2)}\right]}-1\right\} - P3*\left\{e^{\left[\frac{K1*Y}{K3*P4*(273.15+K2)}\right]}-1\right\}\right)$	

Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Fit Graph
0517	Solar Cell: Dark I-V: Model 4: Full I-range Number of variations: 1	Same as function 0507 except that both diodes in the equivalent circuit are assumed to be non-ideal and their ideality factors are treated as parameters. $Y = K3 * \left[P1 * \left(X/K4 - P2 * \left\{ e^{\left[\frac{K1 * (Y/K3 - X * P5/K4)}{P6 * (273.15 + K2)} \right]} - 1 \right\} - P3 * \left\{ e^{\left[\frac{K1 * (Y/K3 - X * P5/K4)}{P4 * (273.15 + K2)} \right]} - 1 \right\} \right) + X * P5/K4 \right]$	
0525	Solar Cell: Dark I-V: Model 2C: Mid I-range w/ Voltage Offset Number of variations: 1	Similar to function 0505 except that an extra parameter, Voffset (P5), has been added to compensate for a possible measurement instrument calibration issue. $Y = K3 * P1 * \left(X/K4 - P2 * \left\{ e^{\left[\frac{K1 * (Y - P5)}{K3 * (273.15 + K2)} \right]} - 1 \right\} - P3 * \left\{ e^{\left[\frac{K1 * (Y - P5)}{K3 * P4 * (273.15 + K2)} \right]} - 1 \right\} \right) + P5$	

Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Fit Graph
0527	Solar Cell: Dark I-V: Model 4C: Full I-range w/ Voltage Offset Number of variations: 1	Similar to function 0507 except that an extra parameter, Voffset (P6), has been added to compensate for a possible measurement instrument calibration issue. $$Y = K3*\left[P1*\left(X/K4 - P2*\left\{e^{\left[\frac{K1*((Y-P6)/K3 - X*P5/K4)}{(273.15+K2)}\right]} - 1\right\} - P3*\left\{e^{\left[\frac{K1*((Y-P6)/K3 - X*P5/K4)}{(P4*(273.15+K2))}\right]} - 1\right\}\right) + X*P5/K4\right] + P6$$	
0528	**New in version 10.0.3** Solar Cell: Dark I-V: Model 4F: Full I-range w/ Voltage Offset Number of variations: 1	$$Y = K3*\left[P1*\left[X/K4 - P2*\left\{e^{\left[\frac{K1*((Y-P5)/K3 - X*P4/K4)}{(P3*(273.15+K2))}\right]} - 1\right\}\right] + X*P4/K4\right]$$	

User Requested Functions
FitAll Function Library

Ftn#	Function Name / Description	Function Definition [Equation (General Form and/or an Example)]	Example Fit Graph
1527 1528 1529 1530	Hyperbola Both branches of the North-South oriented hyperbola are analyzed at the same time. These functions differ in which of the X and Y offset parameters are included in the analysis. These functions contain two independent variables, X1 and X2.	$Y = \begin{cases} P3 + \frac{P1 * \sqrt{P2^2 + (X1 - P4)^2}}{P2}, & \text{for } X2 = 0 \\ P3 - \frac{P1 * \sqrt{P2^2 + (X1 - P4)^2}}{P2}, & \text{for } X2 \neq 0 \end{cases}$	
1537 1538 1539 1540	Hyperbola The North-facing branch of a North-South oriented hyperbola.	$Y = P3 + \frac{P1 * \sqrt{P2^2 + (X - P4)^2}}{P2}$	
1547 1548 1549 1550	Hyperbola The South-facing branch of a North-South oriented hyperbola.	$Y = P3 - \frac{P1 * \sqrt{P2^2 + (X - P4)^2}}{P2}$